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Management Conference



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Boosting knowledge & trust for a sustainable business

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Full Papers***

University of Bocconi, Milan

June 30th and July 1st 2022

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Boosting knowledge & trust for a sustainable business

June 30th and July 1st 2022

Referred Electronic Conference Proceedings

Full Papers

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To the reader,

this volume contains the full papers of the Sinergie-SIMA 2022 Management Conference, hosted by the University of Bocconi of Milan on June 30th and July 1st 2022.

The resource-based view (RBV) has been one of the most cited streams of research in the management literature. This theory has been one of the few theories completely developed within the management disciplines. Since the initial pioneering research in the 80s and 90s, the study of knowledge- and trust-based resources has interested many theoretical and empirical works concerning many issues: company strategies, mergers and acquisitions, alliances and partnerships, organization and HR, innovation, marketing, consumer behavior, channel relationships, entrepreneurship, internationalization, and more. Today the post-pandemic world presents new challenges for managers, organizations, and researchers on which a deeper understanding of knowledge- and trust-based resources can help and shed a new light.

Sustainability and a fast digital transformation are nowadays considered key goals for many companies, managers, public organizations, and governments under the umbrella of EU Next Generation Recovery Plan. The real challenge now is to enhance and leverage the intangible resources heritage - namely knowledge and trust - to get a more sustainable, inclusive and digital world and, as a consequence, for building a better society. In this perspective, also the long-term goals of the firm and its finalism have to be totally re-shaped.

Sinergie Italian Journal of Management dedicated a special issue to this topic more than 20 years ago and many scholars have studied and deepened this multi-faced topic with original approaches in our community.

The Sinergie-SIMA 2022 Management Conference was a great occasion to discuss about the research efforts of our research community on knowledge and trust, also to find new ways to interpret the future economic and social environment to face the post-pandemic challenges.

The Conference call for papers gave the opportunity to submit either an *extended abstract* or a *full paper*. Overall, the editorial staff received 135 *extended abstracts* and 60 *full papers*.

For the *extended abstracts*, the evaluation of the submissions was carried out by the Conference Chairs and the Scientific Committee, on the basis of their consistency with the Conference topic and/or with management studies, according to SIMA Thematic Groups. The clarity and (even potential) relevance of the contributions were evaluated, as well.

For the *full papers*, the evaluation followed the peer review process, with a double-blind review performed by two referees - university lecturers, expert about the topic - selected among SIMA and the community of Sinergie members.

In detail, the referees applied the following criteria to evaluate the submissions:

- clarity of the research aims,
- accuracy of the methodological approach,
- consistency of the contents with the Conference topic/tracks and/or with management studies,
- contribution in terms of originality/innovativeness,
- relevance in relation to the Conference topic/tracks and/or with management studies,
- clarity of communication,
- significance of the bibliographical basis.

The *peer review* process resulted in full acceptance, acceptance with revisions or rejection of the submissions. In the case of disagreement among reviewers' evaluations, the decision was taken by the Conference Chairs. Each work was then sent back to the Authors together with the referees' reports to make the revisions suggested by the referees.

The evaluation process ended with the acceptance of 30 *full papers* and 121 *extended abstracts*, which were published in two distinct volumes.

All the *full papers* published in this volume were presented and discussed during the Conference and published online on the web portal of Sinergie-SIMA Management Conference (<https://www.sijmsima.it/>).

While thanking all the Authors, Chairs and participants, we hope that this volume will contribute to advance knowledge about the boosting knowledge and trust for a sustainable business.

The Conference Chairs

Sandro Castaldo, Marta Ugolini, and Gianmario Verona

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Should I buy it or not? Exploring ‘Made in Italy’ food product purchases by foreign consumers in light of the COVID-19 emergency. Empirical evidence from the UK

ANNUNZIATA TARULLI* DOMENICO MORRONE[•] FRANCESCO MANTA[▲] PIERLUIGI TOMA^{**}

Abstract

Framing of the research. *This study contributes to the debate on consumers’ food purchasing behaviour from a broader perspective. Since little is known about how consumers evaluate imported food products, it investigates this topic using quality schemes, new sales channels, as well as the influence of covid-19 crisis as a lens.*

Purpose of the paper. *Focusing on British consumers, it aims to detect the factors that influence their behaviours towards Italian food products during the COVID-19 pandemic, highlighting the importance of quality and origin certifications (i.e., PDO, PGI, and TSG) and e-commerce in promoting Italian excellence, safety, and reliability abroad.*

Methodology. *To answer our research questions, an Exploratory Factor Analysis was performed on a sample of 200 British respondents. Data was collected through the dissemination of an online questionnaire.*

Results. *Six latent factors were extracted, suggesting that British consumers value information on quality, sustainability, supply chain traceability, as well as quality schemes related to cultural, territorial, and origin, which are expressions of ‘Made in Italy’ values.*

Research limitations. *A longitudinal and cross-country analysis is necessary as it would increase the generalisability of our results. In particular, longitudinal analyses are fundamental to measure the evolution of Country-of-Origin, quality schemes and the internet over time, whereas data from different countries allow for comparisons.*

Managerial implications. *Understanding the way geographical markets perceive the different dimensions of the Country-of-Origin has become essential for companies which wish to develop a significant presence in foreign markets.*

Originality of the paper. *To date, no study has investigated the British consumer responses to Italian food products in conjunction with quality schemes, digital sales channels, and the COVID-19 spread. It contributes to the debate on Country-of-Origin and ‘Made in Italy’ as a lever of competitive advantages at an international level.*

Keywords: *consumer behaviour; Country-Of-Origin-Effect; COVID-19; food purchases; food export; EFA.*

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1. Introduction

The increase in international trade associated with globalization and digitalisation has made the purchasing process more complex for consumers, who have to choose between domestic and imported product alternatives. However, while such abundance makes it possible to meet different needs, on the other hand, it often creates confusion in the mind of the consumer, who ends up feeling overwhelmed. Overall, during purchasing, consumers have to process a wide range of information that affects their preference and buying decisions. Hence, it emerges the need to understand what drives the consumer towards one or another type of product (i.e., domestic or foreign) and, consequently, to define what are the strengths and weaknesses associated with a specific geographical origin. Indeed, several studies (Adina *et al.*, 2015; Han, 1989; Inch and Florek 2009; Newman *et al.*, 2014; Schooler, 1965, 1971; among others) investigated this phenomenon and found out that the way consumers perceive the Country-of-Origin (COO) of a product is very important in influencing his purchasing choices. The strong interest of the COO, both at an academic and managerial level, has led companies to develop strategies aimed at ensuring a significant presence in foreign markets. Indeed, in today's international and multi-cue environments, the country image can affect the global perception the consumers have of the brand or the companies themselves. Here, the concept of 'Made in Italy' emerges as an expression of the Italian distinctiveness, authenticity, know-how, tradition, culture, and quality (Aiello *et al.*, 2015; Bertoli, 2013; Caiazza and Volpe, 2014). The Italian reputation, actually, represents an invaluable source of competitive advantage in various sectors, especially in Agri-food. Thanks to its quality, culture, and territorial uniqueness, it represents the flagship of Italian excellence in foreign markets that need to be protected from fraud and counterfeiting risks (Brooks *et al.*, 2021). Moreover, exogenous events, such as the spread of the COVID-19 virus, may raise food safety concerns and interfere with the food purchasing process of consumers in both domestic and foreign markets. It is a fact that COVID-19 has certainly jeopardized the global food systems, introducing unprecedented challenges in food supply chain (Aday and Aday, 2020). As a result, it affected consumers by reducing their confidence in many aspects of the food safety system (Charlebois and Music, 2021).

To ensure the safety and authenticity of food products along the supply chain, several protocols and traceability systems were reinforced (Brooks *et al.*, 2021; Maragoni-Santos *et al.*, 2021). This study delves into the following instruments to guarantee the safety of Italian food products: the adoption of food quality schemes (e.g., PDO, PGI, TSG) and the use of e-commerce platforms. In detail, quality schemes are used to safeguard the availability, accessibility, and quality of Agri-food products characterized by natural, traditional or geographically specific production processes (Glogoveţan *et al.*, 2022). The European Union encourages their adoption and undertakes to guarantee the names of those products that come from specific regions, have exclusive qualities or enjoy a reputation linked to the production area (EU website). Many Agri-food products have been certified with such quality schemes, most of which are Italian, to guarantee fair competition, consumers awareness, and an integrated internal food market (Glogoveţan *et al.*, 2022). On the other hand, besides being the most widespread sales channel worldwide, e-commerce platforms can be strategic for ensuring food safety and quality abroad. As a matter of fact, e-commerce has experienced continued growth during the last decades and its importance was not affected by the spread of the COVID-19 crisis (Zennaro *et al.*, 2022). It provides opportunities for both companies and consumers, increasing market competitiveness and involvement through the dissemination of valuable information for domestic and foreign food products.

From these considerations arise the three research questions underlying this study. First, it seeks to identify those factors that influence the purchasing process of Italian food products abroad. Secondly, considering the COVID-19 emergency, it tries to understand whether the presence of certain quality certifications (such as PDO, PGI, and TSG) helps consumers in their purchase decisions. Finally, it investigates the power of e-commerce in promoting the quality, safety, and reliability of Italian food products and in selling them all over the world. To answer these questions, the analysis was addressed to a sample of consumers from the United Kingdom, which was selected

based on some market considerations. Indeed, the two countries have a long relationship tradition associated with several historical events. However, the rise of exogenous events (i.e., COVID and Brexit) may have affected this relationship, thus translating into positive or negative consequences for the Italian food exports. Therefore, the empirical analysis will explore the importance of Made in Italy in the British market, the food attributes most appreciated by consumers, as well as the influence of e-commerce and COVID-19 in food purchases. Although in its embryonic stage, this study will bring valuable information - both at an academic and managerial level - in designing and implementing future marketing strategies for the Italian food market.

After this introduction, the present study is organised as follows. Section 2 focuses on presenting the Country-of-Origin-Effect and 'Made in Italy', the influence of COVID-19 and e-commerce in food purchases, as well as the research questions and objectives. Section 3 shows the methodology behind this study and the descriptive analysis of the sample, while Section 4 presents the latent factors that emerged from the empirical analysis. Lastly, Section 5 provides a discussion of the results, conclusions, managerial implications, as well as future perspectives.

2. Literature background

2.1 'Country-of-Origin' and 'Made in Italy' effects

The globalisation of markets and the progressive opening of borders around the world have led to important and inevitable consequences. If, on the one hand, companies have started their internationalisation process, looking at foreign markets as an opportunity to be seized, on the other hand, there has been a sharp increase in competitiveness between companies and countries as well. As a result, it emerged the need to consider new strategies to support production systems and encourage economic development. One of these strategies seeks to exploit the influence a company's native country has on the purchasing behaviour of consumers. Several studies, indeed, demonstrated the impact of the Country-of-Origin (COO) on international trade (Insch and Florek 2009; Newman *et al.*, 2014) analysing it from all of its angles (i.e., Country Image, Brand Image, and Product Image) (Adina *et al.*, 2015). Although Dichter (1962) was the first to suggest that the COO might have a remarkable influence on the acceptance and success of a product (Newman *et al.*, 2014), Schooler was considered the father of this phenomenon. In the 1960s, he conducted empirical researches to understand if the origin of the products was able to influence the purchasing choices of consumers. His results showed a significant difference in the evaluation of products based on the geographical origin indicated on the label (1965). Furthermore, he discovered some correlations between demographic factors and COO, affirming that consumers with higher education, the youngest, and women were more inclined to buy foreign products (Schooler, 1971) - later invalidated by Heslop and Wall (1985). Following the studies of Schooler, Reiersen (1966) discovered the existence of stereotypes, while Nagashima (1970) demonstrated the dynamism of the Country-of-Origin as the sample showed changes in perception over years. These studies have something in common: they consider a single cue - that is, the origin of the product - in the evaluation of consumer behaviour, thus overestimating the importance of the COO and the unreality of the setting. It was Yaprak (1978) who took a step forward, stating that, besides origin, consumer choices can also be influenced by some specific characteristics of the product. After the 1980s, research on the Country-of-Origin effect mushroomed and started to approach to this phenomenon in a more realistic way, taking into account other important cues (i.e., price, brand, quality, product description, level of information, etc.), especially when the changes associated with globalisation are considered.

Overall, during purchasing, consumers have to process a wide range of information that affects their preference and buying decisions. The way consumer perceives a country is very important in assessing COO influences. Since it is impossible to analyse the perception of the product by each consumer, it is possible to generalise this phenomenon by understanding how they behave towards

their native country and foreign ones. In this regard, the ‘halo effect’ was introduced to describe the phenomenon in which a person, even if he doesn’t know the origin of the products or has no previous experience with them, can still have his image of these products and the country (Leuthesser *et al.*, 1995). In this case, the consumer idea is based on the information collected from television, friends, word of mouth, the political and economic situation of the country, etc. (Beckwith and Lehmann, 1975). Contrarily, the ‘summary construct’ depends on the intrinsic and extrinsic attributes of the products and reflects the country image that a consumer has based on his previous buying experience (Han, 1989). Finally, the ‘hybrid goods’ represent a fairly recent concept that indicates those products in which some or all of the production steps (i.e., from the initial idea to the sale) take place in different countries due to benefits of costs, quality, reputation, or image (Chao, 1993; Nebenzahl and Jaffe, 1996). In this scenario, the concept of ‘Made in Italy’ emerges as an expression to evoke the idea of Italian products all over the world, whose reputation is often associated with attributes of distinctiveness, creativity, authenticity, know-how, tradition, culture, and quality (Aiello *et al.*, 2015; Bertoli, 2013; Caiazza and Volpe, 2014). These attributes represent an invaluable source of competitive advantage in various sectors (e.g., luxury, craftsmanship, fashion, art, culture, food, etc.) whose opportunities offered by the direct relationship with customers and the ‘Made in Italy’ must be fully exploited. Among these, the Agri-food sector represents the flagship of Italian excellence, which is appreciated in foreign markets thanks to its quality, culture, and territorial uniqueness. However, if on the one hand, this appreciation represents a source of success for Italian products abroad, on the other, it exposes to fraud and counterfeiting risks (Brooks *et al.*, 2021). Hence, the need to protect Italian food products through legislation and certifications at the national and international level to boost consumer trust and knowledge (Brunori *et al.*, 2013), translating into higher market acceptance and performance.

Finally, it should be noted that, although COO effects on consumers vary between countries, time, and product categories, it is possible to exploit some of its extrinsic signals, especially when associated with products sensitive to quality and safety issues (Becker, 1999). Nevertheless, Inch and Cuthbert (2018) pointed out that confidence in food safety is potentially affected by exogenous events - such as the spread of the COVID-19 virus - which may interfere with the food purchasing process of consumers in both domestic and foreign markets. Thus, the need to investigate this phenomenon and identify those factors that influence consumers' purchasing behaviour of Italian food products abroad.

2.2 The influence COVID-19 in food purchases

The spread of the COVID-19 virus represents a social, economic, and health emergency, which has caused a high level of uncertainty in international trade, with inevitable negative effects on the production system, as well as on exports. It put unprecedented stress on the global economy, with particular influence on the Agri-food sector, where the pandemic largely impacted both food production, processing, distribution, and demand (Abid and Jie, 2021). In particular, huge food safety concerns have been raised, thus increasing the demand for more information on quality and security attributes, including the COO which is often used as a proxy (Inch and Cuthbert, 2018).

Little is known about the degree to which consumers connect the virus to many aspects of the food safety system (Charlebois and Music, 2021). Although food itself was found to be unlikely a source of coronavirus infection, there is no evidence that the COVID-19 virus cannot be transmitted via packaging. As a result, protocols and traceability systems were reinforced in several countries to ensure the safety and authenticity of food products (Brooks *et al.*, 2021; Maragoni-Santos *et al.*, 2021). For this purpose, two quality schemes are used in the food supply chain. The first is based on mandatory standards that are controlled by independent third parties. The second relies on voluntary standards defined by market laws or by international industry associations. Overall, these quality schemes play a key role in safeguarding the availability, accessibility, and quality of Agri-food products characterized by natural, traditional or geographically specific production processes (Glogoveţan *et al.*, 2022). The European Union encourages the adoption of different food quality schemes (e.g., PDO, PGI, TSG) to protect producers and assist consumers in their purchasing

behaviours. In detail, the EU geographical indications system guarantees the names of products that come from specific regions, have exclusive qualities or enjoy a reputation linked to the production area. Product names registered as PDO (i.e., Protected Designation of Origin) have the strongest links to the place of production, as all their transformation processes take place in a specific region. On the other hand, those products that are registered as PGI (i.e., Protected Geographical Indication) emphasise the connection to a specific geographic region for reasons related to peculiar quality, reputation or other geographical characteristics. Therefore, the main difference between these two quality schemes lies in the number of interactions (i.e., the entire production process or at least one step) with a specific geographical area. Lastly, Traditional Specialty Guaranteed (TSG) highlight traditional attributes, such as the production method, a recipe or its ingredients, without being necessarily linked to any specific geographical area (EC website). Many Agri-food products at the European level have been certified with such quality schemes to guarantee fair competition, consumers awareness, and an integrated internal food market. Italy occupies the first position, with a total of 879 registered products, followed by France and Spain (Glogoveţan *et al.*, 2022).

Another key strategy for ensuring food safety and quality is the use of e-commerce platforms. Indeed, the development of Information and Communication Technology (ICT) has led to new digital tools to bridge the information asymmetry gap between producers and consumers and to lower the risk of food insecurity (Abid and Jie, 2021; Glogoveţan *et al.*, 2022). E-commerce is the most widespread sales channel worldwide whose importance has continued to grow with the spread of the COVID-19 crisis (Zennaro *et al.*, 2022). It plays an important role in the interaction and exchange activities among food supply chain actors (Aday and Aday, 2020), providing opportunities to increase market competitiveness and consumer engagement. There are several benefits for both customers and companies in using and implementing e-commerce strategies. From a company perspective, e-commerce strategies make it possible to reach more consumers, communicate additional product information, reduce intermediation costs, as well as enable a quick response to the ever-changing needs and desires of consumers (Glogoveţan *et al.*, 2022; Zennaro *et al.*, 2022). These aspects are crucial and enable SMEs to sell their food products to customers in a direct, transparent and effective way. Due to the uncertainty of the COVID-19 outbreak, food companies must approach these digital marketplaces by changing their business model towards more technological ones (such as using blockchain technology to provide traceability and security information). Consumers, on the other hand, value these platforms for the opportunity to purchase at any time, the comparison of product features and their prices, the high degree of customisation and the constant customer care (Zennaro *et al.*, 2022). It emerges that consumers use this online sales channel mostly to satisfy their own information needs, searching and comparing the extrinsic and intrinsic attributes of an increased range of domestic and foreign food products. Hence the need to deepen the analysis of 'global' consumer behaviour, focusing on identifying and leveraging those attributes that make the Italian food products a success on foreign markets.

2.3 Factors affecting the purchasing process of imported food products

The intensification of international trade associated with globalization has made the purchasing process more complex for consumers, who have to decide between domestic and imported alternatives. To streamline their decision-making process and to make informed choices, consumers rely on a variety of synthetic indicators for quality assessment (Vianelli and Pegan, 2014), such as brand, organoleptic attributes, Country-of-Origin, and so on (Han, 1989; Oberecker and Diamantopoulos, 2011). In general, a product can be regarded as a bundle of characteristics communicated through intrinsic and extrinsic cues to form consumers' quality perception of a food product (Becker, 1999). These cues can derive from different source, such as previous purchasing and consumption experiences, from external sources of information, as well as from economic or social changes. In addition to traditional sources, the internet and social networks nowadays represent a new channel from which consumers take relevant information for their next purchase decisions (e.g., through online reviews, forums, and price comparison sites). Price is recognized as

an important variable in product evaluation and often represents a synonym for perceived product quality (Holdershaw and Konopka, 2018), especially when associated with sustainable, healthy, and organic attributes. Other reliable quality signals are usually communicated with brands, packaging, and labels. As for organic and Country-of-Origin labels, these play a leading role in contemporary society and, besides quality, they are often associated with symbolic and emotional product connotations (i.e., status or pride). Moreover, the ‘Made in’ label offers information regarding the quality and safety dimensions of the food product, supporting local producers as well (Adina *et al.*, 2015; Holdershaw and Konopka, 2018), thus representing strong values that might trigger consumers preferences. This became more evident during the COVID-19 pandemic, where consumer preferences shifted toward certified origin food products due to their potential in reducing confusion and perceived risks (Glogoveţan *et al.*, 2022). Furthermore, the pandemic influence has also modified the traditional purchasing system, initiating new online food purchasing habits. This way, consumers who purchase certified agri-food products online have access to information on the environmental impact and sustainability of products, in addition to the unique properties and characteristics of agri-food products (Glogoveţan *et al.*, 2022).

Overall, consumers can be influenced by different factors and in several ways (e.g., direct or reported experiences, personal or common beliefs, etc.) whose importance may change over time based on changes in endogenous or exogenous factors (i.e., political, economic, or health scandals, etc.). Since there is a lack of research on how consumers evaluate imported food products (Thøgersen *et al.*, 2017) and that these considerations may vary by country (Becker, 1999), this study aims to answer the following research questions by focusing on a sample of foreign consumers:

- RQ1: *What are the factors influencing the purchasing behaviour of ‘Made in Italy’ food products by foreign consumers?*
- RQ2: *In light of the COVID-19 pandemic situation, does the presence of quality and origin certifications (i.e., PDO, PGI, and TSG) influence the food purchasing choices of foreign consumers?*
- RQ3: *Is e-commerce a valid alternative sales channel to promote the quality, safety, and reliability of Italian food products abroad?*

3. Methodology and data

3.1 Research objectives

As just mentioned, the purpose of this study is threefold. Firstly, it seeks to identify those factors that influence the purchasing process of Italian food products abroad. Secondly, considering the COVID-19 emergency, it tries to understand whether the presence of certain quality certifications (such as PDO, PGI, and TSG) helps consumers in their purchase decisions. Finally, it investigates the power of e-commerce in promoting the quality, safety, and reliability of Italian food products and in selling them all over the world. To empirically answer these research questions, the analysis focused on a specific country, the United Kingdom, whose choice was inspired by some considerations arising from the market assessment. The trade relationships between Italy and the UK have deep roots. In particular, looking at the Italian agri-food exports as of 2019, it emerged that the United Kingdom is the fourth country of destination - after Germany, France, and the United States - with a market value of 3.4 billion euros (ISMEA, 2020). In addition, a large network of relationships is found between the two countries, not only among the institutions but also, for example, the academic, cultural or scientific organisations, the production systems or the local authorities. This strong connection has allowed the success of Made in Italy exports in the United Kingdom, also facilitated by the membership of both countries to the European Union, of which the UK became a member in 1973. Although British imports were expected to decline after the 2016 ‘Brexit’ referendum - event that cut ties with the EU members - on the contrary, the trade balance data showed good results, confirming British consumers’ interest in Italian food products (ISMEA,

2020). The COVID-19 pandemic has raised concern in the global marketplace, triggering new food purchasing dynamics influenced by the presence of product safety guarantees, especially for those of foreign origin. Therefore, the need to understand if the British interest in Italian food products is still alive and if the presence of quality and origin certifications plays a role in orienting consumer behaviours.

Consequently, based on the previous background, an online questionnaire targeting British consumers was developed to highlight what makes the 'Made in Italy' so special abroad and to measure the importance that quality and origin certifications have in a context of public health uncertainty. Results will be able to explain how British consumers' approach to Italian products can be enhanced, by underlying the aspects they appreciate the most, but also those that may hinder its adoption.

3.2 Questionnaire development and variables description

To perform the analysis, the input data were collected through the dissemination of an online questionnaire. After an initial pre-test, the investigation reached a well-stratified sample of British consumers through the Google Form platform in the period from September to December 2021. The survey included 51 questions reflecting the topics that emerged from the background analysis. Some question provided a five-point Likert scale evaluation (where '1' and '5' identified a poor or high match), while others included open or multiple-choice answers.

In particular, the survey investigated British respondents' experience of buying Italian food products, looking at their propensity to repurchase, the channels they use to gather information about products as well as where they buy them. These questions provided interesting insights into the characteristics of the sample, laying the groundwork for the analysis of those factors that influence 'Made in Italy' food purchases. Specifically, respondents were asked to rate the aspects they pay attention to when purchasing this kind of product, such as taste, freshness, traceability, availability of quality certifications, among others. These variables will be further analysed to identify those latent factors able to explain the phenomenon under study and to forecast future strategies in this area. Next, they were asked to assess the level of satisfaction with the quality of Italian food products, the value given to certifications, as well as to identify product categories that represent Italian excellence at the international level. Focusing on certifications in a period of uncertainty caused by an exogenous event, such as COVID-19, the attention to the quality and origin of Italian food products, the willingness to pay more for these certified products, as well as the propensity to purchase such products online were explored. The latter was further deepened by examining the reasons behind the purchase of Italian food products online by British consumers (i.e., cost savings, availability of high quality or special products that are hard to find locally, and the increased reliability and safety regarding food products origin). Finally, essential socio-demographic data useful for assessing the heterogeneity and reliability of the sample were collected.

3.3. Data and Sample

The empirical analysis was conducted on a sample of 200 British respondents, whose socio-demographic profile is summarised in Table 1. Since only responses without missing data were included, it can be said that this database is complete and balanced.

Tab. 1: Sample composition (in percentage, %)

Gender	Age (years)	Education	Monthly income (£)	Household members	Location
Female, 65	18-30, 33	High school or below, 17	< 1.999, 34	Single, 30	Northern England, 26
Male, 35	31-45, 45	College or university, 61	2.000-3.999, 51	Couple, 36	Southern England, 30
	46-60, 14	Postgraduate, 22	> 4.000, 15	More than two, 34	East of England, 12
	> 60, 8				The Midlands, 6
					Wales, 4
					Scotland, 22

Source: our elaboration

In particular, participants were 65% female and 35% male, with an average age of 37 years old and an average monthly income of GBP 2.999,00. It emerges that the sample is unbalanced towards the female audience, perhaps due to their greater sensitivity to the topic under investigation (Schooler, 1971). In terms of education, 61% of the sample obtained a college or university education, while the remainder has a high school or below education (17%) and postgraduate education (22%). These results could identify increased attention to food quality and safety of respondents, with an attitude for healthy and conscious diet as well as a heightened awareness of sustainability and food safety issues (Dinnie, 2004). Considering the household members data, Table 1 shows a balanced distribution of the respondents among the three options available. Finally, a good territorial allocation is highlighted, with a greater concentration in Northern and Southern England and also in Scotland. Respondents from these three geographical areas account for 78% of the total, while the remainder is split between the other locations.

4. Results

To answer the research questions and to make a contribution to the managerial literature, the data collected followed a two-stage analysis. At first, the characteristics of British consumers who buy ‘Made in Italy’ food products were analysed, looking at their purchasing and consumption behaviours, the attributes and products most appreciated, quality certifications and their link to food safety in the COVID-19 period, as well as some considerations on the online sale of these products. Next, an Exploratory Factor Analysis (EFA) was performed to identify those latent factors that influence the purchasing process of Italian food products abroad. In particular, alongside the typical attributes that influence the consumer’s food purchasing process (i.e., information, quality, freshness, sustainability, etc.), the analysis also deepened quality and origin certifications (i.e., PDO, PGI, and TSG), their value and importance, as well as the purchasing and consumption dynamics that are triggered when exogenous phenomena occur. Lastly, some interesting conclusions and managerial implications were drawn. IBM SPSS Statistics was used to perform the analysis.

4.1 *The British consumer characteristics*

The first step was, therefore, to study the sample of British consumers by observing their purchasing and consumption habits, the reason behind their behaviour, but especially the characteristics they appreciate most when it comes to ‘Made in Italy’ food products. Data revealed that nearly all respondents (95%) have experience of buying Italian food products, with 48% of them stating they buy Italian food very often. This result shows the widespread propensity of British consumers to buy Italian food products and confirms the success of ‘Made in Italy’ exports to the United Kingdom. As far as the collection of information on these products is concerned, the sample identifies the product labels as the primary source of information, followed by the internet, social media and word of mouth, which play a fairly important role thanks to the information-sharing mechanism of blogs, reviews and feedbacks. Less influential are, on the one hand, traditional communication channels such as television or print advertising (i.e., magazines, newspapers, etc.). Restaurants, on the other hand, are considered for their experiential value, in which to appreciate and enjoy the Italian culinary tradition, but they do not represent a means to acquire information about them. Next, the questionnaire investigated where respondents usually make their Italian food purchases. The results show that 62% of the sample considers supermarkets to be the place where they purchase Italian food products the most, followed by small and medium-size grocery shops (18%). Further on, only the 15% of the sample buys Italian food products on the internet. This may be due to the still unexpressed potential of this channel or to the consumers' need for a direct and sensory experience with the product before buying it. Restaurants and cafés are not considered as a place to make purchases (5%), but rather as a place to taste and enjoy such products.

58% of respondents, indeed, affirm that they habitually have lunch or dinner in Italian restaurants, appreciating the refinement and quality that such places offer.

Subsequently, the analysis focused on understanding the product characteristics respondents value the most when it comes to Italian food purchases. It emerges that the most relevant characteristics that influence the Italian food purchasing choices of British citizens are the taste (35%), freshness (22%), designation of origin and traceability (19%) of the products. These findings are in line with the literature background, confirming the influence of quality and territoriality - and, therefore, Country-of-Origin-Effect - have on the sample purchase and consumption process. The remaining 24% is divided between price, sustainability attention, organic production, short supply chain, and nutritional aspects. It is interesting to note that taste represents the element that consumers most associate with Italian food products, which identifies a clear tendency to purchase not only as a mere nutritional need but as a refined experiential search for high-quality products. This high-quality is, undeniably, the trademark of 'Made in Italy' in the world, an aspect that is widely appreciated by consumers in the UK who declare themselves highly satisfied with the quality of Italian food products (84%).

One way to guarantee the authenticity of these products - avoiding, thus, unpleasant confusion or intellectual property fraud - is the adoption of EU quality schemes (i.e., PDO, PGI, and TSG) to certify the quality and origin of the products on the market. Very significant is the result obtained by the respondents, who associate certified Italian food products with unique excellence in the world (92%), not comparable with similar products from other countries or available at the same price. In particular, the respondents identify pasta as the product category most representative of Italian excellence at an international level (28%), followed by wine (23%), cheese (18%), and salami (16%). Finally, regarding the other categories of Italian food products (i.e., cereals, fruit and vegetables, fresh fish and meat, bakery and cake products, ready meals, and beer), low but positive values are highlighted in the UK market.

Finally, the online survey investigated the behaviour of British consumers in the purchase of Italian food products during the pandemic crisis caused by COVID-19. Specifically, the survey assessed whether and to what extent British consumers gave importance to quality certifications of Italian food products, if they were willing to purchase these products at higher prices and if they chose the e-commerce channel for the purchase of these products. The study revealed that, during the COVID-19 emergency, respondents paid more attention to certified food products and were willing to spend more on these products to meet their need for quality assurance. Furthermore, half of the sample preferred to purchase certified Italian food products through traditional direct channels, thus placing less trust in e-commerce. The reasons could probably be due to the lower safety perception associated with a period of restrictions and widespread fear caused by the pandemic, or more simply to the need of consumers to touch the product before buying it. The last question related to the importance the British consumers assign to the purchase of Italian food products through the e-commerce channel. Most of them (55%) associate this channel with the possibility of purchasing special Italian food products, otherwise difficult to find in local grocery stores. As for the quality, safety and reliability of the food products, the respondents showed medium confidence in this sales channel (35%), appreciating the potential advantages deriving from it, including the immediacy of information about the characteristics of the available products, the ease of purchasing, and the customer care offered by these platforms. Regarding the cost savings of online purchases, the analysis showed that British consumers gave little importance to this aspect (10%), thus confirming that price is no longer a primary variable in the food purchasing process.

4.2 Exploratory Factor Analysis (EFA)

Once the consumer characteristics were examined, the analysis focused on identifying the latent factors influencing the British purchasing behaviour of 'Made in Italy' food products during the COVID-19 pandemic. The most suitable statistical method for our research was the Exploratory Factor Analysis (EFA). However, to avoid correlation and bias problems, some variables of the

original database were omitted, thus identifying a final database with 21 items and 200 observations. In detail, only those variables related to our research questions were included, such as the purchasing and consumption habits, the impact of COVID-19, the characteristics of Italian food products, and the value of e-commerce. Therefore, a correlation analysis was first performed. Overall, Table 2 shows low, good and medium positive correlations among all the variables, confirming their importance when it comes to purchasing Italian food products in the United Kingdom.

Tab. 2: Correlation matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1 <i>Frequency_purc</i>	1																				
2 <i>INFO_Label</i>	0,347	1																			
3 <i>INFO_WOM</i>	0,243	0,042	1																		
4 <i>INFO_Internet</i>	0,246	0,108	0,238	1																	
5 <i>INFO_Social</i>	0,218	0,044	0,212	0,620	1																
6 <i>INFO_Restaurants</i>	0,212	0,225	0,206	0,167	0,064	1															
7 <i>ITplaces_cons</i>	0,156	0,127	0,188	0,094	0,034	0,377	1														
8 <i>Sustainability</i>	0,119	0,047	0,127	0,085	0,133	0,054	0,053	1													
9 <i>S-Supply_ch</i>	0,122	0,079	0,146	0,134	0,135	-0,025	-0,030	0,614	1												
10 <i>Freshness</i>	0,209	0,096	0,123	0,165	0,144	0,206	0,128	0,316	0,363	1											
11 <i>Organic</i>	0,135	0,195	0,106	0,173	0,167	0,043	0,025	0,533	0,521	0,343	1										
12 <i>Traceability</i>	0,024	0,041	0,021	0,184	0,132	-0,020	-0,058	0,368	0,369	0,300	0,330	1									
13 <i>PDO</i>	0,277	0,227	0,139	0,248	0,230	-0,010	0,002	0,257	0,360	0,329	0,366	0,471	1								
14 <i>Pasta</i>	0,318	0,202	0,076	0,120	0,064	0,102	0,138	0,102	-0,041	0,134	-0,047	-0,011	0,105	1							
15 <i>Wines</i>	0,406	0,141	0,085	0,205	0,150	0,043	0,118	0,211	0,202	0,284	0,167	0,072	0,190	0,465	1						
16 <i>High-quality</i>	0,247	0,089	0,090	0,234	0,171	0,015	-0,013	0,036	0,008	0,170	0,036	0,101	0,176	0,289	0,279	1					
17 <i>Special_products</i>	0,189	0,059	0,029	0,214	0,177	-0,177	-0,001	0,071	0,008	0,035	-0,021	0,038	0,173	0,109	0,232	0,477	1				
18 <i>Trust& Security</i>	0,176	0,144	0,162	0,174	0,155	0,128	0,049	0,167	0,116	0,201	0,106	0,148	0,293	0,144	0,221	0,612	0,400	1			
19 <i>Cafe-Rest_purc</i>	0,080	0,146	0,174	0,112	0,089	0,459	0,320	-0,004	-0,096	0,097	0,024	-0,072	-0,164	0,069	-0,012	0,076	0,025	0,129	1		
20 <i>Cheese</i>	0,421	0,228	0,203	0,213	0,223	0,052	0,073	0,130	0,180	0,171	0,128	0,033	0,176	0,326	0,497	0,207	0,092	0,119	-0,029	1	
21 <i>Salami</i>	0,385	0,102	0,214	0,131	0,134	0,103	0,103	0,160	0,059	0,141	-0,015	-0,030	0,131	0,397	0,492	0,273	0,214	0,166	-0,064	0,465	1

Source: our elaboration with IBM SPSS Statistics

In particular, we underlined some medium correlations between the following variables: sustainability, short supply chain, and organic production, which denote the importance of these attributes in the purchase of Italian food products; wine, pasta, cheeses, and salami, which identify the most appreciated categories of Italian food products at an international level; traceability and the presence of quality certifications (i.e., PDO, PGI, and TSG), that indicate very important aspects for the sample examined; and, finally, high quality, trust and safety, and special products, which represent the most requested attributes, especially in e-commerce.

To perform a robust analysis and to understand the adequacy of the sample under study, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO Test) and the Test of Sphericity by Bartlett were carried out. Low index values suggest the potential inadequacy of the sample, as correlations between pairs of variables cannot be explained by the variance shared by the set of variables. Both measures resulted to be significant - as KMO Test values are higher than 0,7 (Tab. 3) - so we proceeded with the analysis.

Tab. 3: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,753
Bartlett's Test of Sphericity	Approx. Chi-Square	1214,133
	df	210
	Sig.	,000

Source: our elaboration with IBM SPSS Statistics

Next, Communalities were studied (Tab. 4), which showed significant values - as they are less than '1' but greater than ',40' - in terms of the level of variance explained by common factors.

Tab. 4: Communalities

	Initial	Extraction
<i>Frequency_purc</i>	1,000	0,572
<i>INFO_Label</i>	1,000	0,753
<i>INFO_WOM</i>	1,000	0,499
<i>INFO_Internet</i>	1,000	0,746
<i>INFO_Social</i>	1,000	0,754
<i>INFO_Restaurants</i>	1,000	0,663
<i>ITplaces_cons</i>	1,000	0,463
<i>Sustainability</i>	1,000	0,684
<i>S-Supply_ch</i>	1,000	0,685
<i>Freshness</i>	1,000	0,436
<i>Organic</i>	1,000	0,598
<i>Traceability</i>	1,000	0,499
<i>PDO</i>	1,000	0,611
<i>Pasta</i>	1,000	0,499
<i>Wines</i>	1,000	0,641
<i>High-quality</i>	1,000	0,740
<i>Special_products</i>	1,000	0,592
<i>Trust&Security</i>	1,000	0,715
<i>Cafe-Rest_purc</i>	1,000	0,634
<i>Cheese</i>	1,000	0,601
<i>Salami</i>	1,000	0,641

Extraction Method: Principal Component Analysis.

Source: our elaboration with IBM SPSS Statistics

Subsequently, the Total Variance Explained (Tab. 5) was carried out, which shows that the factors to be extracted are six and that these are able to explain more than half of the total variance of the phenomenon under consideration (precisely, 61,55%).

Tab. 5: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4,463	21,250	21,250	4,463	21,250	21,250	2,983	14,205	14,205
2	2,458	11,706	32,956	2,458	11,706	32,956	2,752	13,107	27,312
3	1,954	9,307	42,263	1,954	9,307	42,263	2,084	9,923	37,235
4	1,629	7,758	50,021	1,629	7,758	50,021	2,027	9,651	46,886
5	1,338	6,371	56,393	1,338	6,371	56,393	1,811	8,624	55,510
6	1,084	5,161	61,554	1,084	5,161	61,554	1,269	6,044	61,554
7	0,902	4,296	65,850						
8	0,863	4,110	69,960						
9	0,755	3,597	73,557						
10	0,687	3,271	76,828						
11	0,596	2,837	79,665						
12	0,582	2,772	82,437						
13	0,573	2,727	85,164						
14	0,501	2,384	87,548						
15	0,466	2,218	89,766						
16	0,446	2,124	91,890						
17	0,440	2,094	93,984						
18	0,377	1,796	95,781						
19	0,352	1,677	97,457						
20	0,292	1,392	98,849						
21	0,242	1,151	100,000						

Extraction Method: Principal Component Analysis.

Source: our elaboration with IBM SPSS Statistics

Finally, the Rotated Component Matrix (Tab. 6) identified the six extracted components: *product characteristics*, *'Made in Italy' products*, *COVID-19 effect*, *experience cycle*, *information channels*, and *informed purchases*.

The first one includes all the variables related to the characteristics that British consumers pay more attention when it comes to purchasing Italian food products (i.e., Sustainability, S-Supply_ch, Freshness, Organic, Traceability, and PDO). This latent factor, which we have called '*product characteristics*', confirms the importance given to sustainable production and consumption, characterised by a short, controlled and traceable supply chain, the link with tradition and territory, as well as quality and origin certifications (i.e., PDO). The second component includes the following items: Pasta, Wines, Cheese, and Salami. Since these variables identify the most representative product categories of Italian excellence at an international level, we referred to this latent factor as '*Made in Italy products*'. The third factor is called the '*COVID-19 effect*' as it is composed of those aspects that make the online shopping experience of Italian food products more appealing (i.e., High-quality, Special-products, and Trust&Security). It includes elements that play a fundamental role in the international food purchasing process, such as the high-quality, safety, trust, and reliability of the '*Made in Italy*' food products, as well as those special products that are hard to find locally.

Tab. 6: Rotated Component Matrix

	Component					
	1	2	3	4	5	6
<i>Frequency_purc</i>						,569
<i>INFO_Label</i>						,824
<i>INFO_WOM</i>					,407	
<i>INFO_Internet</i>					,827	
<i>INFO_Social</i>					,852	
<i>INFO_Restaurants</i>				,785		
<i>ITplaces_cons</i>				,662		
<i>Cafe-Rest_purc</i>				,771		
<i>Sustainability</i>	0,786					
<i>S-Supply_ch</i>	0,811					
<i>Freshness</i>	0,573					
<i>Organic</i>	0,748					
<i>Traceability</i>	0,628					
<i>PDO</i>	0,528					
<i>Pasta</i>		0,656				
<i>Wines</i>		0,754				
<i>Cheese</i>		0,723				
<i>Salami</i>		0,777				
<i>High-quality</i>			0,822			
<i>Special_products</i>			0,726			
<i>Trust&Security</i>			0,801			

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser

Normalization.

Source: our elaboration with IBM SPSS Statistics

The '*experience cycle*' represents the fourth latent factor emerging from the analysis of the British sample. It identifies the importance given by consumers to the product experience cycle, which starts from the collection of information, and then ends with the purchase and consumption of the food product. It takes place in environments that recreate the contexts of origin, such as Italian cafes and restaurants abroad (i.e., *INFO_Restaurants*, *ITplaces_cons*, and *Café-Rest_purc*), which makes consumers experience more authentic, reinforcing their personal idea of Made in Italy. The fifth component locates the '*information channels*' used by the UK respondents in their

collection process (i.e., INFO_WOM, INFO_Internet, and INFO_Social). It is based on informative aspects, both online and in physical contexts, through word of mouth, the internet or social networks, which allow the sharing of feedback and reviews. Lastly, the label represents a direct and immediate source of information on the characteristics of the food product. Through its consultation, the consumer makes '*informed purchases*' choices, which is our sixth latent factor (i.e., Frequency_purc and INFO_Label). The frequency of purchase outlines a quality index associated with Made in Italy, which represents a distinctive element whose presence on the label is preferable to be easily recognisable.

Table 7 summarised the abovementioned considerations.

Tab. 7: Summary

<i>Latent factor</i>	<i>Description</i>	<i>Item</i>
<i>Product characteristics</i>	It refers to the characteristics that British consumers value when it comes to purchasing Italian food products (i.e., sustainable production and consumption, short, controlled and traceable supply chain, the link with tradition and territory, as well as quality and origin certifications).	<i>Sustainability</i> <i>S-Supply_ch</i> <i>Freshness</i> <i>Organic</i> <i>Traceability</i> <i>PDO</i> <i>Pasta</i>
<i>'Made in Italy' products</i>	It refers to the most representative product categories of Italian excellence at an international level: pasta, wines, cheese, and salami.	<i>Wines</i> <i>Cheese</i> <i>Salami</i>
<i>COVID-19 effect</i>	It refers to attributes that leverage on the pillars of 'Made in Italy', such as high-quality, safety and reliability, as well as typical productions.	<i>High-quality</i> <i>Special-products</i> <i>Trust&Security</i>
<i>Experience cycle</i>	It refers to the collection of information, and the purchase and consumption of the food product into an Italian environment (i.e., cafes and restaurants).	<i>INFO_Restaurants</i> <i>ITplaces_cons</i> <i>Cafe-Rest_purc</i>
<i>Information channels</i>	It refers to the information channels used by UK respondents in their collection process (i.e., word of mouth, the internet or social networks).	<i>INFO_WOM</i> <i>INFO_Internet</i> <i>INFO_Social</i>
<i>Informed purchases</i>	It refers to repeated purchases of Italian food products resulting from the presence of clear and recognisable label information.	<i>Frequency_purc</i> <i>INFO_Label</i>

Source: our elaboration

5. Discussion and Conclusions

Through the exploration of a sample of British consumers, it was possible to contribute to the debate on consumers' food purchasing behaviour from a broader perspective. Since little is known about how consumers approach and evaluate imported food products (Thøgersen *et al.*, 2017), this study aimed to bridge this knowledge gap by investigating the factors that drive foreign consumers to purchase Italian food products. Our findings are consistent with the previous sample and background analysis and confirm the importance of quality cues in the decision-making process. Specifically, six latent factors were extracted from the exploratory analysis. The first one refers to the characteristics of the Italian product most appreciated by British consumers. It emphasises aspects related to the freshness and quality of the food product, the length of the supply chain, its traceability, sustainable production and consumption, as well as quality schemes related to cultural, territorial, and origin certifications (i.e., PDO, PGI, and TSG). These characteristics are associated with the greater propensity of consumers towards healthy and conscious food habits, which is found to increase as food safety concerns emerge (Dinnie, 2004). As for the second latent factor, it identifies the most representative product categories of Italian excellence at an international level: pasta, wines, cheese, and salami. These products are an expression of 'Made in Italy' values of quality, tradition, culture, passion, and know-how (Aiello *et al.*, 2015; Bertoli, 2013; Caiazza and Volpe, 2014). The sample also linked 'Made in Italy' to attributes of high-quality, safety, trust,

reliability and speciality, which attract consumers in their shopping experience, even in dematerialised contexts such as e-commerce. This occurs especially when economic, social, or health-related crises arise, such as the COVID-19 pandemic, which make the shopping experience more difficult and generate uncertainty and market instability. The fourth component, on the other hand, identifies the steps that form the consumer's cycle experience. In detail, it starts with the collection of information on the characteristics of the food product which then translates into purchasing and consumption decisions. Hence the importance of an accurate communication strategy on the characteristics of Italian food products, which must be clear and focused on those attributes that appeal to foreign consumers the most. It is also necessary to pay attention to the consumption environments, which represent an important source of knowledge for foreign consumers, through which they strengthen their idea of 'Made in Italy'. The intensity of their experience, indeed, is found to be stronger when it is placed in contexts recalling the Country-of-Origin cue (such as Italian restaurants and cafes abroad). Lastly, the investigation identified two latent factors on how British respondents collect information on Italian food products. It emerges that they retrieve information from physical or online contexts (i.e., word of mouth, internet, social media, label, and purchasing experiences), the analysis of which lead consumers to make informed purchasing choices.

According to these findings, the value and characteristics that foreign consumers associate with 'Made in Italy' are well established, thus allowing us to broaden the theoretical knowledge in this research field as well as to answer the questions underlying this study. Regarding the first research question, this study aimed to identify those factors that influence the purchasing process of Italian food products abroad. The results show that quality, freshness, sustainability, traceability of the supply chain, as well as cultural, territorial, and origin certifications are characteristics highly esteemed by British consumers, which identify the first latent factor extracted from the sample. Secondly, although the analysis has highlighted the importance of food quality throughout the supply chain, to date no study has investigated the influence of its certifications (i.e., PDO, PGI, and TSG) in a context of high uncertainty such as that of COVID-19. It emerges that UK consumers are looking for more information on food safety in the purchasing process, using different tools for quality assessment. Its implementation is crucial as the emergency is taking longer than initially expected due to the unpredictability of the phenomenon. Among others, product labels and country-of-origin quality schemes are key allies in ensuring consumer safety when purchasing but also in boosting exports. Finally, this study explored the power of e-commerce in promoting the quality, safety, and reliability of Italian food products in worldwide markets. Several statistics underline the resilience and strength of this distribution channel, which, unlike others that have suffered breakdowns and stagnant sales, has brought home unimaginable performance during a global economic crisis. Thus, the reasons for its success, as well as its potential, were researched. In this regard, it was found that attributes related to high-quality, special and refined products, as well as aspects related to trust and food safety, are associated with online shopping experiences. Besides its convenience, e-commerce also represents a safer distribution channel for consumers in terms of both information accuracy and health protection. As regards the former, it seeks to bridge the information asymmetry gap between producers and consumers, lowering the risk of food insecurity (Abid and Jie, 2021; Glogoveţan *et al.*, 2022). As for the latter, it shortens the distribution chain and reduces the chances of infection compared to an in-store shopping experience. Based on these results, it is possible to answer positively all research questions and suggest that Italian companies should strategically leverage and exploit the 'Made in Italy' competitive advantage, such as through territorial marketing campaigns (Roth and Diamantopoulos, 2009). In particular, it is desirable to adopt communication and promotion strategies based on product quality schemes intended not as mere certifications but as tools to promote territorial development, increase the supply chain value and favour social responsibility. In this way, the concept of origin becomes synonymous with quality, tradition, uniqueness and territorial identity, transforming consumption into a remote territorial experience for the consumer. Furthermore, strategies to enhance transparency along the food supply chain need to be implemented as a future defence against food fraud (Brooks *et al.*,

2021). Indeed, the effectiveness of actions against counterfeit Italian food products is based on the level of education of the final consumer towards product characteristics. Therefore, communicating and enhancing all these aspects of the Italian offer could be a great opportunity for Italian businesses.

From a managerial perspective, although its embryonic stage, our research represents a first step towards the understanding of the benefits of exploiting 'Made in Italy' attributes abroad. In particular, this study reveals some managerial implications for various players in the food value chain, considering both producers and distributors. As far as producers are concerned, the product characteristics most appreciated by consumers are underlined, which must be implemented to strengthen the value of their offer in terms of quality, safety, authenticity, health, etc. Thanks to quality schemes (i.e., PDO, PGI, and TSG) it is possible to transfer more information, make more informed purchases, promote the production areas, and make consumers live a remote territorial experience. In addition, it is highlighted the role of certifications as a further element of safety and authenticity of food from a health perspective. On the distribution side, e-commerce proves to be a remarkable distribution channel, whose interest has increased with the spread of the COVID-19 virus. Consequently, nowadays producers and distributors need to implement this sales channel, adopting an omnichannel strategy and improving their offer through partnerships with companies in complementary sectors to face the constantly evolving scenario. This will only be possible if coordination between the business and academic world is ensured, creating a dynamic environment aimed at strengthening the Italian value. Furthermore, new strategies need to be developed to be prepared for possible future exogenous events (such as a new pandemic or economic crisis), which, if not properly addressed, can lead to disastrous consequences.

Undoubtedly, the present study is not without limitations, which provide promising avenues for further research. First, it considers only the United Kingdom. Despite leaving the eurozone, the United Kingdom remains a country close to Italy, both in geographical and cultural terms. As pointed out by the analysis of the sample, the consumption and buying habits of the British do not differ much from those of the Italians, as both are developed and wealthy countries. Contrarily, it would be interesting to answer our research questions by considering less westernised countries, characterised by purchasing and consumption behaviours far from those we are used to. Secondly, the sample under consideration is not large enough to generalise the obtained results. Therefore, several extensions of this study are acknowledged. Future analysis should focus on a large and well-stratified sample and include a cross-countries examination and comparison. As preferences change among the nationality or regionality of the consumers, as well as between consumers (Becket, 1999), further investigations are necessary to explore new markets and confirm the importance of Country-of-Origin in other contexts too. This way, it will be possible to understand whether exists any cross-cultural difference in this context and how to overcome or exploit this barrier. Thirdly, the existence of other food attributes capable of influencing this phenomenon must also be investigated. Lastly, longitudinal studies are needed. Research on Country-of-Origin, certifications and the internet, is highly influenced by the time in which they're conducted (Adina *et al.*, 2015; Inch and Cuthbert, 2018; Lu *et al.*, 2016). Hence the need to monitor the evolution of these topics over time.

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Internazionalizzazione e eco-innovazione: analisi del contesto italiano

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Abstract

Inquadramento della ricerca. Il presente lavoro contribuisce allo studio della relazione tra eco-innovazione e internazionalizzazione. In particolare, si è cercato di capire come: l'essere una MNE, l'intensità della presenza sui mercati esteri tramite IDE e la diversificazione geografica impattano sullo sviluppo di eco-innovazioni.

Obiettivo del paper. Dalla necessità mondiale di ridurre l'impatto ambientale delle attività verso modelli di sviluppo sostenibili, obiettivo dello studio è confermare la relazione positiva tra imprese multinazionali ed eco-innovazione, misurata grazie ai brevetti verdi, e approfondire l'effetto di una specifica modalità di internazionalizzazione, gli IDE, sull'eco-innovazione.

Metodologia. È stata condotta un'analisi econometrica su un campione di 38,993 imprese italiane multinazionali e non, innovatrici con brevetti green e non.

Risultati. I risultati confermano che le imprese multinazionali introducono più eco-innovazioni rispetto alle imprese domestiche e che la diversificazione geografica risulta essere una determinante chiave per l'eco-innovazione.

Limiti della ricerca. L'uso del brevetto come misura dell'eco-innovazione è un limite alla ricerca. Nell'eco-innovazione l'elemento di novità che genera un impatto positivo sull'ambiente non deve per forza essere sconosciuto allo stato dell'arte ma deve essere nuovo per l'impresa che lo adotta.

Implicazioni manageriali. Per le aziende che operano a livello internazionale e per le politiche pubbliche questo studio ha importanti implicazioni pratiche. Per raggiungere modelli di sviluppo sostenibile è necessario incentivare la presenza internazionale tramite IDE e su Paesi diversificati.

Originalità del paper. L'analisi, grazie all'impiego di diverse dimensioni di internazionalizzazione ha permesso di dimostrare l'importanza di un meccanismo specifico di internazionalizzazione (IDE), come determinante per l'eco-innovazione.

Parole chiave: Internazionalizzazione, Eco-innovazione, Green Patents, Analisi Empirica.

Framing of the research. This work contributes to the study of the relationship between eco-innovation and internationalization. We tried to understand how: being an MNE, the intensity of presence on foreign markets through FDI and geographical diversification impact the development of eco-innovations.

Purpose of the paper. From the global need to reduce the environmental impact of activities towards sustainable development models, the aim of the study is to confirm the positive relationship between multinational companies and eco-innovation, measured as green patents, and to investigate the effect of a specific method of internationalization, FDI, on eco-innovation.

Methodology. An econometric analysis was conducted on a sample of 38,993 Italian multinational and non-multinational firms, innovators with green and non-green patents.

Results. The results confirm that multinational companies introduce more eco-innovations than domestic companies and that geographical diversification is a key determinant of eco-innovation.

Research limitations. The use of the patent as a measure of eco-innovation limits our research. In eco-innovation, the novelty element that generates a positive impact on the environment does not necessarily have to be unknown to the state of the art but must be new for the company that adopts it.

Managerial implications. For international firms and for public policy, this study has important practical implications. To achieve sustainable development models, it is necessary to encourage international presence through FDI and in diversified countries.

Originality of the paper. The analysis, thanks to the use of different dimensions of internationalization, allowed to demonstrate the importance of a specific internationalization mechanism (FDI), as a determinant for eco-innovation.

Keywords: Internationalization, Eco-innovation, Green Patents, Empirical Analysis.

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1. Introduzione

La lotta contro il cambiamento climatico è una sfida che non si può più rimandare. È necessario moderare l'impatto sull'ambiente, sfruttando ogni mezzo a disposizione. Semplificando questo concetto e grazie alla celebre equazione IPAT¹ (Ehrlich e Holdren, 1971) è possibile individuare le tre cause principali che lo determinano: popolazione, benessere economico e tecnologia. È su quest'ultimo fattore che le imprese possono e devono concentrarsi, per ridurre l'impatto ambientale delle proprie attività e raggiungere modelli di produzione e sviluppo sostenibile. In particolare, le eco-innovazioni possono essere considerate come una risposta ai problemi ambientali che prevede cambiamenti tecnologici e produttivi (Ehrenfeld, 2008). Eco-innovazione è definita come “produzione, applicazione o sfruttamento di un bene, servizio, processo produttivo, struttura organizzativa, metodo di gestione o business nuovo per l'impresa o per l'utente e che si traduce, durante tutto il suo ciclo di vita in una riduzione del rischio ambientale, dell'inquinamento e degli impatti negativi dell'uso delle risorse (compreso l'uso dell'energia) rispetto alle alternative rilevanti esistenti” (Kemp e Foxon, 2007, p. 4). Eco-innovare fornisce vantaggi tecnologici che generano non solo benefici ambientali, per la popolazione, ma anche economici, per l'impresa (Sarkar, 2013). Diventa quindi rilevante comprendere al meglio le motivazioni che stimolano l'eco-innovazione.

Tra le altre, una delle determinanti principali dell'eco-innovazione è l'internazionalizzazione. Diversi studi hanno infatti analizzato l'effetto della presenza sui mercati internazionali sull'innovazione (Kafourous *et al.*, 2008; Hsu *et al.*, 2015; Vrontis e Christofi, 2021) sostenendo che le caratteristiche intrinseche dell'internazionalizzazione rendono le imprese più propense all'innovazione rispetto alle imprese domestiche (Shearmur *et al.*, 2015). L'internazionalizzazione, infatti, offre alle imprese l'opportunità di entrare in contatto con mercati globali, caratterizzati da meccaniche, normative e regolamenti diversi rispetto a quelli del mercato domestico, con la possibilità di migliorare la propria base di competenze e sfruttare processi di apprendimento unici, interagendo con clienti, collaboratori, comunità, diversi rispetto a quelli dei mercati locali.

Per queste ragioni, si è ipotizzato che le imprese che operano su mercati internazionali introducono maggiori innovazioni ambientali rispetto alle imprese che si concentrano solo nel mercato domestico. In particolare, per contribuire all'avanzamento della letteratura rispondendo alla chiamata di Hojnik *et al.* (2018), si è deciso di approfondire un particolare meccanismo di internazionalizzazione, gli Investimenti Diretti Esteri (IDE). Sono state sviluppate tre ipotesi di ricerca: le imprese che detengono almeno un IDE sono più inclini a sviluppare eco-innovazioni; le imprese che detengono un numero maggiore di IDE sono più inclini a sviluppare eco-innovazioni; le imprese che detengono IDE in un numero maggiore di Paesi sono più inclini a sviluppare eco-innovazioni.

Per testare le ipotesi di ricerca è stato utilizzato un campione di 38,993 imprese italiane multinazionali e non, che hanno brevettato o meno in eco-innovazioni, con dati relativi all'anno 2019. La scelta di misurare le eco-innovazioni tramite brevetto ha permesso di individuare specifiche categorie di tecnologie ambientali, come definito dall'IPC Green Inventory (Oltra *et al.*, 2010; Hašičić e Migotto, 2015).

Il contesto italiano risulta appropriato per l'indagine. Le stime indicano che i valori relativi agli IDE rappresentano quasi il 24% del PIL. Inoltre, la tematica ambientale è oggi di primaria importanza per il Paese. L'8 settembre 2021 il parlamento italiano ha approvato l'inserimento in Costituzione della tutela dell'ambiente, della biodiversità e degli ecosistemi. Anche il mondo delle imprese è impegnato sul fronte dello sviluppo sostenibile. Sono infatti oltre 441 mila le imprese che hanno deciso di investire in tecnologie e prodotti green nel quinquennio 2016-2020 (Fondazione Symbola, 2021). I risultati confermano che le imprese multinazionali introducono maggiormente l'eco-innovazione rispetto alle imprese domestiche. Tra le modalità di internazionalizzazione, la diversificazione internazionale risulta essere una determinante per l'eco-innovazione.

¹ L'impatto ambientale è sintetizzabile in una formula ($I = P \times A \times T$) presentata da Paul Ehrlich e John Holdren (1976) e composta da tre variabili indipendenti: la popolazione ($P = \text{population}$), il benessere economico ($A = \text{affluence}$) e la tecnologia ($T = \text{technology}$).

2. Eco-innovazione e internazionalizzazione: analisi della letteratura e sviluppo delle ipotesi di ricerca

2.1 Eco-innovazione: evoluzione del concetto e determinanti

La prima definizione di eco-innovazione data in letteratura risale al 1996 (Fussler e James, 1996) e la descrive come “i nuovi prodotti o processi che forniscono valore al consumatore e all’azienda, ma che diminuiscono considerevolmente gli impatti ambientali”. Oggi il concetto è stato ampliato, rielaborato e definito come “produzione, applicazione o sfruttamento di un bene, servizio, processo produttivo, struttura organizzativa, metodo di gestione o business nuovo per l’impresa o per l’utente e che si traduce, durante tutto il suo ciclo di vita in una riduzione del rischio ambientale, dell’inquinamento e degli impatti negativi dell’uso delle risorse (compreso l’uso dell’energia) rispetto alle alternative rilevanti esistenti” (Kemp e Foxon, 2007, p. 4). Le eco-innovazioni possono essere quindi considerate come una risposta volta ad affrontare gli impatti ambientali dei processi economici, che include cambiamenti tecnologici e produttivi con lo scopo di migliorare la performance ambientale di prodotti, servizi e del loro processo di produzione (Ehrenfeld, 2008).

L’elemento chiave che caratterizza l’eco-innovazione rimane la performance ambientale, che prescinde dalla mera motivazione ambientale. Infatti, l’eco-innovazione può nascere da importanti motivazioni ambientali (Ozusaglam, 2012), ma può essere anche “effetto collaterale” di altre motivazioni (Kemp e Pearson, 2007), come ad esempio rispettare le regolamentazioni o le norme, la necessità di aumentare la produttività, di ridurre i costi degli input. Qualsiasi innovazione può essere quindi considerata come una potenziale eco-innovazione (OECD, 2009). Per questo le eco-innovazioni non vengono create solo nelle eco-industrie ma in qualsiasi settore dell’economia, come parte integrante degli sforzi innovativi delle imprese (Sica, 2016).

Come accade per le innovazioni, sviluppare eco-innovazioni dipende dai benefici che l’impresa può ottenere. I benefici possono essere diretti, come i vantaggi operativi, il risparmio sui costi grazie a una maggiore produttività delle risorse, una migliore logistica e maggiori vendite dalla commercializzazione, o indiretti, come una migliore immagine, migliori relazioni con i fornitori, i clienti e le autorità, una maggiore capacità di innovazione generale grazie ai contatti con i detentori di conoscenze, benefici per la salute e la sicurezza e maggiore soddisfazione dei lavoratori (Kemp e Andersen, 2004).

Per sviluppare eco-innovazioni è necessario però anche superare il “problema della doppia esternalità” (Rennings, 2000; Horbach *et al.*, 2013). Le eco-innovazioni possono fornire vantaggi sia alle imprese che le adottano ma anche ad attori diversi da quelli che vi investono. Se i benefici si verificano nel medio-lungo periodo, viceversa i costi dell’eco-innovazione sono concentrati in anticipo e devono essere sostenuti esclusivamente dalle imprese innovatrici (Cecere *et al.*, 2020). A causa di queste esternalità, gli incentivi delle imprese a realizzare progetti innovativi calano, causando sotto investimenti (Rennings, 2000). Il problema della doppia esternalità evidenzia l’importanza di individuare fattori determinanti per superare lo scarso incentivo all’eco-innovazione (Cainelli *et al.*, 2015).

Le determinanti dell’eco-innovazione, differenti rispetto alle innovazioni tradizionali, sono state oggetto di studio in letteratura (Barbieri *et al.* 2016; del R o *et al.* 2016; Hojnik e Ruzzier 2016; Pacheco *et al.* 2017). Per prima cosa, la maggior complessità delle eco-innovazioni necessita di migliori livelli collaborazioni inter e intra organizzative (Messeni Petruzzelli *et al.*, 2011). L’impresa cercherà partner con cui cooperare nel processo eco-innovativo, in modo da condividere il rischio (Cainelli *et al.*, 2015). Anche De Marchi (2012) sottolinea che la cooperazione formale con *partner* esterni è ancora più importante per le eco-innovazioni. Un’altra determinante all’eco-innovazione è la varietà di risorse necessaria. Sono richieste infatti fonti di conoscenza più eterogenee rispetto ad altre innovazioni (Horbach *et al.*, 2013). Anche lo sviluppo di risorse interne è una determinante chiave per l’eco-innovazione. Un’organizzazione strutturata, dotata di capacità di ricerca e sviluppo interna è positivamente correlata all’introduzione di eco-innovazioni (Cainelli

et al., 2015). Infine, le imprese per eco-innovare necessitano maggiormente di personale altamente qualificato e risorse finanziarie (del Ríó *et al.*, 2016; Ghisetti *et al.*, 2017).

In sintesi, la propensione al rischio, la capacità di collaborare con partner esterni, la facilità di accesso a fonti esterne di finanziamento e la disponibilità di conoscenza e risorse umane rappresentano fattori chiave per lo sviluppo di eco-innovazioni.

2.2 Internazionalizzazione come determinante per l'eco-innovazione

Diversi studi hanno analizzato il ruolo dell'internazionalizzazione come determinante per l'innovazione (Kafouros *et al.*, 2008; Hsu *et al.*, 2015; Vrontis e Christofi, 2021). Shearmur *et al.* (2015) sostengono che le caratteristiche intrinseche dell'internazionalizzazione rendono le imprese che operano su mercati internazionali più propense all'innovazione rispetto alle imprese domestiche. L'internazionalizzazione, infatti, è il processo di acquisizione, integrazione e utilizzo delle conoscenze e delle competenze in operazioni internazionali attraverso una crescente partecipazione ai mercati esteri (Vahlne e Johanson, 2013). Partendo dalla teoria dell'apprendimento organizzativo, essere esposti a una fonte di conoscenza diversa, non disponibile nel mercato domestico aumenta la base di competenze di un'impresa, che potrà trarre vantaggio da questi diversi input di conoscenza per promuovere l'innovazione. Le imprese che operano su mercati internazionali apprendono infatti da partner, clienti e rivali stranieri e sfruttano queste nuove conoscenze per innovare e implementare nuove tecnologie (Love e Ganotakis, 2013). Il processo di apprendimento fornisce all'impresa nuove competenze, abilità e metodi di lavoro, migliorandone la capacità innovativa. Inoltre, partendo dall'ipotesi di superiorità tecnologica di imprese situate in paesi sviluppati, possono beneficiare dell'esistenza di *spillover* tecnologici tra capitali situati in Paesi diversi. Le imprese quindi, attraverso l'internazionalizzazione, hanno maggiori possibilità di accedere a tecnologie più avanzate e quindi sviluppare a loro volta innovazione (Álvarez e Moleró, 2005).

Nonostante la vasta letteratura riguardante l'innovazione, l'analisi del rapporto tra internazionalizzazione e eco-innovazione rappresenta un filone di ricerca nascente, con diversi aspetti ancora da esplorare (Cainelli *et al.*, 2012; Chiarvesio *et al.*, 2015). In linea con la letteratura che mette in relazione internazionalizzazione e innovazione, si suppone che la stessa relazione sussista anche con l'eco-innovazione (Peñasco *et al.*, 2017). L'internazionalizzazione offre infatti opportunità di apprendimento che potrebbero favorire anche l'eco-innovazione (Williams e Shaw, 2011; Boermans e Roelfsema, 2015). L'analisi esplorativa di De Marchi e Grandinetti (2013) suggerisce che il numero di partner con cui un'azienda collabora nel perseguimento delle attività di innovazione è più alto per gli eco-innovatori rispetto agli innovatori tradizionali, e aumenta con il numero di problematiche ambientali che le aziende affrontano attraverso i loro sforzi innovativi.

Hojnik *et al.* (2018) hanno lanciato un invito a sviluppare nuovi studi che analizzino le meccaniche con cui l'internazionalizzazione stimola l'eco-innovazione, suggerendo di approfondire il ruolo delle modalità di internazionalizzazione, come gli IDE. Gli IDE sono infatti un importante meccanismo per le imprese per entrare nelle reti di settore globali, dove la conoscenza relativa alle migliori pratiche ambientali e all'innovazione è condivisa e circola (Gulati *et al.* 2000). Forniscono preziosi collegamenti per aumentare l'efficienza ambientale, attraverso la generazione di *spillover* tecnologici vantaggiosi per l'ambiente e la stimolazione delle dinamiche competitive (Neumayer e Perkins, 2004). Se alle esportazioni e all'*outsourcing* corrisponde lo sviluppo di nuovi prodotti e processi, la presenza internazionale tramite IDE impatta direttamente sulla brevettazione e sulla spesa in ricerca e sviluppo. È importante sottolineare che attraverso gli IDE le imprese sono anche esposte a maggiori pressioni istituzionali per la sostenibilità ambientale e l'innovatività, le quali, se soddisfatte, aiutano l'azienda a ottenere una reputazione migliore dal punto di vista della responsabilità ambientale. Nello studio di Cainelli *et al.* (2012) tuttavia, le spinte internazionali come gli IDE o il commercio internazionale sembrano avere relativamente meno peso nello spiegare l'adozione dell'eco-innovazione rispetto ai fattori locali, quali i distretti industriali locali oppure la cooperazione con attori pubblici o privati locali. Secondo gli autori le imprese

multinazionali devono essere infatti localmente integrate e geograficamente agglomerate per avere un vantaggio nell'adozione delle eco-innovazioni rispetto alle imprese nazionali (Cainelli *et al.*, 2012). Infine, un altro studio sostiene che forme complesse di innovazione, come l'eco-innovazione, siano strettamente correlate con modalità di internazionalizzazione quali gli IDE (Boermans e Roelfsema, 2015).

In sintesi, seguono le prime due ipotesi di ricerca:

HP1: le imprese che detengono almeno un IDE sono più inclini a sviluppare eco-innovazioni.

HP 2: le imprese che detengono un numero maggiore di IDE sono più inclini a sviluppare eco-innovazioni.

Le imprese con una presenza globale su più paesi sviluppano pratiche, politiche e standard ambientali adattati a diverse legislazioni, spesso più esigenti di quelle locali (Porter e Van der Linde, 1995), stimolando l'apprendimento di conoscenza (Hitt *et al.*, 1997) e lo sviluppo di migliori capacità organizzative. La diversificazione internazionale e l'adozione di una strategia ambientale proattiva sono infatti positivamente correlati (Aguilera-Caracuel *et al.*, 2012). Anche i risultati degli studi di Christmann e Taylor (2001) e di Luan *et al.* (2016) confermano che le imprese multinazionali hanno un effetto positivo sulle prestazioni ambientali e sulla probabilità di adottare le norme ISO 14000, in quanto trasferiscono le tecnologie ambientali avanzate alle loro filiali localizzate in paesi diversi, insieme a sistemi di gestione ambientale, che soddisfano le richieste normative dei paesi più severi (Suarez-Perales *et al.*, 2017).

Segue quindi l'ultima ipotesi:

HP 3: le imprese che detengono IDE in un numero maggiore di Paesi sono più inclini a sviluppare eco-innovazioni.

3. Analisi empirica

3.1 Campione e fonti

Le analisi si concentrano sul contesto Italiano. Si è deciso di lavorare su un campione di imprese italiane per due motivi: il primo riguarda l'importanza della tematica ambientale per il paese. Le recenti modifiche nella costituzione e l'introduzione di figure chiave per lo sviluppo sostenibile nel governo, come il Ministro per la Transizione Ecologica o il Ministro delle Infrastrutture e della Mobilità Sostenibile, sono passaggi chiave che testimoniano la rilevanza di questa di sfida. Il secondo motivo riguarda il contesto dell'economia italiana. L'economia italiana è aperta, con importanti accordi all'estero. Testimonianza sono i valori relativi agli IDE, che rappresentano quasi il 24% del PIL.

Il database utilizzato per l'analisi è composto da dati provenienti da diverse fonti relative ai brevetti e alle informazioni aziendali. Il campione è stato ottenuto con la tecnica del campionamento stratificato dalla popolazione di imprese Italiane estratta dal database *Orbis Worldwide* (*Bureau van Dijk*), comprendente aziende attive che avessero dati di bilancio disponibili per l'anno 2019 (anno di riferimento per le analisi). Questo ha permesso di considerare un campione numeroso ed eterogeneo di imprese, sia in termini di innovazione che di internazionalizzazione.

I dati sui brevetti sono stati estratti dal database *Orbis Intellectual Property* (*Bureau van Dijk*), costruito con le informazioni disponibili su *PATSTAT*, database rilasciato dall'*European Patent Office*. È stato costruito lo stock di brevetti di un'impresa come il numero di brevetti depositati dall'impresa nell'arco temporale 2000-2019². Inoltre, abbiamo misurato l'eco-innovazione come lo

² Come data in cui l'impresa ha depositato il brevetto è stato considerato il *priority date*.

stock di *green patents* facendo riferimento al *IPC Green Inventory*, realizzato dal comitato di esperti *IPC*. Questa classificazione raccoglie i brevetti che rientrano nelle *Environmentally Sound Technologies*, tecnologie definite verdi dal *United Nations Framework Convention on Climate Change (UNFCCC)*. L'inventario suddivide i brevetti in 7 categorie principali: *alternative energy production, transportation, energy conservation, waste management, agriculture / forestry, administrative, regulatory or design aspects, nuclear power generation*.

I dati relativi all'internazionalizzazione sono stati estratti dal database *Reprint*. *Reprint* dispone di un censimento di imprese italiane che hanno realizzato IDE in uscita a partire dal 1986. I criteri per l'identificazione degli IDE sono basati su principi economici, non di natura giuridico formale o giuridico amministrativa. Per questo motivo, non sono stati considerati gli IDE effettuati da istituzioni finanziarie (Mariotti e Mutinelli, 2017).

I dati di bilancio, relativi all'anno 2019, sono stati estratti dal database *Orbis Worldwide*.

Il campione finale, risultato dell'unione delle variabili provenienti dai tre database, comprende 38,993 imprese italiane.

3.2 Variabili

Il brevetto è considerato tra le misure più precise per quantificare gli output di innovazione (Wang, 2007). A differenza di misure di input, come la spesa in ricerca e sviluppo, il brevetto può essere infatti considerato una misura del risultato del processo di innovazione (Hall *et al.*, 1984; Griliches, 1990). I vantaggi di questo tipo unità di misura sono duplici. Per prima cosa, è commensurabile. Il tipo di invenzione che può essere brevettato è basato su uno standard oggettivo ed è chiaramente definito. Inoltre, grazie alla procedura di brevettazione, è validata la qualità dell'innovazione. Infine, queste considerazioni vengono rafforzate nel caso dell'eco-innovazione (Ambec *et al.*, 2013). L'uso dei brevetti facilita infatti la classificazione tecnologica delle innovazioni, caratteristica fondamentale per l'analisi delle innovazioni ambientali. Per questo motivo l'uso del brevetto in campi di ricerca relativi all'ambiente è molto diffuso (Brunnermeier and Cohen, 2003; Nameroff *et al.*, 2004; Laurens *et al.*, 2017; Montobbio e Solito, 2018). Per queste ragioni è stata misurata l'eco-innovazione (*Green Patents*) come lo stock di brevetti appartenenti all'*IPC Green Inventory* detenuti da un'impresa, con priority date compreso nel periodo 2000-2019.

Le variabili indipendenti chiave per le analisi misurano l'internazionalizzazione di un'impresa. In letteratura è stato spesso discusso su quale fosse la misura più corretta da adottare (Reuber e Fischer, 1997). Seguendo studi recenti (Dunning, 2013; Alessandri *et al.*, 2018), sono state costruite tre variabili per indagare se, quanto e come un'impresa si espansione a livello internazionale. Se un'impresa possiede almeno un IDE è classificata come multinazionale (*Multinazionale*). L'intensità di internazionalizzazione è misurata come il numero di IDE di un'impresa (*Num IDE*). La diversificazione dell'internazionalizzazione è misurata come il numero di Paesi in cui l'impresa ha investito (*Num Paesi*).

Variabili di controllo sono state considerate. Il patrimonio di conoscenza di un'impresa è considerato un fattore determinante per l'eco-innovazione (Laurens *et al.*, 2017; Montobbio e Solito, 2018). La variabile *Innovazione*, data dallo stock di brevetti di ogni categoria tecnologica posseduto dall'impresa, con priority date dal 2000 al 2019 è ritenuta essere la proxy migliore.

La dimensione dell'impresa influenza direttamente sia i risultati dell'innovazione che il processo di generazione di conoscenza (Leal-Rodríguez *et al.*, 2015). Fattori come la scarsità di risorse scoraggiano l'innovazione nelle piccole imprese, mentre nelle grandi imprese multinazionali le aspettative degli stakeholders stimolano le imprese stesse ad essere più attive verso l'eco-innovazione (Vanstraelen *et al.*, 2003). La *Dimensione* è misurata come il logaritmo del fatturato.

Tab. 1: Variabili, descrizioni e fonti

Variabile	Definizione	Fonte
Variabile dipendente		
<i>Green Patents</i>	Stock di Green Patents (priority date dal 2000 al 2019)	PATSTAT
Independent internationalization variables		
<i>Multinazionale</i>	Variabile dummy di valore 1 se l'impresa è multinazionale, 0 altrimenti	REPRINT
<i>Num IDE</i>	Numero di IDE	REPRINT
<i>Num Paesi</i>	Numero di Paesi in cui l'impresa possiede almeno un IDE	REPRINT
Independent control variables		
<i>Innovazione</i>	Stock di brevetti (priority date dal 2000 al 2019)	PATSTAT
<i>Dimensione</i>	Logaritmo del fatturato	ORBIS
<i>Età</i>	Anni dall'anno di fondazione (al 2019)	ORBIS
<i>ROA</i>	Redditività del capitale investito	ORBIS
<i>ROE</i>	Redditività del capitale proprio	ORBIS
<i>ASR</i>	Flusso di cassa sul totale attivo	ORBIS
<i>RSR</i>	Capitale investito sui ricavi dalle vendite	ORBIS
<i>PSR</i>	Debiti di lungo termine sul totale attivo	ORBIS
<i>Quotata</i>	Variabile dummy di valore 1 se l'impresa è quotata, 0 altrimenti	ORBIS
<i>Posizione</i>	Variabile categorica per la sede geografica dell'impresa, con i seguenti livelli: "Nord", "Centro", "Sud"	ORBIS
<i>Settore</i>	Variabile categorica per il settore di attività delle imprese, con i seguenti livelli: "Pavitt science based", "Pavitt specialised suppliers", "Pavitt scale and information intensive", "Pavitt suppliers dominated", "Pavitt other"	ORBIS

Fonte: ns. elaborazioni

Quoted è la variabile dummy che controlla se l'impresa sia quotata in borsa.

Le variabili *ROA* e *ROE* sono state incluse come indici di redditività, per controllare la profittabilità dell'impresa (Hanel e St-Pierre, 2002; He e Jiang, 2019).

L'eco-innovazione richiede uno sforzo significativo, in termini di risorse finanziarie ed organizzative. Un'impresa in difficoltà finanziaria ha ridotte possibilità di sviluppare progetti a lungo termine. Sono state quindi prese in considerazione i tre tipi di slack resources (Daniel *et al.*, 2004; Alessandri *et al.*, 2018): available slack resources (*ASR*) è data dal rapporto tra il flusso di cassa e il totale attivo; recoverable slack resources (*RSR*) è misurata come il rapporto tra il capitale investito e i ricavi dalle vendite; potential slack resources (*PSR*) è data dal rapporto tra i debiti di lungo termine e il totale attivo.

Età è stata inclusa come proxy per la complessità e l'esperienza di un'organizzazione. In relazione all'innovazione, imprese da più tempo sul mercato potrebbero richiedere maggiori sforzi per innovare a causa dell'inerzia organizzativa (Egri e Herman, 2000). È stata misurata come il numero di anni dalla fondazione dell'impresa.

Sono state infine incluse variabili categoriche per controllare l'effetto derivante dalle diversità geografiche (se la sede dell'impresa è al *Nord*, al *Sud* o al *Centro*) e settoriali (se l'impresa appartiene a *Pavitt science based*, *Pavitt specialised suppliers*, *Pavitt scale and information intensive*, *Pavitt suppliers dominated*, *Pavitt other*). Nel primo caso, la variabile permette di controllare il fenomeno Nord-Sud tipico del territorio italiano (Eckaus, 1961), nel secondo caso perché le strategie di innovazione sono fortemente influenzate da specifici settori industriali (De Marchi, 2012; Berrone *et al.*, 2013; Bossle *et al.*, 2016).

In Tab. 1 sono presentate le definizioni e le fonti delle variabili, dipendenti e indipendenti, precedentemente descritte e utilizzate nelle analisi empiriche.

3.3 Statistiche descrittive e modelli

In Tab. 2 è descritta la distribuzione del campione tra imprese multinazionali, 10,224 (26% del campione), e imprese non multinazionali, 28,769 (74% del campione).

Tab. 2: Statistiche descrittive

	Imprese	Multinazionale = 0		Multinazionale = 1	
		N	%	N	%
	38993	28769	73.78%	10224	26.22%
<i>Imprese con almeno</i>					
Un brevetto	4288	802	2.06%	3486	8.94%
Un brevetto verde	339	32	0.08%	307	0.79%
<i>Settori</i>					
Science based	2191	1132	2.90%	1059	2.72%
Specialised Suppliers	7591	4496	11.53%	3095	7.94%
Scale and information intensive	3371	2032	5.21%	1339	3.43%
Suppliers dominated	18249	14348	36.80%	3901	10.00%
Others	7591	6761	17.34%	830	2.13%
<i>Posizione</i>					
Nord	22093	13994	35.89%	8099	20.77%
Centro	8089	6600	16.93%	1489	3.82%
Sud	8811	8175	20.97%	636	1.63%
<i>Dimensione</i>					
Piccola	31671	27301	70.02%	4370	11.21%
Media	4616	1169	3.00%	3447	8.84%
Grande	2706	299	0.77%	2407	6.17%
<i>Dimensione con almeno un brevetto verde</i>					
Piccola	54	17	5.01%*	37	10.91%*
Media	105	10	2.95%*	95	28.02%*
Grande	180	5	1.47%*	175	51.62%*

Fonte: ns. elaborazioni

* rispetto alle sole imprese con almeno un brevetto verde

Le imprese, seguendo la nomenclatura delle unità territoriali statistiche in Italia, sono così dislocate: 22,093 al Nord (Nord-Est e Nord-Ovest), 8,089 imprese al centro, 8,811 al sud. Il campione riflette correttamente il tessuto industriale italiano, con la prevalenza delle imprese situate nel nord Italia. Analizzando innovazione ed eco-innovazione, sono 4,288 le imprese che possiedono almeno un brevetto (11% del campione), 339 quelle che possiedono almeno un brevetto green (1% del campione). I dati rivelano significative differenze a livello geografico e innovativo, nelle proporzioni tra imprese multinazionali e non. Evidenza importante emerge dal confronto sulle imprese innovatrici, le proporzioni infatti si ribaltano se si considerano esclusivamente imprese multinazionali: dell'89% di imprese del campione che non possiede alcun brevetto, solo l'11% è rappresentato da imprese multinazionali. Al contrario, dell'11% di imprese che possiede un brevetto, il 9% è rappresentato da imprese multinazionali.

A livello settoriale le proporzioni sono stabili.

A livello dimensionale, classificando le imprese in base al fatturato, il campione è composto prevalentemente da piccole imprese, 31671 (più dell'80% del campione), suddivise in 27301 imprese non multinazionali (70% del campione) e 4370 imprese multinazionali (11% del campione). Le imprese multinazionali di media dimensione sono 3447 (9% del campione), mentre quelle di grande dimensione sono 2407 (6% del campione). Approfondendo l'analisi, i dati mostrano come, a parità di dimensione, il numero di imprese multinazionali con almeno un brevetto verde sia superiore a quello delle imprese non multinazionali. In particolare, la categoria delle imprese multinazionali di grande dimensione è la più numerosa, con 175 imprese (51% delle imprese con almeno un brevetto verde).

La matrice di correlazione, disponibile su richiesta, presenta indici di correlazione accettabili. È stata testata la possibile collinearità tra le variabili stimando i *variance inflation factors* (i.e., VIF test). Il test VIF (Torchia *et al.*, 2011; Ajaz *et al.*, 2020) ha confermato l'assenza di multicollinearità (tutti i valori sono risultati inferiori a 10).

Data la natura count della variabile dipendente, sono stati realizzati 3 modelli di Poisson (Kennedy, 2008; Greene, 2018; Wooldridge, 2019). Il Modello 1 testa l'impatto della variabile *Multinazionale*, il Modello 2 testa l'impatto della variabile *Numero IDE* e il Modello 3 testa

l'impatto della variabile *Numero Paesi*. Tutti i modelli fanno riferimento alla variabile dipendente *Green Patents*.

4. Risultati

In Tab. 3 sono presentati i risultati dei 3 modelli econometrici. Il Modello 1 conferma la prima ipotesi di ricerca, le imprese che detengono almeno un IDE sono più inclini a sviluppare eco-innovazioni. Il coefficiente della variabile *Multinazionale* è positivo e significativo ($p < 0.01$). Il Modello 2 invece non permette di confermare la seconda ipotesi di ricerca. *Num IDE* ha un coefficiente, seppur molto piccolo, negativo e significativo ($p < 0.05$). Confermata infine la terza ipotesi di ricerca, il coefficiente di *Num Paesi* è positivo e significativo ($p < 0.01$), come testimoniato dal Modello 3. Per quanto riguarda le variabili di controllo, tutti i modelli presentano gli stessi risultati. *Dimensione*, *Quotata*, *ASR* e *PSR* hanno un'influenza positiva e significativa sull'eco-innovazione, in linea con quanto atteso. Imprese di grandi dimensioni e motivate da esigenze di stakeholders esterni, imprese strutturate e imprese che dispongono di risorse chiave sono più propense all'eco-innovazione. Risultato inatteso per quanto riguarda *Età* e *ROE*: nel primo caso il coefficiente è positivo e significativo, nel secondo caso è negativo e significativo. In conclusione, *ROA* non esercita impatto significativo sull'eco-innovazione.

5. Conclusioni

Internazionalizzazione ed eco-innovazione rappresentano oggi scelte necessarie per rimanere competitivi sul mercato domestico e internazionale (Hojnik *et al.*, 2018). In particolare, l'eco-innovazione è una fonte di vantaggio competitivo globale e diventa quindi un fattore chiave per le imprese che operano sui mercati esteri (Martínez-Román *et al.*, 2019).

Tab. 3: Modelli

	M1 <i>Log-Mean</i>	M2 <i>Log-Mean</i>	M3 <i>Log-Mean</i>
Multinazionale	2.0441 *** (0.1254)		
Num IDE		-0.0006 ** (0.0003)	
Num Paesi			0.0197 *** (0.0022)
Innovazione	0.0007 *** (0.0001)	0.0007 *** (0.0001)	0.0006 *** (0.0001)
Dimensione	0.4942 *** (0.0123)	0.6053 *** (0.0110)	0.5526 *** (0.0120)
Quotata	0.5736 *** (0.0752)	0.4313 *** (0.0740)	0.3509 *** (0.0765)
Età	0.0119 *** (0.0009)	0.0130 *** (0.0008)	0.0137 *** (0.0009)
ROE	-0.0024 *** (0.0004)	-0.0027 *** (0.0004)	-0.0027 *** (0.0004)
ROA	-0.0058 (0.0048)	-0.0052 (0.0042)	-0.0050 (0.0044)
ASR	1.5494 *** (0.4560)	1.4064 *** (0.3439)	1.2886 *** (0.3863)
PSR	1.2809 *** (0.1906)	1.3662 *** (0.1880)	1.5700 *** (0.1878)
RSR	0.0002 (0.0001)	0.0002 * (0.0001)	0.0002 * (0.0001)
Posizione Settore (Intercetta)	-13.9540 *** (0.2437)	-14.4205 *** (0.2295)	-13.3689 *** (0.2421)
Osservazioni	38993	38993	38993
R ²	0.628	0.614	0.616

* $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$

Fonte: ns. elaborazioni

La recente letteratura sulla relazione tra internazionalizzazione ed eco-innovazione suggerisce che l'internazionalizzazione è una determinante positiva per l'adozione di eco-innovazioni (Hojnik, 2018). I risultati dello studio supportano questa tesi dimostrando che le imprese multinazionali italiane sono più propense delle imprese domestiche all'introduzione di eco-innovazioni, misurate come *green patents*. L'eco-innovazione è un processo complesso, caratterizzato da un alto grado di incertezza, di novità e varietà (del R o *et al.*, 2016; Hojnik e Ruzzier, 2016; Pacheco *et al.*, 2017). È necessario che l'impresa che decide di intraprendere questo percorso sia predisposta a correre rischi, abbia a disposizione capitale umano altamente qualificato e sia in grado collaborare con attori esterni. Questa predisposizione è tipica delle imprese multinazionali. L'opportunità di entrare in contatto con mercati globali, caratterizzati da meccaniche, normative e regolamenti diversi rispetto a quelli del mercato domestico, apre nuovi scenari alle imprese diverse per aumentare la propria base di competenze. Interagire con nuovi clienti, collaboratori ed enti regolatori, e avere la possibilità di osservare le migliori tecnologie e pratiche mondiali permette alle imprese di assorbire conoscenze, informazioni e risorse uniche, che favoriscono il processo di eco-innovazione.

Questo studio contribuisce all'avanzamento di questo filone di ricerca rispondendo alla chiamata di Hojnek *et al.* (2018) approfondendo i meccanismi attraverso cui l'internazionalizzazione promuove l'eco-innovazione. È stata analizzata la relazione tra gli IDE, modalità specifica di internazionalizzazione, e la propensione all'eco-innovazione. Gli IDE rappresentano il mezzo più adatto per entrare in contatto con le reti di settore globali. Questo permette alle imprese multinazionali di assorbire conoscenza relativa alle migliori pratiche ambientali e all'innovazione, generare spillover tecnologici e stimolare dinamiche competitive (Gulati *et al.*, 2000; Neumayer e Perkins, 2004; Boermans e Roelfsema, 2015). Caratteristica chiave è la destinazione dell'IDE. A seconda del Paese in cui l'impresa investe, variano le pressioni istituzionali per la sostenibilità ambientale e l'innovatività. Se soddisfatte, aiutano l'azienda a ottenere una reputazione migliore dal punto di vista della responsabilità ambientale (Kostova e Zaheer, 1999). A tal proposito, dalle analisi realizzate emerge un risultato importante: il numero di Paesi in cui un'impresa investe aumenta la capacità di generare eco-innovazioni dell'impresa, confermando la terza ipotesi di ricerca. La diversificazione internazionale, oltre ad essere correlata positivamente con l'adozione di una strategia ambientale proattiva (Aguilera-Caracuel *et al.*, 2012), è quindi una determinante positiva dell'eco-innovazione. Infine, il numero di IDE risulta avere un peso inferiore nell'adozione di eco-innovazioni e non permette di confermare la seconda ipotesi di ricerca. Tuttavia, questo risultato concorda con lo studio di Cainelli *et al.* (2012).

I risultati di questo studio permettono di concludere che gli IDE rappresentano una modalità di internazionalizzazione determinante per l'eco-innovazione, ma che è opportuno diversificare le destinazioni di investimento piuttosto che concentrare lo sforzo internazionale in unico Paese.

Lo studio non è esente da limiti. L'uso del brevetto come misura dell'eco-innovazione limita la ricerca. Nell'eco-innovazione l'elemento di novità che genera un impatto positivo sull'ambiente non deve per forza essere sconosciuto allo stato dell'arte ma deve essere nuovo per l'impresa che lo adotta. Il campione analizzato può essere raffinato e la definizione del settore meglio focalizzata al confronto di imprese comparabili. Il contesto italiano, inoltre, nonostante risulti appropriato per questo studio, è un campione nazionale che limita la possibilità di confronto con altri contesti istituzionali. Infine, un limite dovuto alla mancanza di dati è la distinzione tra tipologia di IDE, come possono essere quelli destinati alla vendita di prodotti o quelli legati alla produzione all'estero.

Sviluppi futuri prevedono un'analisi ulteriore delle meccaniche con cui l'internazionalizzazione favorisce l'eco-innovazione e l'introduzione di altre misure di eco-innovazione. Sarebbe utile approfondire ancor di più le modalità di internazionalizzazione, per esempio caratterizzando la tipologia di IDE (acquisizioni o greenfield) o considerando oltre al numero di Paesi la destinazione degli IDE così da valutare, l'importanza di investire in Paesi con regolazioni ambientali stringenti o capacità tecnologiche avanzate.

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Switching from off-line to on-line in pandemic times: the role of response efficacy and tangible facilities[♦]

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Abstract

Framing of the research. *The lockdowns and distancing measures introduced to face the Covid-19 pandemic have brought people to forcedly become accustomed to remote shopping as a coping strategy. Academics and practitioners are questioning if these behaviours can be permanent or only temporary and what are the drivers to use to respond to changing buying patterns.*

Purpose of the paper. *This explorative study applies an extension of the Theory of Planned Behaviour (TPB) to understand consumers' intention to switch from off-line to on-line channels in the aftermath of the pandemic, investigating the role of response efficacy to Covid-19 and tangible facilities.*

Methodology. *The research is performed through a survey based on a structured questionnaire submitted on-line. 370 questionnaires were collected and processed using a structural equation modelling technique.*

Results. *Consumers' switching intention to on-line channels are significantly and positively impacted by attitude towards on-line shopping and response efficacy to Covid-19, but not by perceived behavioural control and subjective norms. Tangible facilities exert a direct impact on consumers' intention to switch from off-line to on-line channels, as well as moderate the attitude-intention relationship diminishing consumers' proneness to on-line switching.*

Research limitations. *The study is explorative in nature. The survey focuses on consumers' channel switching intention but does not include actual behaviour. The analysis focuses on Italians shoppers but it could benefit from comparing a more evolved national context in relation to e-commerce.*

Managerial implications. *Our findings can help retailers in better understanding what expecting from shoppers after the pandemic and what are the drivers they should manage if they want to support or prevent channel switching to on-line.*

Originality of the paper. *This paper provides evidence of the role of the pandemic in supporting the switch towards on-line channels by consumers, opening up new perspectives on channel switching influential factors.*

Keywords: *channel switching; consumer buying behaviour; response efficacy to Covid-19; tangible facilities; grocery shopping; Theory of Planned Behaviour.*

[♦] Even if the paper is the result of a common effort of the authors, paragraphs 1, 2, 3 and 6 can be attributed to Elisa Martinelli; parr. 4, 5 and 7 to Francesca De Canio.

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1. Introduction

In the last decade, there have been several and rapid changes in the distribution channels of goods and services. Indeed, the advent of the internet has paved the way to a proliferation of channels, platforms and apps, changing the ways in which consumers buy and interact. On-line shopping has started to be a shopping option, even if its spread differs pretty much depending on the national context and on the product category. From the former viewpoint, in pre-pandemic times, Italy occupied the last positions in the EU: 38% of Italians made at least one on-line purchase, 2% more than 2018 and 26% more since 2009, when the percentage was 12%, highly below the European average (60%) (Eurostat, 2019). Regarding product categories, entertainment, tourism and financial services were the most bought on-line in pre-pandemic times, while food and groceries struggled to reach an interesting penetration rate. In this context, the spread of the Covid-19 pandemic has acted as an accelerator of on-line purchases. Despite the general drop in consumption at the beginning of 2020, B2C eCommerce closed at € 25.9 billion at the end of the year. Due to the restrictions on physical trade caused by the governmental provisions taken to face the pandemic the off-line consumption slowed down. Accordingly, the on-line penetration on total retail purchases recorded a significant leap forward and went from 7% in 2019 to 9% in 2020. The e-commerce played the role of commerce growth engine in this particular historical period. The food&grocery sector has become one of the leaders: on-line shopping for groceries has grown in Italy by a further + 37.5% in 2021, after an increase of 2.9 billion euros in 2020 (+ 84% compared to 2019) (Osservatorio eCommerce B2C, 2021). This development has led academics and practitioners to ask themselves if these behaviours can be permanent or only temporary and corresponding to provisional coping strategies that consumers are adopting to face the pandemic (Laato *et al.*, 2020; Martin-Neuning and Ruby, 2020; Mehta *et al.*, 2020; Sheth, 2020; Wang *et al.*, 2020). However, consumption is habitual and once consumers develop a routine in purchase preferences this tends to last over time (Liu *et al.*, 2021; Sheth, 2020). Therefore, some of the shopping behaviours that consumers developed during the pandemic can be expected to become part of buying patterns and stay afterward (Mehta *et al.*, 2021). On the other side, governmental restrictions to mobility, lockdowns, social distancing and the use of personal protective equipment (PPE) might have led people to mature a strong desire towards a coming back to traditional off-line shopping. To this concern, the study of Watanabe and Omori (2020) predicts that the level of on-line consumption of the consumers more prone to on-line shopping is likely to return to pre-Covid-19 levels after the pandemic. Thus, the issue is quite controversial and requires further investigation.

Within this context, the study investigates consumers' channel switching behaviour intentions in order to gain a better understanding of the possible consequences of the Covid-19 spread on buying patterns. Specifically, this study applies an extended version of the Theory of Planned Behaviour (TPB) - integrated with an important construct derived from the protection motivation theory (PMT) (Rogers and Prentice-Dunn, 1997), namely response efficacy to Covid-19 - to understand consumers' intention to switch from off-line to on-line channels. Further, due to the wider recognised sensorial lack in on-line shopping setting, the paper explores the role of tangible facilities as a possible moderator of attitude towards channel switching on consumers' intention to switch on-line. Studies on the impact of the pandemic on buying behaviours are concentrated on changing consumption and shopping habits during the lockdown, while a few researches investigated, to date, future consumer shopping channel switching intentions. Moreover, extant literature does not take in adequate consideration some factors that can exert a different influence on pushing shoppers to switch from off-line to on-line shopping. The response efficacy to Covid-19 can be considered as a determinant of coping strategies supporting a channel switch (Youn *et al.*, 2021), while the role of tangible facilities can act as an inhibitor. Therefore, we propose to verify a model in which both factors are included, in order to provide new perspectives on channel switching influential factors for academic thinking as well as useful managerial insights for retailers.

The paper is structured as follows. After having described the way in which consumers respond to the pandemic, changing their buying patterns, the conceptual model and the relative hypotheses are depicted. Then, the methodology employed is described, evidencing the research design of the survey, the measures employed and the features of the sample collected. Afterwards, results are presented and discussed. Conclusions end the paper, stating the limitations of the study and the possible avenues for further research.

2. Changing buying patterns during the Covid-19 pandemic

Consumption and shopping patterns have changed substantially during the ongoing Covid-19 pandemic. A number of studies started to investigate consumers' coping strategies during the lockdowns, evidencing a change in channels use, shopping patterns and hoarding behaviour due to panic buying (Foroudi *et al.*, 2021; Laato *et al.*, 2020; Loxton *et al.*, 2021; Martin-Neuninger and Ruby, 2020; Wang *et al.*, 2020). These works found out that consumers started to shift from shopping across multiple channels to purchase all in a single store because of the governmental restrictions to mobility and the fear of getting infected by the virus (Naeem, 2020; Martinelli *et al.*, 2021). In addition, consumers reduced the shopping frequency and time passed in-store, concentrating purchases and increasing the amount spent per shopping trip. Uncertainty due to supply chain disruptions led consumers to stocking up, purchasing and storing an increased number of products compared to "normal" times, especially commodities and basic needs products, such as toilet paper, meat, bread, and disinfecting and cleaning products, causing panic buying and further discontinuities in the supply of these goods (Kirk and Rifkin, 2020; Long and Khoi 2020; Sheth, 2020). Another result of the restrictive measures is the growing attention of consumers to the origin of the products they purchase (Kim *et al.*, 2021). To sustain the economy of their own country, more consumers have stated that they prefer local products to global brands, reinforcing the anti-globalization sentiment (Cambefort, 2020). In addition, consumers have started to buy more consciously, opting for sustainable products, and trying to limit food waste (Cohen, 2020). At the same time, an increasing number of consumers start to buy on-line, accelerating a trend already on the way (Farah and Ramadan, 2017). The perceived risk that an activity such as shopping in a physical store may have for both oneself and others has significantly increased the attractiveness of on-line shopping and made attitudes to switch to e-commerce more favourable (Youn *et al.*, 2021). The increase in on-line buying recorded during the Covid-19 pandemic happened also during the previous SARS epidemic (e.g., Kee and Wan, 2004), even if subsequent structural buying changes were not investigated in the long-run. According to a study conducted by Watanabe and Omori in Japan in 2020, on-line purchases during the pandemic increased due to two factors: (1) the contribution due to the entry of new consumers who had never used the internet for shopping before, and (2) the contribution due to the increase in the on-line shopping share of consumers who were already, even if unfrequently, shopping on-line before the pandemic. However, the main group responsible for the increase in on-line consumption during the coronavirus period were consumers who were already shopping on-line before the pandemic. The same study also showed that the level of on-line shopping of consumers firstly approaching the on-line channel for fear is likely to return to pre-Covid-19 levels after the pandemic.

Emerging studies on the pandemic also showed that during it, differences occurred in consumer behaviour between generations (Eger *et al.*, 2021). In particular, the shift toward on-line shopping was more pronounced among younger than older consumers. Several studies show that despite the increase in positive beliefs about channel switching, this does not translate into an increase in on-line shopping intentions among older consumers, in contrast to younger consumers who experience an increase in intentions leading to positive attitudes toward on-line shopping (Chen and Chi, 2021; Moon *et al.*, 2021; Youn *et al.*, 2020). Evidence shows that the difference between age groups in terms of switching to on-line consumption is not due to differences in digital literacy, but likely reflects differences in attitudes toward infection risk (Watanabe and Omori, 2020).

3. Theoretical framework and hypotheses

Channel switching is a dynamic process in which the customer analyses and evaluates a channel option before deciding (Pookulangara *et al.*, 2011). Consumers choose between alternative distribution channels on the basis of the relative opportunity cost of time, cost of goods, pleasure derived from shopping, perceived value of goods, and relative risk of each channel (Reardon and McCorkle, 2002). As a consequence, a consumer looks not only for the channel able to maximize his/her satisfaction with hedonic purposes, but also for the channel that can minimize the correlated economic and cognitive shopping costs.

The Theory of Planned Behaviour (TPB) has been extensively used in a number of studies that investigate channel-switching behaviour (Chou *et al.*, 2016; Madahi and Sukati, 2016; Pookulangara *et al.*, 2011), resulting in being a theoretical framework appropriate and suitable for investigating consumers' channel-switching intention. According to Ajzen (1991), the theory posits that the stronger the intention to perform a certain behaviour, the higher is the probability that the behaviour will be performed. In line with this theoretical framework, the consumer's intention is influenced by three main determinants: attitude (ATT), subjective norms (SN) and perceived behavioural control (PBC). Attitude toward the behaviour consists in the degree to which a person has a positive or negative evaluation toward the behaviour of interest (Ajzen, 1991; Ajzen and Fishbein, 1980) and it is consistent with an individual's opinion (belief) about a certain intended behaviour. Subjective norms relate to social pressure in whether or not to conform to the expectations of each consumer's important referrals (peers and people of importance to him/her). Perceived behavioural control refers to the degree of ease or difficulty an individual perceives by performing a given behaviour, resulting in fluctuating perceptions of behavioural control depending on the circumstances.

According to George (2004), who conducted a study to empirically test the TPB on Internet shopping in the U.S., attitude, subjective norms and perceived behavioural control behaviour are predictors of Internet shopping. In compliance, Gangwal and Bansal (2016) found that attitude, subjective norms, and perceived behavioural control are the immediate antecedents of intention to adopt on-line shopping. The study of Pookulangara *et al.* (2011) verified that ATT, SN and PBC were significant predictors for the channel-switching intention in the internet context. These effects have also been verified by the studies of Youn *et al.* (2021) and Martinelli *et al.* (2021) in and immediately after the lockdowns provoked by the spread of the pandemic. Consequently, to test if TPB determinants can influence the shift to on-line channels after the pandemic, the following hypotheses are postulated:

H1: Attitude towards on-line shopping positively impacts channel-switching intention towards on-line grocery shopping in the aftermath of the pandemic;

H2: Subjective Norms positively impacts channel-switching intention towards on-line grocery shopping in the aftermath of the pandemic.

H3: Perceived Behavioural Control positively impacts channel-switching intention towards on-line grocery shopping in the aftermath of the pandemic.

When facing a threat or when the possibility of a dangerous outcome is feasible perceived, individuals often adopt a particular set of cognitive processes to determine how to react. These cognitive processes are concerned with coping appraisal processes studied by the protection motivation theory (PMT) (Rogers and Prentice-Dunn, 1997). Actually, individuals evaluate how effective the adoption of a coping mechanism would be in preventing or reducing the threat (response efficacy). Response efficacy refers to the belief of an individual that, by adopting a specific behaviour, s/he will be able to contrast or eliminate the danger. This has been verified when health threats are involved (Ruan *et al.*, 2020), especially in the tourism sector, and has been proved true in pandemic times: Hsieh *et al.* (2021) found an increase in consumers' intention to stay in a hotel during the pandemic thanks to the positive effect exerted by response efficacy to Covid-19. In

the specific context of this study, response efficacy refers to the degree to which individuals believe shopping groceries on-line can effectively help them in facing the COVID-19 threats, preserving themselves from catching the virus. Accordingly, the following hypothesis can be suggested:

H4: Response efficacy to Covid-19 positively impacts channel-switching intention towards on-line grocery shopping in the aftermath of the pandemic.

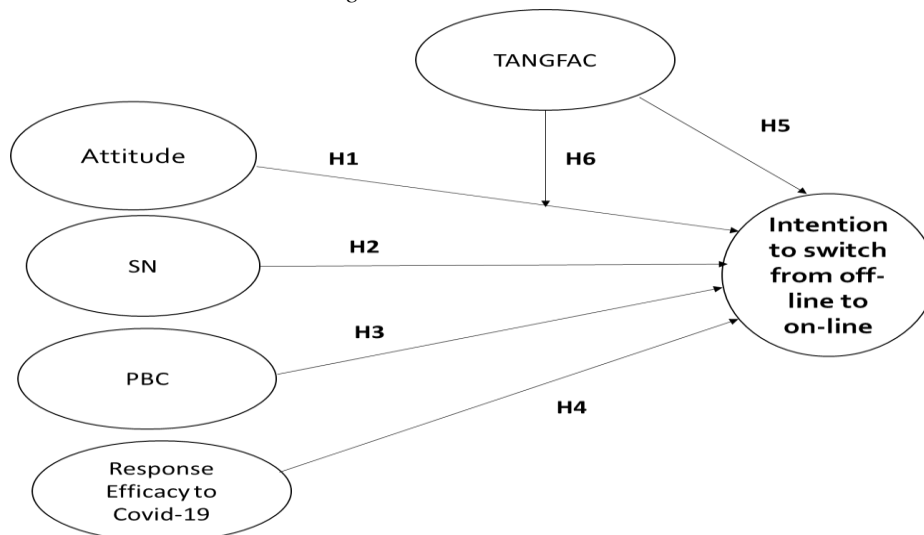
Scholars argue that one of the main reasons for consumers to shop off-line or examine the product in a physical store before making the purchase on-line is the need for touch (NFT) (De Canio and Fuentes-Blasco, 2021; Flavián *et al.*, 2016; Reid *et al.*, 2016) as well as the importance of the tangible experience in and with the store facilities (Chen and Tan, 2004). This is due to the nature of the virtual retail environment, where consumers cannot have a physical interaction with the product (Kaur and Quareshi, 2015), even if artificial intelligence can help in overcoming these barriers (Petit *et al.*, 2019), but not sufficiently, till now. Touching and feeling the product and experiencing the store are important source of variation in consumer behaviour and can significantly affect the final purchase decision especially for consumers with high-touch motivation. This can occur by reducing the consumers' risk and uncertainty and consequently reinforcing their initial belief or leading them to prefer an alternative product (Dholakia *et al.*, 2010). The opportunity to interact physically with the product/store prior to purchase is strongly reduced in an electronic commerce context. Consumers have access to technical product descriptions and can view the products and the web-store facilities, sometimes with an extraordinary level of detail, but cannot touch or feel them physically (Liu *et al.*, 2017). Jha *et al.* (2020) found touching products may moderates consumers overall evaluation depending on the shopping environment. San-Martín *et al.* (2017) stated that people with a high sense of touch are less likely to opt for digital channels to access to the structural products' attributes more easily. This lack of physical contact during the buying process is a key inhibitor of uses of electronic commerce. As a consequence, tangible facilities can directly act on channel-switching intentions towards on-line grocery shopping, decreasing the push to on-line, but the construct can also moderate the positive impact of the attitude towards on-line shopping channels. Thus, our last hypotheses are the following:

H5: Tangible facilities negatively impact consumers' channel-switching intention towards on-line grocery shopping in the aftermath of the pandemic.

H6: Tangible facilities moderates attitude towards on-line shopping.

The proposed model is shown below (Fig. 1).

Fig. 1: The theoretical model



Source: our elaboration

4. Methodology

4.1 Research design

To explore consumer channel switching behaviour towards on-line shopping, a survey was performed employing a structured questionnaire. A sample of Italian consumers was surveyed on-line during September 2021. Mobility restriction requirements were slackened down, as well as contagions at that time, thanks to the summer period that enabled people to stay outside and led to decrease infections.

Respondents were intercepted posting the link to the on-line survey on food and grocery shopping Facebook's thematic pages. 35 Facebook groups were contacted, accounting for a number of members around 290,000. The sharing of the on-line questionnaire brought to collect an overall sample of 441 people. However, a screening question was employed in order to select only the household responsible for grocery. At the end of the day, 370 fully completed questionnaires were retained and processed.

Participants completed a questionnaire composed of two parts; one focused on socio-demographic information, and the second composed of measurements aimed at empirically test the postulated hypotheses.

4.2 Measures

Items, evaluated on 7-point Likert type rating scale, (1 = strongly disagree and 7 = strongly agree), are presented in Table 1 and display good values of reliability (Cronbach's alpha well above the acceptable threshold).

Attitude towards on-line shopping was measured adapting a scale developed by Spence *et al.* (2018); subjective norms were measured on a scale developed by Pookulangara *et al.* (2011); perceived behavioural control and response efficacy were adapted from scales developed by Youn *et al.* (2021); a reduced scale adapted by Chen and Tan (2004) and Kaur and Quareshi (2015) was used to measure the tangible facilities construct.

Tab. 1: Constructs and measures

Constructs	Items	Factor Loadings	T-values
Intention to switch from off-line to on-line $\alpha=0.862$	I intend to switch from off-line stores to on-line shopping platforms to meet my grocery shopping needs	0.766	n.a.
	In the future I will search directly on-line when I need grocery shopping	0.865	20.045
	Next time I shop, I will get my groceries delivered to my house	0.838	15.772
Attitude towards on-line shopping $\alpha=0.869$	Shopping for groceries on-line is wise	0.851	n.a.
	Shopping for groceries on-line is rewarding	0.781	15.270
	Shopping for groceries on-line is a good idea	0.856	19.770
Subjective Norms $\alpha=0.953$	My family/friends approve my choice to buy groceries on-line	0.953	n.a.
	Most people who are important to me approve my choice to buy groceries on-line	0.955	35.437
Perceived Behavioural Control $\alpha=0.869$	It is easy for me to shop groceries on-line	0.745	n.a.
	I have the necessary knowledge, resources, and ability to shop groceries on-line	0.739	15.362
	I think it's easy to get groceries delivered to my house	0.859	18.267
	There are many opportunities in the marketplace that allow me to get my groceries delivered to my house	0.830	16.580
Response Efficacy $\alpha=0.926$	Shopping groceries on-line works for not catching COVID-19	0.951	n.a.
	Shopping groceries on-line can limit the spread of COVID-19	0.946	34.008
	When shopping groceries on-line, protection from catching COVID-19 is more likely to be guaranteed	0.813	26.407
Tangible Facilities $\alpha=0.922$	Touching or trying on the product I want to buy is important to me when shopping.	0.846	n.a.
	The product tangibility influences my channel of distribution choice	0.946	20.991
	The physical facility and environment of the store is important for me when grocery shopping	0.890	21.290

Note: α =Cronbach alpha; n.a. = not available.

Source: our elaboration

4.3 Sample

The final sample is composed of 370 individuals, 81.6% of which were female. Respondents are mainly mid-aged people (Tab. 2), with a good level of education (Tab. 3).

Tab. 2: Sample, age classes

Age Classes	Frequency	%
18-25	74	20.0
26-35	118	31.9
36-50	89	24.1
51-65	59	15.9
>65	30	8.1
Total	370	100.0

Source: our elaboration

Tab. 3: Sample, education

Education	Frequency	%
Below high school	19	5.1
High school	147	39.7
Bachelor	75	20.3
Master/PhD	129	34.8
Total	370	100.0

Source: our elaboration

The sample comprises mainly couples (32.4%) and families composed by three people (27.3). Similar, the presence of mono-families (20.3%) and big families (4 or more components) (20%).

The monthly household income declared by the 94% of the sample is lower than 600€ for the 3.0% of respondents, and between 601 and 1.300€ for the 12.2% of the sample. 31.4% earns between 1.301 and 2.600€, 20.8% between 2.600 and 3.600€, while 14.6% state an income between 3601 and 5.000€. The remaining 12.1% of the sample earns more than 5.000€.

Only a minority of respondents (8.4%) declared to buy groceries on-line on a regular basis (often/always), while 11.9% buys sometimes. 43.5% of respondents never shopped on-line for groceries, while almost 20% shopped very rarely or rarely (7.6%).

4.4 Empirical model and measure validity

Implementing the two-step approach to firstly validate the measurement model, and secondly to measure relationships between latent variables we developed both a Confirmatory Factor Analysis (CFA) and a Covariance-Based Structural Equation Model (CB-SEM) (Anderson and Gerbing, 1988).

Using results of the CFA (Table 1), we assessed the convergence validity of measures. To improve the measure scale fit, three items with low loadings were dropped respectively one from the Attitude scale “Shopping for groceries on-line is necessary” and two from the Subjective Norms scale “My family/friends would think that I should buy my groceries on-line” and “Most people who are important to me think that I should buy my groceries on-line”. All the remaining items show high factor loadings, higher than its cut-off of 0.7, and t-values (t-value > 15) (Hu and Bentler, 1999). All the items show a high item-total correlation, proving their capability to measure the investigated construct. Cronbach’s alphas are greater than .70 (de Vaus, 2002), confirming the good reliability of the measures.

The Average Variance Extracted (AVE) and the Composite Reliability (CR) confirm the convergent validity of constructs. Indicators of both indexes in all the investigated constructs are greater than their thresholds (AVE > 0.5 and CR > 0.7; Fornell and Larcker, 1981) (Table 4).

The discriminant validity was also confirmed by the Fornell and Larcker criterion showing that the square root of the AVE of each construct is higher than the correlation of the construct with other measures (Fornell and Larcker, 1981).

Tab. 4: Correlation Matrix

Constructs		AVE	CR	Correlation Matrix					
<i>Intention to switch</i>	<i>SWI</i>	0.640	0.890	0.800					
<i>Attitude</i>	<i>ATT</i>	0.642	0.893	0.797	0.801				
<i>Social Norms</i>	<i>SN</i>	0.910	0.953	0.626	0.778	0.954			
<i>Perceived Behavioural Control</i>	<i>PBC</i>	0.632	0.873	0.495	0.663	0.559	0.795		
<i>Response Efficacy</i>	<i>REFF</i>	0.820	0.932	0.383	0.417	0.350	0.485	0.906	
<i>Tangible Facilities</i>	<i>TANGF</i>	0.801	0.923	-0.229	-0.126	-0.061	0.057	0.158	0.895

Note: Data on the main diagonal (in bold) show the square root of the AVE. Correlations between latent factors are showed below the diagonal; AVE= Average Variance Extracted (AVE); CR=Composite Reliability.

Source: our elaboration

4.5 CFA model fit

The CFA model fit shows an overall good measurement model. The Satorra and Bentler chi-square $\chi^2_{(SB)(120)} = 330.317$, $p < 0.00$, and the Close-Fit RMSEA (RMSEA=0.0692, p-value= 0.0002) are both significant. However, the chi-square ratio $\chi^2_{(SB)}/df = (2.769)$ confirms that the measurement model properly measures the postulated theoretical model. This is confirmed also by others fit indexes such as Normed Fit Index (NFI = 0.966) and the Comparative Fit Index (CFI=0.978) higher than their cut-off of 0.90 (Byrne, 2013). The standardised root mean square residual (SRMR= 0.061) shows a low value confirming the low discrepancy between the observed correlations and the model-implied correlations.

5. Results

The hypothesized motivational model was tested using structural equation modelling developed employing the software LISREL 8.80 (Joreskog and Sorbom, 2006). To evaluate the moderating effect played by tangible facilities on the attitude-intention to switch path, the two-step procedure suggested by Ping (1996) was implemented. Data were double mean-centred (Lin *et al.*, 2010).

The structural model shows a good model fit: Satorra and Bentler chi-square $\chi^2_{(SB)(132)} = 344.374$, $p < 0.00$; chi-square ratio $\chi^2_{(SB)}/df = (2.609)$; Close-Fit RMSEA (RMSEA=0.0660, p-value= 0.0012); Normed Fit Index (NFI = 0.965); Comparative Fit Index (CFI=0.978); Standardised root mean square residual (SRMR= 0.0585); Goodness of Fit Index (GFI=0.889). All the paths included in the structural model are able to explain 67.3% of the variance of the intention to switch from off-line to on-line ($R^2_{SWI} = 0.673$).

Results of the structural model, presented in Table 5, show a positive direct impact of attitude towards on-line shopping and response efficacy to Covid-19 on shoppers' intention to switch to the on-line channel, with the former exerting the main role, confirming both H1 and H4. Conversely, both subjective norms and perceived behavioural control were found not significant in influencing shoppers' intention to switch from the off-line to the on-line channel in the aftermath of the pandemic, leading us to reject H2 and H3. Finally, tangible facilities exert a negative and significant impact on consumers' channel switching intentions, decreasing switching intentions toward on-line shopping for groceries and almost counteracting the positive role of response efficacy. Accordingly, H5 is confirmed. Furthermore, results show that tangible facilities moderate negatively the relationship between attitude towards on-line shopping and shoppers' intention to switch online, leading us to confirm H6.

Tab. 5: Structural Model Results

	Standardised structural path	T-Value (p-value)	Hypothesis	
<i>ATT</i> → <i>SWI</i>	0.733***	6.779 (0.000)	<i>H1</i>	Confirmed
<i>SN</i> → <i>SWI</i>	0.034	0.468	<i>H2</i>	Not confirmed
<i>PBC</i> → <i>SWI</i>	-0.066	0.975	<i>H3</i>	Not confirmed
<i>REF</i> → <i>SWI</i>	0.115**	2.109 (0.037)	<i>H4</i>	Confirmed
<i>TANGF</i> → <i>SWI</i>	-0.145***	3.434 (0.000)	<i>H5</i>	Confirmed
<i>TANGF*ATT</i> → <i>SWI</i>	-0.089**	2.533 (0.012)	<i>H6</i>	Confirmed

Note: two-tailed p-values: *** $p < .001$; ** $p < .05$.

Source: our elaboration

6. Discussion

Our findings contribute to the literature on consumer behaviour and retailing, giving a focus on disaster coping research and deepening the understanding on the possible consequences of the Covid-19 spread on future buying patterns. Studies on the impact of the pandemic on buying behaviours are concentrated on changing consumption and shopping habits during the lockdown, while researches investigating consumers' shopping channel switching intention whenever the pandemic may end lack. This work gives this evidence, underscoring that consumers might switch to the on-line channel for grocery shopping because of the new coping strategies adopted during the pandemic. To this concern, our findings are giving support to the role of the pandemic as an accelerator of the shift towards on-line channels, confirming Youn *et al.* (2021) conclusions and supporting the perspective of researchers believing in a permanent shift towards the on-line channel after the end of the pandemic (Liu *et al.*, 2021; Mehta *et al.*, 2021; Sheth, 2020). Actually, our findings evidence that channel shifting to digital in pandemic times is driven by a limited number of the traditional factors underpinning the TPB approach, only partially confirming Pookulangara *et al.*'s (2011) findings. Thus, when the TPB is integrated with the PMT, only attitude towards online channels positively influences the intention to switch to online as the belief that consumers have nurtured during the last two years about the effectiveness of shopping on-line to protect and preserve them from catching the virus comes into play. Thus, coping appraisal processes (Rogers and Prentice-Dunn, 1997) are affecting cognitive processes to prevent the threat of being infected, substituting the role of PBC and SN. This confirms the function of response efficacy to a health threat (Ruan *et al.*, 2020) in consumer behaviour, extending its effectiveness also in the grocery retail sector, not only in tourism (Hsieh *et al.*, 2021). However, our results have also highlighted the importance of tangibility for shoppers: NFT and the overall shopping experience supported by tangible facilities moderate and directly constraint consumers' intention to switch to on-line when shopping groceries. The higher the importance of tangibility in shopping, the lower the proneness to switch from off-line to on-line channels; this is enhanced by the moderating role that TANGFAC exerts on the relationship between attitude towards on-line shopping and intention to switch from off-line to on-line. These findings confirm previous studies on the role of the need for touch (NFT) (De Canio and Fuentes-Blasco, 2021; Flavián *et al.*, 2016; Reid *et al.*, 2016) as one of the main reasons for consumers to shop off-line or web-rooming, stressing the importance of the tangible experience in and with the store facilities (Chen and Tan, 2004). Thus, the possibility to physically interact with the product (Kaur and Quareshi, 2015), can still play a competitive role for traditional channel over virtual ones.

The results arisen from the survey conducted may help retailers in better supporting their strategies and operational policies towards digital. On-line or bricks-and-clicks retailers wishing to take advantage of the positive disposition of consumers to grocery shopping on-line generated by the spread of the pandemic should push on enhancing a positive attitude towards this channel, stressing its role in terms of protection of health safety. But to respond to these potential intentions and take the most out of them, e-tailers and bricks-and-clicks multiples should make intensive use of augmented reality and artificial intelligence in order to decrease the lack of touching products

and experiencing in-store facilities, otherwise the acquaintance to grocery shopping on-line acquired during the pandemic will be counteracted and neutralised. On the contrary, given the decrease in the number of times the shopper visits the store and the tendency to shift to on-line driven by the pandemic, brick-and-mortar retailers should increase the in-store consumer's experience, creating a multi-sensory atmosphere in offering shoppers more appealing experiences of the retail setting (Helmefalk and Hultén, 2017). Tangibility and the possibility to experience products in-store represent tools of competitive advantage for traditional retailers on which they should push communication strategies if they wish to support their physical store chains.

7. Conclusions

This study has investigated consumers channel switching intention in the light of the Covid-19 pandemic spread, proposing an application of the Theory of Planned Behaviour (TPB) integrated with response efficacy to Covid-19, and exploring the role of tangible facilities. Results evidenced that a shift is undergoing and even if many Italian consumers are still not grocery shopping on-line, the propensity to channel switching is present and it is determined not only by some of the traditional factors underpinning the TPB approach, but it is also an outcome of the coping strategies that consumers are adopting to face the pandemic experience. Our findings are giving support to the role of the pandemic as an accelerator of the shift towards on-line channels. However, the channel switch from off-line stores is still constrained by the search for tangibility by shoppers who continue to be attracted by NFT and the overall shopping experience supported by tangible facilities.

Despite the issues brought to discussion by this investigation, some limitations are present and can drive next studies. First, the survey relates to the Italian context and would boost its findings whenever other cultures can be investigated: national contexts in which on-line shopping presents high penetration rates can present peculiarities and wide the knowledge on the topic. Second, the study surveyed channel switching intentions but did not include actual behaviours; integrating this understanding can strongly improve the predictive power of our results. Finally, the proposed model should be enriched in future studies trying to identify possible differences between hedonic vs. utilitarian shoppers, as well as between consumers with high vs. low risk perception.

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The moderating role of culture in the relationship between female entrepreneurship and innovation: a cross-national study of happiness as a driver of knowledge creation

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Abstract

Framing of the research. *The influence of culture on the quality of life and well-being of individuals has been widely acknowledged by scholars. Happy people are known for being open minded, optimistic, willing to invest in long-run oriented projects, and able to share their knowledge with others. Though, individual freedoms, such as those related to entrepreneurial initiative or to the possibility of enjoying life, depend on countries' cultural background. As instance, in some economies female entrepreneurship is forbidden, whilst, in others - such as sub-Saharan cultures -, intellectual property is deemed exploitative. Yet, cultures high in individualism are more likely to invest in R&D. Such evidences prove the relevance of studying the effects of culture on female entrepreneurship and innovation.*

Purpose of the paper. *This study aims at exploring how the interplay between female entrepreneurship and three main cultural dimensions - namely, masculinity versus femininity, indulgence versus restraint, long terms versus short term orientation - impacts innovation. Indulgence is used as a proxy measure of happiness, freedom, and leisure of a society. We argue that the three aforementioned cultural dimensions moderate the relationship between female entrepreneurship and innovation. Therefore, culture affects female entrepreneurship orientation toward innovation.*

Methodology. *For the research design, first, we drew a large-scale dataset from both World Bank and Eurostat. Then, we considered data related to the six-dimensions Hofstede's cross-cultural scale. We focused on a single year, 2021. Hypotheses testing was conducted by analyzing the relationship between our independent variables and product/service innovation. We also looked specifically into eco-innovation, by means of a separate test. We used two different statistical methodologies: Principal component Analysis (PCA) for scale reduction and Ordinary Least Squares (OLS) linear regression for relationship analyses.*

Results. *Our findings confirm that an increased numbers of female entrepreneurs benefit product/process innovation. By contrast, and, surprisingly, a high number of female entrepreneurs hinders eco-innovation. Either way, the three considered cultural dimensions are proved to be moderators of said relationships. Specifically, indulgence exerts a strong and positive moderation effect on the relationship between female entrepreneurship and innovation, where masculinity exerts a negative effect. Therefore, culture influences female entrepreneurship orientation toward innovation.*

Research limitations. *Due to numerous missing data, this study has a limited cross-national focus - 16 different countries - and a short longitudinal extension.*

Managerial implications. *The progress of a society depends on cultural change, well-being, and on elimination of gender inequalities. Such actions can foster entrepreneurship and innovation.*

Originality of the paper. *Previously, most studies showed that innovation depends on cultural individualism. Differently, our study demonstrates that indulgence - i.e.: happiness - is a preminent factor for new knowledge creation and for female entrepreneurship.*

Keywords: *innovation, Hofstede, culture, female entrepreneurship, knowledge, happiness*

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1. Introduction

Happiness has been described as a presence of pleasant emotions or the relative absence of unpleasant emotions, as subjectively evaluated by an individual with respect to experience of life as whole (Diener, 1984, Kim *et al.*, 2005, Blanchflower and Graham, 2021). However, the very concept of happiness is elusive and varies over time and cultures (Oishi, *et al.*, 2013, Burns and Crisp, 2022). As instance, American and Western cultures are becoming increasingly agentic (Roberts and Helson, 1997) and narcissistic (Twenge and Campbell, 2008), whereas collectivistic countries are becoming somewhat individualistic (Hamamura, 2012). Accordingly, Hofstede *et al.* (2010) proposed a sixth cross-cultural dimension measuring “indulgence versus restrain” of a society. This dimension captures the levels of happiness and freedom of a society. As a matter of fact, indulgent cultures are focused on individual happiness, well-being, leisure and freedom, as opposed to restrained cultures (Hofstede *et al.*, 2010). Thereby, indulgence is deemed a proxy measure of happiness. The level of happiness or the degree of freedom allowed in a country are preeminent aspects in business phenomena. As a matter of fact, culture pervasiveness may determine consumption patterns (Xu, *et al.*, 2004, Demangeot and Sankaran, 2012, Cleveland, Laroche, and Hallab, 2013, Zhang, 2017), including consumption of - or acceptance of/ resistance to - innovation (Kleijnen *et al.*, 2009, Cova and Dallı, 2009, Sorum, 2020). In particular, indulgence expresses both individual attitude toward enjoying life and the degree of individual freedom, as instance as the freedom to undertake an entrepreneurial initiative or to protect intellectual property. According to World Bank (see webliography), labor laws restrict the type of job that women can do - including entrepreneurship - in 104 countries. This situation affected 2.7 billion women in 2018. In a similar vein, intellectual property rights are poorly protected in some economies, such as sub-Saharan Africa. This is the case of Yemen, which ranks the lowest in terms of women entrepreneurship, according to the International Prevention Research Institute (iPRI) (see webliography). Hence, anecdotal evidence provides a clear indication of the relevance of culture, and, in particular, of indulgence, for female entrepreneurship and innovation.

Culture, as “the software of the mind” (Hofstede, Hofstede, and Minkov, 2005) is the result of the interplay among values, rituals, symbols, beliefs, and thought processes that are learned, shared, and passed on by a community to another over time. It influences - and it is influenced by - history, politics, technology, social institutions, religion, media, education, and business. Since culture resides in individual minds, it affects perceptions, cognition, and behavior, including one’s creativity (Stein, 1953, Tesluk, Farr, and Klein, 1997). In other words, culture impacts individual knowledge.

According to this fashion, some scholars argued that happiness may have a positive effect on entrepreneurial creativity (Chen, Chang, Lin, 2018). A close examination of happiness also requires to understand how it interplays with other individual characteristics and personality traits. With this regard, the big 5 personality traits model - conscientiousness, agreeableness, neuroticism, openness to experience, extraversion (Schmitt *et al.*, 2007, Schmitt *et al.*, 2008, Komarraju *et al.*, 2011, Cobb-Clark, Schurer, 2012) -, demonstrates that personality influences factors such as emotions (Berkovich and Eyal, 2021), cognition (Yeh *et al.*, 2021) - i.e.: knowledge-, entrepreneurial orientation (Santos, Marques, and Ferreira, 2020), and innovation orientation (Kusa *et al.*, 2021). Accordingly, Diener *et al.* (2003) suggested that the prevalence of either one or the other personality trait, along with cultural dimensions scoring, explains whether people feel happy and satisfied or not. Happy people are usually open, extraverted, score high in self-esteem, are trusting ones, and optimistic (Gutiérrez *et al.*, 2005, Sirgy, 2021). Also, researched based on the Big Five Inventory scale revealed that women reported higher levels of neuroticism, extraversion, agreeableness, and conscientiousness than did men across most nations (Schmitt *et al.*, 2008).

Conscientiousness, agreeableness, extraversion -prevalent in female groups - and openness - prevalent in male groups- are all positively related to the four existing learning styles, differently from neuroticism (Komarraju *et al.*, 2011). Anyway, personality traits also follow geographical patterns of distributions, based on country-culture (Schmitt *et al.*, 2007). Thus, research suggests

that culture hugely impact happiness, personality and dispositions of individuals. In addition, scholars proved the existence of a strong and positive association between happiness and the followings: economic growth (World Value Survey 2021, see webliography), value co-creation (Hughes and Vafeas, 2021), knowledge-intensive contexts (Salas-Vallina *et al.*, 2018), entrepreneurial initiative and innovation (Usai *et al.*, 2020), female entrepreneurship (Ozyirmidokuz *et al.*, 2019), entrepreneurial orientation (Bernoster *et al.*, 2020).

So, on one hand, indulgence influences knowledge creation. On the other hand - as a facet of social inclination toward freedom - it signals the level of gender parity and women empowerment in a society. Thus, culture and female entrepreneurship are strongly connected.

Previously, cultural dimensions have often been considered as moderator variables (Schneider, Ehrhart, and Macey, 2013, Schneider, Ehrhart, and Macey, 2016). Also, many scholars found a positive association between individualism and R&D investments (Shao *et al.*, 2013, Choi, 2020, Kim, 2021). However, there is a scarce number of studies explaining how cultural dimensions interplay with both innovation and female entrepreneurship. Specifically, to the best of our knowledge, there are very few studies examining how indulgence- as a proxy measure of happiness - (Khan and Cox, 2017), masculinity, and long-terms-orientation interplay with female entrepreneurship, thus affecting innovation. In addition, previous studies do not take under consideration cultural shifts.

Originally, we argue that the three aforementioned cultural dimensions are moderators of the relationship between female entrepreneurship and innovation. Thereby, culture affects female entrepreneurial orientation toward innovation. As a matter of fact, these variables influence factors such as: women access to entrepreneurial careers, to education or to funding opportunities, individual creativity, values, belief, thought processes, etc. In a nutshell, cultural variables have an impact on the strength and the direction of the relationship between female entrepreneurship and innovation.

In order to test research's hypotheses, first, we drew a large-scale dataset from both World Bank and Eurostat. Then, we considered data related to the six-dimensions Hofstede's cross-cultural scale. We focused on a single year, 2021. After excluding missing cases listwise, we examined a total of 16 different countries (Belgium, Bulgaria, Czechia, Denmark, Estonia, Finland, Croatia, Hungary, Italy, Latvia, Lithuania, Luxembourg, Poland, Portugal, Romania, Slovenia) and a sample of about 38.000 female owned enterprises. Results are grouped by countries. Hypotheses testing was conducted by analyzing the relationship between our independent variables and product/service innovation. We also looked specifically into eco-innovation. We used two different statistical methodologies: Principal component Analysis (PCA) for scale reduction and Ordinary Least Squares (OLS) linear regression for relationship analyses.

Our findings confirm that a high number of female entrepreneurs is associated with a great level of innovation. Though, surprisingly, a high number of female entrepreneurs seems also to hinder eco-innovation. Either way, the three considered cultural dimensions are proved to be moderators of said relationships. Specifically, indulgence exerts a strong and positive moderation effect on the relationship between female entrepreneurship and innovation, where masculinity exerts a negative effect. The dimension named "long terms versus short term orientation" has an extremely mild effect on any of the examined relationships. Intuitively, masculinity hinders female entrepreneurship. Differently, indulgence stimulates new knowledge creation processes. In brief, indulgence and masculinity can be deemed a moderator of female entrepreneurship orientation toward innovation, whereas "long term orientation" is almost non influent.

Accordingly, current study extends the conversation on the relationship between female entrepreneurship and innovation. The progress of a society depends on cultural change, well-being, and on elimination of gender inequalities. Such actions can foster entrepreneurship and innovation.

For the remainder, the study is structured as follows: section 2 includes the analysis of literature and model's hypotheses, section 3 shows the empirical analysis, along with the discussion, section 4 suggests our concluding remarks.

2. Background and research hypotheses

2.1. *The link between happiness and knowledge: how culture and emotions pave the way to innovation*

The relationship between individual knowledge and collective culture roots in the history of humanity. The “intrinsic sociality of mind” (Child, 1940) is a deep connection between individual knowledge - cognitive structures, experiences, ideas, concepts, forms of thoughts (McCarthy, 2005) - and societal culture. Hence, societal culture is one of the paramount elements that define a human being.

Culture is both a formal and a substantial expression of societal languages, values, belief, norms, and envisions of the world. It profoundly impacts business and managerial styles (Morris and Pavett, 1992, Bakhtari, 1995, Lam, *et al.*, 2021). As instance, culture influences individual need for power and achievement, as well as people’s communication style or strategic thinking. According to Hall and Whyte (1960), high-context cultures are heavily dependent on non-verbal communication, differently from low-context cultures. Also, in high-context cultures, gender biases occur more frequently. That is the case of economies such as those of Asia, Middle East, and Latin America (see weblibliography, MSCI - Women on boards).

In a nutshell, culture shapes individual experience of the world -said knowledge - either formally or substantially. Accordingly, knowledge can be described as a socially-determined realm of mental products (Berger and Luckmann, 1966), because it is “selected, arranged, and priced by the intellectual and moral judgments and linguistic practices of a social world” (McCarthy, 2005, p. 2).

The relationship between knowledge and culture is complex and multifaced. Knowledge and culture influence each other reciprocally: collective knowledge (said culture) is a set of ideas accepted as real by a community; individual knowledge is the experience of life (Durkheim, 1909). In literature, such approach is classified as the phenomenological study of knowledge, or the study of phenomena as they occur over time and space. The phenomenological envision of knowledge is based on the assumption that knowledge is a strategic construction of reality, implemented on purpose to compete and survive by means of triggering a change or resisting to it, continuously. Feelings have the most preeminent position when determining the experience of life called knowledge. In this vein, knowledge is generated by ceaseless interactions between individuals and reality. As such, knowledge is an objectified cognitive response of individuals: it is both a thing - susceptible to be stored - and a process. At a first stance, it is possible to distinguish knowledge into two distinct categories: knowledge by acquaintance - “knowledge of things” by direct experience -, and propositional knowledge, a “knowledge about things” acquired indirectly (Zagzebski, 2017). Accordingly, knowledge is a purposefully organized set of information, acquired by means of experience, exposition, and inference (Zack, 1999). Over time, scholars proposed different types of knowledge classifications, such as: individual and collective (Kimmerle *et al.*, 2010, Hecker, 2012, Anderson and Lewis, 2014, Cress and Kimmerle, 2017); tacit -non-codified, informally articulated and shared, know how - and explicit - codified, formally articulated and systematically shared, know what (Smith, 2001, Dhanaraj *et al.*, 2004, Lei *et al.*, 2021, Gubbins and Dooley, 2021); general and specific (Jensen and Heckling, 1995); declarative - a description of something -, procedural - how something occurs -, and causal - why something occurs (Zack, 1999). At a managerial level, organizations have to “efficiently and effectively create, locale, capture, and share knowledge and expertise in order to apply that knowledge to solve problems and exploit opportunities” (Zack, 1999, p. 45). Hence, the knowledge-creating company is a firm focused on continuous innovation (Nonaka and Takeuchi, 2007).

At an organization level, the cognitive function of firms occurs as the recombination of various types of knowledge and as the transformation of personal knowledge into organizational one (Grant, 1996), “as if” the company was a living organism with its own identity, ideals, and fundamental purpose (Nonaka and Takeuchi, 2007). This process is largely based on the preeminent value of tacit knowledge for organizational learning. Tacit knowledge is a personal form of knowledge,

directly spurring from experience, where the cognitive dimension - made of mental models, beliefs, and perspectives - prevails over others.

The concept of tacit knowledge was firstly introduced by Polanyi (1958, 1967) to refer to awareness, conceptualizations, and perceptions of a person: as instance, we do not need to see a car to know it exists (Cowan *et al.*, 2000). Tacitness of knowledge, in its primigenial sense, is increasingly pervasive of current world politics. It originates per effect of context (Ancori, Bureth, and Cohendet, 2000) and culture, because culture is ingrained in society and individuals make experience of reality based on it.

Previous considerations suggest that the understanding of the interactions among knowledge creation, emotions, and culture is extremely relevant for business studies.

As said, emotions are deeply ingrained in knowledge creation processes, both at individual and collective levels. Emotions trigger mechanisms of socialization, externalization, combination, and internalization - SECI model - fundamental for knowledge creation (Nonaka *et al.*, 1994). They also help to amplify “the knowledge created by individuals and crystallize it as a part of the knowledge system of an organization” (Nonaka *et al.*, 1996, p. 833). Hence, emotions act as knowledge enablers (Von Krogh *et al.*, 2000). Nonaka and Konno (1998) focused on the locus of knowledge creation, or “ba” (Konno and Schillaci, 2021). According to these scholars, knowledge resides and it is embedded in “ba”, in both existential and phenomenological manners, where “ba” is a locus of individual acquisition of knowledge through one’s own experience or reflections on the experiences of others (Konno and Schillaci, 2021). If knowledge is separated from “ba”, it turns into information (Nonaka and Konno, 1998). At a collective level, the “ba” turns into “basho” (Nonaka and Konno 1998, Konno and Schillaci, 2021) Although scholars recognized the importance of emotions for knowledge studies, they limited their analysis to very specific aspects (Fteimi *et al.*, 2021, Rashid *et al.*, 2021), such as: information technology use (Beaudry and Pinsonneault, 2010), emotional intelligence (Peng, 2013), emotional obstacles (Pemberton *et al.*, 2007), emotional knowledge (Stein and Levine, 2021). Therefore, they failed to use a constructive approach that captures the nexus between positive psychology - happiness - and knowledge creation, as the result of a social construction that self-actualize through culture. It has been said that a specific stimulating environment is required for knowledge sharing to occur. Positive emotions elicit such a socialized response, because they improve one’s intellectual, social and psychological resources (Fredrickson *et al.* 2003). Such positive emotions go under the label of subjective-wellbeing (SWB), a term encompassing many different components, as instance as: hedonic happiness, life satisfaction, eudamonic happiness, etc. (Kim-Prieto *et al.*, 2005). The academic interest toward these themes was growing in prominence in the last 20 years (Delle Fave *et al.*, 2016, Ashkanasy, 2011, Waterman, 2008, Oishi *et al.*, 2013, Sirgy, 2021, Pena-López *et al.*, 2021). However, definitions and measurements of happiness are extremely elusive, because they vary over time and space per effect of culture (Delle Fave *et al.*, 2016).

By and large, the terms happiness is used to refer to “a positive inner state, deriving from goal achievement and fulfillment of aspirations” (Delle Fave *et al.*, 2016, p. 30) and to life satisfaction or subjective well-being (Kahneman *et al.*, 1999). Though, cross-cultural differences in conceptualization of happiness are still a relatively under-explored issue (Uchida *et al.*, 2004, Oishi *et al.*, 2008, Joshanloo, 2014). Thus far, the most popular cultural dimension of happiness is the one introduced by Hofstede (2010), labeled “indulgence versus restrain”. Indulgence considers individual acknowledgement of leading a happy time (frequency and percentage) and the extent to which people enjoy freedom. Freedom, along with an inner sense of happiness, is proved to be essential for entrepreneurial initiative and innovation (Usai *et al.*, 2020).

It can be said that freedom, intended as the interaction among countries’ regulations, economic environment, and personal liberties, is per se a foundation of entrepreneurial initiative (Minniti, 2008, Lamine, *et al.*, 2021). This mix varies cross-countries, affecting entrepreneurial fabric as a whole. In particular, some economies still posit heavy restrictions to female entrepreneurial initiative (Goel, 2018) and obstacles to personal liberties. Such factors explain the persistence of gender bias and gaps.

Previously, Hofstede (1980) had already introduced other five cross-culture dimensions: Power Distance Index (PDI) - the degree to which the less powerful members of a society accept and expect that power is distributed unequally-, Individualism versus Collectivism - attention toward the “I” rather than the “we” -, Masculinity versus Femininity - preference in society for achievement, heroism, assertiveness, and material rewards for success rather than cooperation, modesty, caring for the weak and quality of life-, Uncertainty Avoidance Index (UAI) - the degree to which the members of a society feel uncomfortable with uncertainty and ambiguity-, Long Vs Short Term Orientation - preference for tradition rather than for change.

As instance, in North America happiness is associated with excitement, euphoria, enthusiasm, differently from Eastern Asia where the association is to serenity, peacefulness, tranquility (Lee *et al.*, 2000). In knowledge management, happiness has been mostly studied in light of value creation or co-creation (Cosimato, Faggini and del Prete, 2021, Hughes and Vafeas, 2021) and in relationship to team dynamics (Chung and Huang, 2021). Also, some prior scholars recognized the preeminent position of happiness in innovation processes (Usai *et al.*, 2020, Brulé and Munier, 2021).

Yet, the interplay among different cultural dimensions, or, more precisely, whether countries score low or high in each of the six dimensions, etc. affects female entrepreneurship, as well as innovation. Finally, culture has proved to be a significant moderator of many phenomena, such as: social network size and venture growth in entrepreneurship (Batjargal, *et al.*, 2019); entrepreneurial intentions and perception (Shinnar, Giacomini, and Janssen, 2012), individual resources and social value creation (Brieger and De Clercq, 2018).

2.2. *Happiness, female entrepreneurship, and orientation toward innovation: research hypotheses*

Among the many trending topics in managerial literature, female entrepreneurship deserves the utmost attention for its real and social impact.

Bullough *et al.* (2022) argue that women entrepreneurship largely contributes to the progress of society. Though, societal culture may hinder or foster women’s role in society, by means of gender role expectations. Specifically, many obstacles to female entrepreneurship stem from the cultural systems women are immersed in (Anambane and Adom, 2018). As a matter of fact, according to most cultures, women should be devoted to family.

Policy makers have long tried to foster gender equalities - or, at least, in some economies - by means of innovating the regulatory system and by providing various types of incentives.

Nonetheless, most of times, such incentives proved to be partially ineffective: they proved to be just a palliative to real problems, because cultural walls are hard to be torn down, alongside with the elimination of economic and social disparities. Stigmas, stereotypes, inaccessibility of networks and resources are all factors hindering female entrepreneurship. Amid the other stereotypes, as instance, women are less likely to access scientific education. These conditions affect women’s leadership legitimacy (Newburry, Belkin, and Ansari, 2008), despite female being recognized for their superior interpersonal skills, empathy, and ability of being multitasking (Ruderman, *et al.*, 2002). There again the synchronic or multi-chronic (multi-tasking attitude) envision of time depends on cultural legacy.

As the result, a gender gap still persists worldwide. Accordingly, the understanding of how to promote gender equality by means of education, career, etc. is one of the most important current debates, to the length that it became the 5th of the 17 sustainable development goals.

In any case, culture emerges as a variable that can positively or negatively affect gender bias by strengthening or weakening relationships, especially in the entrepreneurship field, because it interacts with many other factors. The effect of culture on female entrepreneurship depends on the cultural forces that are at a play in a country, on how these interplay among each other, and on whether a country scores high or low in the various cultural dimensions.

Looking at the cognitive sphere of prejudices against women in business, the length of prevalence of men - or exclusive access of men to - in certain types of careers was the precondition

of current status quo. Thus, men are seen as independent, assertive, natural-born leaders, whilst women are seen as compassionate, nurturing, caregiving (Osborn and Vicars, 1976, Shahriar, 2018, Gupta, Wieland, and Turban, 2019). According to Globe 2020 - Global Leadership and organizational behavior effectiveness - (see webliography), individual trust in leadership capabilities is gender-biased, depending on culture. Also, perceptions vary cross-countries.

Hence, existing gender stereotypes affect either the relationship between gender and entrepreneurship or the relationship between gender and innovation.

On the positive side, women seem to score high in those traits that favor innovation and creativity, as instance as: judging emotions (Macaskill *et al.*, 2002), community building, intercultural attitude (Javidan, Bullough, and Dibble, 2016).

Thus far, scholars have investigated various aspects associated with female entrepreneurship, such as: the role of digital technologies in supporting female entrepreneurship (Ughetto, *et al.* 2020), the influence of context on female entrepreneurship in Africa (Ojong *et al.*, 2021), business opportunities for female entrepreneurship in Tunisia (Mokline, 2021), etc.

Surprisingly, there are few studies - to the best of our knowledge - examining how interactions between female entrepreneurship and cultural dimensions affect innovation.

At large, entrepreneurial literature is built upon the core idea that entrepreneurs are innovators by definition (Schumpeter, 1934, Rosenberg, 1982, Hagedoorn, 1996, Trischler *et al.*, 2020). Innovation always begins with an act of creativity (Okpara, 2007). Accordingly, Kirzner (1999) advises that creativity is tied to entrepreneurial alertness. Alertness is the act of discovery/recognizing an opportunity occurring in reason of cognitive, motivational, and environmental factors (Foss and Klein, 2010). Thus, what triggers alertness and drives innovation? Studies suggested that positive affect - happiness - may actually be essential for alertness and innovation (Levasseur *et al.*, 2020, Fellnhofer, 2021, Tang *et al.*, 2021). Alert entrepreneurs are optimist (Tang *et al.*, 2021), because positive emotions impact evaluations and judgments of opportunities in terms of increased capabilities of scanning for information, opportunity search, and connection (Levasseur *et al.*, 2020). Alertness also depends on the big five personality traits. As a matter of fact, conscientiousness, openness, and extraversion are positively linked to alertness, whereas agreeableness and neuroticism have a poor connection with it (Awwad and Al-Aseer, 2021). Alertness is also influenced by culture (Hu *et al.*, 2018) vicariously (Lounsbury, *et al.*, 2019). Culture can limit or boost the innovation process, by means of manifest or latent meanings and by symbolism. Untill these days, the impact of culture on innovation was underemphasized (Sarasvathy and Dew, 2008).

Yet, a culture is established “by” and it finds expression “through” a series of elements (Lounsbury, *et al.*, 2019), as instance as: schemas, scripts, norms and values (Parsons, 1937, Thornton *et al.*, 2012, Giorgi *et al.*, 2015), narratives (Kahl and Grodal, 2016), identity (Navis and Glynn, 2010), practices, objects, and images (Meyer *et al.*, 2018).

These elements influence the routine of innovation, either in an orthodox or in an unconventional manner. This view is opposed to the archetypical envision of the entrepreneur as an inspired human being.

In Western-calvinistic cultures, innovation is an individualistic (self-oriented) process, as opposed to the collectivistic subordination of personal sake to the goals of the many- Eastern approach (Morris *et al.*, 1993). The focus on individualism, and, thus, on the archetype of entrepreneurs as individual innovators, still persists to date in most of the studies concerned with entrepreneurship and innovation (Nakara *et al.*, 2021, Wang and Tan, 2020). Similarly, pragmatism still pervades studies of drivers of eco-innovation (Li, *et al.*, 2020). Aforementioned criticisms and gaps let emerge the short-sighted approach of current literature to the genesis of innovation. Hence, the time is ripe to start a new conversation on the primacy of the role of culture in innovation sourcing and fuelling. Rethinking innovation in terms of culture is urgent because of an existing lack of studies in terms of gender-personalization. As instance, an individual-purposeful-based view of eco-innovation prevailed till these days (Lee and Raschke, 2020). In brief, emotions, gender, and cultural differences were poorly studied jointly in relationship to innovation and sustainability.

According to Steiner (1995), sources of innovation are mostly understood in terms of individual authenticity. It is proved that innovation burgeons when an individual is in a positive mental state of flow (Csikszentmihalyi and Larson, 2014, Lomas, *et al.* 2020) - when one is fully immersed and focused in a feeling, fully involved, and experience joy in the process, thus creating a transformation. The main limit of this approach resides in the undifferentiated egocentrism or solipsism of the process, in absence of any consideration of factors such as emotions, gender, culture. This limit also occurs when innovation is studied at collective/heterogeneous levels (Montes *et al.*, 2005, Rampersad, 2020, Guth and Ginsberg, 1990). Nonetheless, the shift from the competitive capitalism (Schumpeter, 1934, Schefold, 1996, Soriano and Huarng, 2013) to the trustified one (Ebner, 2006) were urging thus far for context-based explanations - based on socio-cultural development, material, and ethical progress (Ebner, 2006) - of the dichotomy between entrepreneurship and innovation (Hodgson, 2001). Differently from prior research, we argue that innovation is extremely intertwined with factors such as culture, emotions, and gender. Previously, scholars proved that happiness is positively associated with entrepreneurial orientation (Entrialgo *et al.*, 2000, Fowle, 2019, Bernoster *et al.*, 2020). Specifically, Fowle (2019) asserts that entrepreneurs are extremely resilient. Shimoni (2021) suggests that, in Western cultures, women are incentivized to self-invest and to be optimistic. Evidence also indicates that adaptation and freedom of choices drives happiness and resilience (Clark, Frijters and Shields, 2008, Inglehart *et al.*, 2008). Anyway, most of countries does not have same cultural tenets, nor the same level of freedom or peace: these factors foster entrepreneurship. As instance, at the moment of writing Ukraine is under the attack of Russia. Along with all other economic and social consequences, such a dreadful situation lowered the morale of people worldwide. Emotions can be contagious. In this sense, emotions relate to the concept of informed empathy, which refers to knowledge about impairments, activity limitations, and participation restrictions that can be associated with other cultures/countries (Miller, 2013). At an entrepreneurial level, some countries posit various kinds of restrictions on entrepreneurship, especially on female entrepreneurship, mostly because of culture-driven phenomena. At the same time, though, Arrosa and Gandelman (2016) argue that “worldwide women are happier than men. At the country level, “the happiness gap favors females in some cases and males in others” (Arrosa and Gandelman, 2016, p. 731). The two authors also remark that, if exposed to similar scenarios, females would be even happier than males, because they respond to happiness determinants more positively than men. Notably, happiness is strictly connected to personality traits and to social mechanisms. As instance, Lu and Argyle (1991) proved that happiness is connected to extraversion and cooperation. Accordingly, de Groot *et al.* (2015) found that happiness relates to “mating bonds, deep friendship, close kinship, and cooperative coalitions” (de Groot *et al.*, 2015, p. 15). Often, females experience occupational differences in the labor market- specifically, in engineering/computer, medical, teaching, and service occupations - (Joy, 2006). Nonetheless, this might not affect their personality traits or their level of happiness, because happiness is proved to also depend on contrast and habituation (Brickman *et al.*, 1978). Yet, happiness is associated with a subjective sense of attainment (Plagnol and Easterlin, 2008) and, precisely, to four major motivations: “eudaimonic motivation (seeking meaning, authenticity, excellence, and growth), hedonic pleasure motivation (seeking pleasure, enjoyment, and fun), hedonic comfort motivation (seeking comfort, relaxation, ease, and painlessness) and extrinsic motivation (seeking money, power, status, popularity, and image) (LeFebvre and Huta, 2021, p. 2299). Though, how cultural dimensions, and, particularly, indulgence, interplay with female entrepreneurship and innovation was an under-explored topic to date. Based on above considerations and identified gaps, we argue that culture - and, specifically, happiness - exerts a significative effect on innovation and on female entrepreneurship. Therefore, these variables influence female entrepreneurs’ orientation toward innovation. Thus, we focus on happiness, as measured by indulgence, and on female entrepreneurship. The salience of female entrepreneurship is explained by existing differences in personality traits in gender groups, existence of a happiness gender-gap, existence of structural obstacles that hinder gender parity or self-actualization by means of career. Women are deemed more creative than men. Also, they score high in agreeableness, conscientiousness, and extraversion.

Such aspects seem to suggest that the relationship between innovation and gender should be strong. However, the antecedents of this mechanism are mostly hidden. Differently from prior literature, we argue that culture is a moderator of innovation in female entrepreneurship. Hence, we specifically consider happiness as a driver of innovation. In other words, indulgence - a proxy measure of happiness - favors a creative mindset and stimulates knowledge creation processes, by means of improved socialization, externalization, combination, and internalization mechanisms. Such a fertile background fosters openness to world or to new ventures and create preconditions for collaboration, through leveraging personal resilience, willingness to share knowledge, need for achieving something meaningful, need for self-actualization and for improving society. Indulgence also interacts with other cultural factors, such as masculinity versus femininity and long versus short term orientation. Masculine cultures are deemed poorly concerned with quality of life and they might hinder female entrepreneurship. Long versus short term orientation may favor innovation, because it requires a long-run commitment.

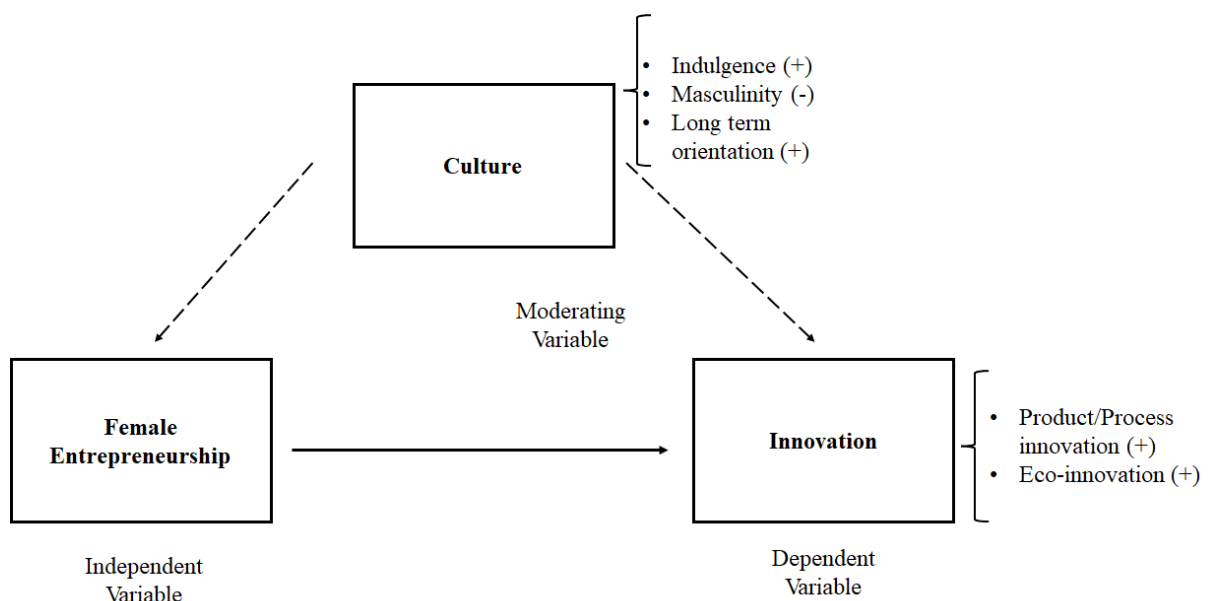
In brief, we assume that the interaction between the aforementioned cultural dimensions and female entrepreneurship moderates the relationship between the latter and innovation.

When a culture scores high in indulgence, femininity, and long run orientation, thus, there is a positive relationship between female entrepreneurship and innovation. In brief, more women in business bring along further innovation. Given the acknowledged personal traits of women, including environmental sensitivity (Mohai, 1992), we also expect that the same positive relationship can be found between female entrepreneurship and eco-innovation. Therefore, we formulate the following hypotheses:

- i. Hp1: “indulgence versus restraint”, “masculinity versus femininity”, and “long term versus short term orientation” are moderators of the relationship between female entrepreneurship and innovation;
- ii. Hp2: “indulgence versus restraint” positively moderates the relationship between female entrepreneurship and innovation;
- iii. Hp3: “masculinity versus femininity” negatively moderates the relationship between female entrepreneurship and innovation;
- iv. Hp4: “long term versus short term orientation” positively moderates the relationship between female entrepreneurship and innovation;
- v. Hp5: female entrepreneurship is positively associated with both innovation and eco-innovation.

Figure 1 synthesizes the research model.

Fig. 1: Research Model



3. Research design and empirical analysis

3.1. Sample

During the last 20 years, a wealth of prominent researches had used cross-cultural dimensions in order to understand the dynamic of women entrepreneurship. Data were collected variously, by means of primary and secondary researches. Most of scholars made reference to Hofstede's dimensions (1980), others have used the Globe extended scale (House, *et al.*, 2004), which considers the six-dimensions Hofstede's (2006) scale, along with 21 primary dimensions of leadership and it is focused on consequences of culture.

Mostly, primary data were extracted from global and large archival repositories. A few studies on the relationship between women entrepreneurship and culture have used data from World Bank (Neumeyer, *et al.*, 2019, Hechavarría and Brieger, 2020). Others, have used data from Eurostat repositories (Mroczek-Dąbrowska and Gawel, 2020, Gawel and Głodowska, 2021).

Consistently, we collected and merged three different sets of data, drawing them from: World Bank, Eurostat, and Hofstede's cross-cultural rankings.

Specifically, we downloaded data from the Enterprise survey of The World Bank (see webliography). Thus, we extracted data related to gender and innovation, at enterprise level.

Data refer to 2021 and to European Union (EU). This extraction criterion was applied in each data collection (same reference period and geography). The choice of focusing on a single year was motivated by three different factors: presence of missing data for a large number of economies and years, global-pandemic-related biases in 2020, need for taking a snapshot of the status quo after covid-19 by using a cross-sectional analysis. Thus, the cross-sectional analysis allowed an increased cross-countries comparability and a smaller number of missing data.

We also decided to focus our attention on EU economies based on similar considerations. Many world economies release poor or no data, differently from US or EU. In addition, EU is a multinational market region, characterized by an acceptable degree of market standardization, which makes this setting rather ideal in order to study both product/process innovation and eco-innovation.

Specifically, EU is characterized by: economic and political union, no internal tariff and non-tariff barriers, free trade, free people circulation, a single currency, geographic and temporal proximity (time difference is short cross-countries), presence of a scalable and global mass market, price standardization, fair competition, and, to a given extent, some cultural similarity. Cross-countries differences still persist, though, such as: presence of different languages, cultural differences, political differences.

Yet, the existence of a central government allows to enforce EU laws throughout the union. This element fostered standardization. Standardization improves the validity of our analysis as well.

Also, EU has one of the most stringent environmental regulations in the world, as is the case of eco-label. Eco-label is a world-wide accepted certification of low environmental impact of goods and services. It is focused on meeting environmental standards throughout products/services entire life cycle, including reparability and circularity (see webliography).

After deciding inclusion criteria, we tabulated and organized data as follows: we excluded all missing values listwise, we classified firms by means of gender of top managers and ownership types, we selected firms by including only those where top managers were female, and we measured the mean values of firm size, in order to control for firms' dimension.

Country-culture effects were explored thanks to the use of data related to the six-dimensions Hofstede's cross-cultural scale (see webliography).

Finally, we drew data related to the EU eco-innovation index (see webliography) from the Eurostat data repository.

After excluding cases listwise, we finally examined a total of 16 different countries (Belgium, Bulgaria, Czechia, Denmark, Estonia, Finland, Croatia, Hungary, Italy, Latvia, Lithuania,

Luxembourg, Poland, Portugal, Romania, Slovenia). The sample includes about 38.000 women-owned enterprises.

3.2. Methodology

Previous researches used a wealth of methods to test relationships among culture, innovation, and female entrepreneurship.

However, each of currently selected variables is characterized by several dimensions. There are six dimensions of culture, five dimensions of innovation, and six dimensions of gender access to top managerial roles (two of which relate exclusively to female entrepreneurship).

Therefore, it emerged the need for reducing and selecting the main components explaining each construct, both in order to meet the criterion of parsimony of variables and to avoid multicollinearity (or the problem that independent variables may predict each other).

Among the frequently used methods to test relationships among culture, innovation, and female entrepreneurship, there are: Principal Component Analysis - PCA - (Capitanio *et al.*, 2009, Kostis, 2021, Kawai and Kazumi, 2021, Khan, *et al.*, 2021), multiple linear regression (Alam, *et al.*, 2011, Beriso, 2021, Achim *et al.*, 2021, Pheng and Yuquan, 2002, Lee, *et al.*, 2013, Aytakin, *et al.*, 2022), moderation analysis (Larbi-Siaw, *et al.*, 2022, Panda, *et al.*, 2022, Schepers and Wetzels, 2007, Welsh, *et al.*, 2014, Santos and Neumeyer, 2022).

Consistently, we used a mix of different methodologies to test our model's hypotheses. First, we applied Principal Component Analysis to reduce the number of factors related to female entrepreneurship and to innovation.

For the PCA, we initially run the descriptive statistics. We chose the initial solution and, then, we calculated the correlation matrix, by considering: coefficients, significance levels, determinants, KMO and Bartlett's test of sphericity, reproduced, anti-image. Then, we extracted factors based on eigenvalues > 1. We chose varimax PCA analysis, we excluded cases listwise, and we suppressed coefficients < 0,3.

After that, we performed three different Ordinary Least Squares (OLS) multiple linear regression analyses. In the first linear regression, we used all six dimensions of Hofstede's cross-cultural scale. The first analysis signaled a problem of multicollinearity among some country-culture dimensions. These dimensions presented a high value of VIF - a value close to 5 or higher. High values signal potential multicollinearity.

Therefore, we excluded those country-culture dimensions that presented a VIF > 5, in order to improve robustness of analyses and to avoid multicollinearity.

As a matter of fact, our second regression with only 3 out of the 6 cross-cultural dimensions provided robust results.

The general linear regression equation is the following:

$$Y_i = \beta_0 + \beta_1 X_{i1} + \dots + \beta_n X_{in} + e_n$$

The third regression investigated the relationship between our independent variables and eco-innovation.

The moderation effect was tested by using a multiplicative method, by means of introducing an interaction term: "Moderation effects are tested with multiple regression analysis, where all predictor variables and their interaction term are centered prior to model estimation to improve interpretation of regression coefficients" (Fairchild and MacKinnon, 2009, p. 89). Moderations between constructs occur when coefficients are statistically different from zero.

3.3. Variables

3.3.1. Independent variables

Our assumption is that there is a positive relationship between innovation - including eco-innovation - and female entrepreneurship. In a nutshell, we argue that the presence of a high number

of female entrepreneurs favors innovation. Previous studies have long suggested the relevance of female entrepreneurship for progress and development of countries (Brush and Cooper, 2012, Ojong, Simba, and Dana, 2021).

Therefore, female entrepreneurship is our independent variable. As previously explained, this variable was selected by means of PCA. Initially considered factors were: Percent of firms with female participation in ownership, Percent of firms with majority female ownership, Percent of firms with a female top manager, Proportion of permanent full-time workers that are female (%), Proportion of permanent full-time production workers that are female (%), Proportion of permanent full-time non-production workers that are female (%). Based on the PCA analysis, the most relevant factor for female entrepreneurship is: “percent of firms with female participation in ownership”. Therefore, we used this metric to calculate our independent variable. This choice is consistent with many previous works (Matricano, 2022, Audretsch *et al.*, 2022).

3.3.2. *Dependent variables*

Innovation and eco-innovation are our dependent variables, respectively, in the three different regressions. Innovation depends on a myriad of micro, meso, and macro factors.

To the end of measuring innovation, we considered the following factors: Percent of firms using technology licensed from foreign companies, Percent of firms having their own Web site, Percent of firms that introduced a new product/service, Percent of firms whose new product/service is also new to the main market, Percent of firms that introduced a process innovation, Percent of firms that spend on R&D. However, since these factors show a high level of bivariate correlation, we reduced the number of factors thanks to a PCA analysis.

After running the PCA, we measured innovation as: “Percent of firms whose new product/service is also new to the main market”. This metric choice is corroborated by a plethora of studies (Handfield, *et al.*, 1999, Link, 2022).

Eco-innovation (regression model 3) was measured as the EU eco-innovation index (Orlando, *et al.*, 2020).

3.3.3. *Moderating factors*

Our assumption is that country-culture moderates the relationship between female entrepreneurship and innovation.

Therefore, we considered the six-dimensions Hofstede’s (2010) cross-cultural scale as moderating factors. The dimensions are the followings: Individualistic/ Collectivism (idv), Power Distance Index (PDI), uncertainty avoidance (uai), masculinity/feminists (mas), long term versus short term normative orientation (ltowvs), indulgence versus restraint (ivr).

3.4. *Results*

The first PCA is aimed at selecting main factors explaining female entrepreneurship. Table 1 shows the correlation matrix.

Tab. 1: Correlation between gender variables, 2-tailed, $p < .05$. $p < .01$

	1	2	3	4	5	6
1. Percent of firms with female participation in ownership	1,000					
2. Percent of firms with majority female ownership	0,991	1,000				
3. Percent of firms with a female top manager	0,993	0,977	1,000			
4. Proportion of permanent full-time workers that are female (%)	0,967	0,944	0,977	1,000		
5. Proportion of permanent full-time production workers that are female (%)*	0,928	0,916	0,914	0,946	1,000	
6. Proportion of permanent full-time non-production workers that are female (%)*	0,961	0,948	0,948	0,946	0,963	1,000

Based on above matrix, it appears that variables are highly correlated between each other. Hence, reduction of factors is needed in order to avoid multicollinearity problems. Thus, we performed the KMO and Bartlett’s tests of sphericity (table 2).

Tab. 2: KMO and Bartlett tests of sphericity in the group of gender variables

KMO Test		0,821
Bartlett sphericity test	Approx Chi-squared	216,783
	DF	15
	Sig.	0,000

The KMO provides a result of 0,821, which means that the sample is highly adequate. So, we extracted components (tables 3 and 4).

Tab. 3: Total explained variance of gender variables

Component	Initial eigenvalues			Extraction sum of squared loadings		
	Total	% of variance	% cumulative	Total	% of variance	% cumulative
1	5,773	96,222	96,222	5,773	96,222	96,222
2	0,129	2,144	98,366			
3	0,060	0,997	99,363			
4	0,029	0,486	99,849			
5	0,007	0,118	99,967			
6	0,002	0,033	100,000			

Tab. 4: Component matrix of gender variables

Number	Component	Total explained variance
1	Percent of firms with female participation in ownership	0,993
2	Percent of firms with a female top manager	0,987
3	Proportion of permanent full-time workers that are female (%)	0,982
4	Percent of firms with majority female ownership	0,982
5	Proportion of permanent full-time non-production workers that are female (%)*	0,980
6	Proportion of permanent full-time production workers that are female (%)*	0,962

Extraction method: Principal Component Analysis. 1 component extracted

The PCA extracted a single factor, and, namely, the “Percent of firms with female participation in ownership”. This factor explains the 99% of variance. Therefore, it was used as our independent variable in all regression tests.

The same analysis was applied to understand what is the main component explaining innovation. Table 5 shows correlations among factors related to innovation.

Tab. 5: Correlation between technology and innovation variables, 2-tailed, $p < .05$. $p < .01$

	1	2	3	4	5
1. Percent of firms using technology licensed from foreign companies*	1,000				
2. Percent of firms having their own Web site	0,916	1,000			
3. Percent of firms that introduced a new product/service	0,921	0,982	1,000		
4. Percent of firms whose new product/service is also new to the main market	0,171	0,462	0,501	1,000	
5. Percent of firms that introduced a process innovation	0,937	0,971	0,987	0,422	1,000

As in the previous case, most of factors are highly correlated between each-other. Thus, a second PCA helped to reduce factors related to innovation. In this case, the value of KMO and Bartlett’s tests of sphericity is equal to 0,734 (table 6), which indicates a good level of sample adequacy.

Tab. 6: KMO and Bartlett tests of sphericity in the group of technology and innovation variables

Kmo test		0,734
Bartlett's sphericity test	Approx. Chi-squared	135,340
	Df	10
	Sign.	0,000

A single component was extracted also in the innovation case (tables 7 and 8), and, namely, "Percent of firms that introduced a new product/service". This factor explains the 0,99% of variance. This component was used as our dependent variable.

Tab. 7: total explained variance of technology and innovation variables

Component	Initial eigenvalues			Extraction sum of squared loadings		
	Total	% of variance	% cumulative	Total	% of variance	% cumulative
1	4,058	81,161	81,161	4,058	81,161	81,161
2	0,875	17,497	98,658			
3	0,035	0,705	99,364			
4	0,026	0,513	99,876			
5	0,006	0,124	100,000			

Tab. 8: Component matrix of technology and innovation variables

Number	Component	Total Explained Variance
1	Percent of firms that introduced a new product/service	0,997
2	Percent of firms that introduced a process innovation	0,989
3	Percent of firms having their own Web site	0,987
4	Percent of firms using technology licensed from foreign companies*	0,927
5	Percent of firms whose new product/service is also new to the main market	0,501

Extraction method: Principal Component Analysis. 1 component extracted

Once reduced the number of variables and confirmed our assumptions by means of evidence, we tested our model's hypotheses by using three different multiple linear regressions. In the first analysis (model 1), we used all Hofstede's (2010) dimensions. Table 9 shows the descriptive statistics of the first regression analysis. The correlation table (table 10) signals that there is a low level of correlation between independent variables.

Tab. 9: Descriptive statistics- model 1

	Mean	Standard Deviation
Percent of firms that introduced a new product/service	79,246875000000000	34,338741331767000
mas	40,94	21,834
ltowvs	58,454030226700200	17,315242979311700
ivr	34,640066964285700	17,675831533336000
Percent of firms with female participation in ownership	96,996875000000000	41,007769462017800
pdi	54,38	18,366
idv	55,19	19,195
uai	75,31	19,231

Tab. 10: Pearson correlations - model 1, 2-tailed, $p < .05$. $p < .01$

	1	2	3	4	5	6	7	8
1. Percent of firms that introduced a new product/service	1,000							
2. mas	0,077	1,000						
3. ltowvs	-0,366	0,076	1,000					
4. ivr	-0,211	-0,032	-0,415	1,000				
5. Percent of firms with female participation in ownership	0,929	0,243	-0,304	-0,407	1,000			
6. pdi	0,294	0,230	-0,006	-0,368	0,392	1,000		
7. idv	-0,089	0,307	0,258	0,237	-0,124	-0,687	1,000	
8. uai	0,255	0,423	-0,025	-0,304	0,414	0,831	-0,491	1,000

The model 1 has a good level of acceptability, with an adjusted R-squared of 0,89 and a p value= 0,000 <0,01. Also, the Durbin-Watson test provides a value of 2,034, thus proving that there is no autocorrelation between variables. Autocorrelation occurs when lagged values of a variable depends on values generated in previous time intervals. When a Durbin-Watson test value is equal or greater than 2, there is no autocorrelation. Differently, values that are significantly less than 1 are a sign of alarm and they indicate that successive error terms are positively correlated.

Tab. 11: Linear regression - model 1. Summary statistics

R	R-squared	Adjusted R-squared	Estimated standard error	Modified R-squared	Modified F	Df1	Df2	Sig. Modified F	Durbin-Watson
,969 ^a	0,939	0,885	11,634467333913200	0,939	17,524	7	8	0,000	2,034
a. Predictors: (costant), uai, ltowvs, mas, Percent of firms with female participation in ownership, ivr, idv, pdi									
b. Dependent variable: Percent of firms that introduced a new product/service									

However, according to collinearity diagnostics reported in table 12, the Variance Inflation Factor (VIF) shows that some variables have moderately high values. Therefore, they do not contribute significantly as predictors of our dependent variable. Thus, we eliminated such variables, and, specifically: PDI, uai, idv.

Tab. 12: Coefficients and collinearity diagnostics- model 1

	Non-standardized coefficients		Standardized coefficients	t	Sign.	95,0% confidence interval for B		Collinearity Diagnostics	
	B	Standard Error	Beta			Lower bound	Upper bound	Tolerance	VIF
(Costant)	-29,656	32,800		-0,904	0,392	-105,292	45,980		
mas	-0,293	0,210	-0,186	-1,391	0,202	-0,778	0,192	0,428	2,337
ltowvs	0,147	0,299	0,074	0,490	0,637	-0,543	0,837	0,336	2,976
ivr	0,519	0,274	0,267	1,895	0,095	-0,113	1,151	0,385	2,600
Percent of firms with female participation in ownership	0,928	0,121	1,109	7,651	0,000	0,648	1,208	0,365	2,743
pdi	0,343	0,411	0,183	0,834	0,429	-0,606	1,292	0,158	6,327
idv	0,128	0,362	0,072	0,355	0,732	-0,706	0,963	0,187	5,346
uai	-0,285	0,316	-0,160	-0,901	0,394	-1,015	0,444	0,244	4,101

The second regression analysis (model 2) considers how the interaction between the three significant country-culture dimensions and female entrepreneurship impacts product and process innovation. Table 13 shows the correlation matrix of model 2, whilst table 14 synthesizes results of the regression.

Tab. 13: Pearson correlations - model 2, 2-tailed, p<.05. p<.01

	1	2	3	4	5
1. Percent of firms that introduced a new product/service	1,000				
2. mas	0,077	1,000			
3. ltowvs	-0,366	0,076	1,000		
4. ivr	-0,211	-0,032	-0,415	1,000	
5. Percent of firms with female participation in ownership	0,929	0,243	-0,304	-0,407	1,000

Tab. 14: Linear regression - model 2. Summary statistics

R	R-squared	Adjusted R-squared	Estimation of standard error	Modified R-squared	Modified F	Df1	Df2	Sig. Modified F	Durbin-Watson
,965 ^a	0,931	0,906	10,552893756918000	0,931	36,956	4	11	0,000	2,171
a. Predictors (costant), Percent of firms with female participation in ownership, mas, ltowvs, ivr									
b. Dependent variable: Percent of firms that introduced a new product/service									

The adjusted R-squared is 0,90 of model 2, which is very good. In this second regression, VIF values and collinearity diagnostics improved largely, as showed by table 15 and 16. The Durbin-Watson test value is 2,171, therefore it is deemed acceptable.

Tab. 15: Coefficients and collinearity diagnostics- model 2

	Non-standardized coefficients		Standardized coefficients	t	Sig.	95,0% confidence interval for B		Collinearity Diagnostics	
	B	Standard Error	Beta			Lower bound	Upper bound	Tolerance	VIF
(Costant)	-31,807	24,646		-1,291	0,223	-86,053	22,438		
mas	-0,308	0,134	-0,196	-2,300	0,042	-0,603	-0,013	0,869	1,150
ltowvs	0,218	0,218	0,110	1,001	0,338	-0,262	0,698	0,520	1,922
ivr	0,559	0,221	0,288	2,532	0,028	0,073	1,044	0,488	2,049
Percent of firms with female participation in ownership	0,944	0,095	1,127	9,975	0,000	0,736	1,152	0,493	2,027

Tab. 16: Collinearity diagnostics-model 2

Dimension	Eigenvalue	Content index	Variance proportion				
			(Costant)	mas	ltowvs	ivr	Percent of firms with female participation in ownership
1	4,452	1,000	0,00	0,01	0,00	0,00	0,00
2	0,258	4,157	0,00	0,06	0,00	0,25	0,06
3	0,149	5,471	0,01	0,76	0,07	0,02	0,01
4	0,133	5,781	0,00	0,13	0,11	0,03	0,26
5	0,008	23,521	0,99	0,04	0,82	0,69	0,67

a. Dependent variable: Percent of firms that introduced a new product/service

In particular, all VIF values range between 1 and 2, which means there is very poor correlation between variables and the predictors are adequate.

Therefore, the final model is:

Percent of firms that introduced a new product/service= -31,8 - 0,3 mas + 0,2 ltowvs + 0,5 ivr + 0,9 Percent of firms with female participation in ownership

In brief, results show that there is a positive association between innovation and female entrepreneurship. Increasing levels of female entrepreneurship foster innovation. Though, the constant shows that there is a high trade-off between the number of female entrepreneurs that are required to foster innovation and actual levels of product/process innovation. In other words, a huge number of female entrepreneurs are actually required to finally contribute to innovation. This effect is clearly explained by country characteristics, such as culture.

As a matter of fact, our findings prove that culture moderate the relationship between female entrepreneurship and innovation.

In particular, we found: a) a negative association between innovation and “masculinity versus femininity”, which means that masculinity hinders innovation, as well as female entrepreneurship; b) a positive, but small, association with “short-term versus long-term normative orientations”, which implies that innovation is path-dependent and that time envision affects female entrepreneurship; c) a high positive association with “indulgence versus restraint”, which indicates that freedom and happiness thrive innovation and female entrepreneurship.

The third regression (model 3) tests the relationship between our independent variables and eco-innovation (outcome variable).

We used a F probability=0,01 in this case as well. Table 17 shows the correlation matrix.

Tab. 17: Pearson correlations - model 3, 2-tailed, $p < .05$. $p < .01$

	1	2	3	4	5
1.eco-innovation index	1,000				
2. mas	-0,195	1,000			
3. Itowvs	-0,188	0,020	1,000		
4. ivr	0,689	0,033	-0,345	1,000	
5. Percent of firms with female participation in ownership	-0,685	0,234	-0,345	-0,407	1,000

In model 3, correlations among variables are weak, as they were in previous case. Table 18 synthesizes model 3 statistics.

Tab. 18: Linear regression - model 3. Summary statistics

R	R-squared	Adjusted R-squared	Estimation of the standard error	Modified R-squared	Modified F	Df1	Df2	Sig. Modified F	Durbin-Watson
,855 ^a	0,731	0,623	21,092	0,731	6,781	4	10	0,007	1,110
a. Predictors: (constant), Percent of firms with female participation in ownership, mas, Itowvs, ivr									
b. Dependent variable: eco-innovation index									

However, we have a less significant R value than previous cases - adjusted R-squared= 0,6, and a potential autocorrelation problem, with a Durbin-Watson test value of 1,110.

Nonetheless, the low values of VIF and other collinearity diagnostics allow to exclude the possibility of multicollinearity problems, as showed in tables 19 and 20.

Tab. 19: Coefficients and collinearity diagnostics- model 3

	Non-standardized coefficients		Standardized coefficients	t	Sig.	95,00% confidence interval for B		Collinearity Diagnostics	
	B	Standard Error	Beta			Lower bound	Upper bound	Tolerance	VIF
mas	-0,077	0,271	-0,050	-0,284	0,783	-0,681	0,528	0,874	1,144
Itowvs	-0,597	0,440	-0,296	-1,356	0,205	-1,579	0,384	0,564	1,772
ivr	0,654	0,450	0,327	1,451	0,177	-0,350	1,658	0,530	1,887
Percent of firms with female participation in ownership	-0,521	0,189	-0,642	-2,756	0,020	-0,943	-0,100	0,496	2,016
a. Dependent variable: eco-innovation index									

Tab. 20: Collinearity diagnostics- model 3

Dimension	Eigenvalues	Index of contents	(Constant)	mas	Itowvs	ivr	Percent of firms with female participation in ownership
1	4,454	1,000	0,00	0,01	0,00	0,00	0,00
2	0,256	4,171	0,00	0,04	0,00	0,27	0,08
3	0,153	5,395	0,01	0,72	0,07	0,02	0,00
4	0,128	5,895	0,00	0,21	0,10	0,08	0,25
5	0,009	22,867	0,99	0,03	0,82	0,63	0,66
a. Dependent variable: eco-innovation index							

In this case, the final equation is the following:

Eco-innovation index=155,9 - 0,077 mas - 0,597 Itowvs + 0,654 ivr - 0,521Percent of firms with female participation in ownership.

This result suggests that eco-innovation is positively associated with indulgence, whilst it has a strong and negative association with all other variables, including female entrepreneurship.

3.5. Discussion

This analysis largely contributes to innovate the conversation about innovation, culture, and gender entrepreneurship by bringing to the surface previously unknown and hidden mechanism.

First, our findings prove that female entrepreneurship is a driver of innovation, indeed. However, an absolutely huge number of women entrepreneurs is required for finally generate a positive effect on innovation. The explanation is related to country-culture. Originally, our evidence showed that three dimensions proved to be significant moderators of the relationship between innovation and female entrepreneurship: “masculinity versus femininity”, long term versus short term orientation”, and “indulgence versus restraint”.

Masculine cultures are based on assertiveness and on the “I”, as opposed to feminine cultures, which are relationship-oriented. Accordingly, gender roles are clearly differentiated in masculine cultures. Hence, women have to look after family and cannot access entrepreneurial careers. No surprise, then, that masculine cultures hinder female entrepreneurship. However, according to our research, this mindset is still largely diffused in EU, despite all regulatory efforts to change the context.

Previous studies provided mixed results about the effect of masculinity on innovation (Khan and Cox, 2017): masculinity hinders adoption of innovation (Van Everdingen and Waarts, 2003), but it does not affect the levels of intellectual capital (Shane, 1993) or creativity (Williams and McGuire, 2010) of a country.

Our study shows that masculinity indeed obstacles innovativeness of female entrepreneurs: for an elevated number of women entrepreneurs, only a few of them actually can become innovators. “Long versus short term orientation” is a dimension based on the positive and negative sides of the Confucian logic ((Khan and Cox, 2017). On the positive side, long term orientation is positively associated with innovation (Van Everdingen and Waarts, 2003) and it is concerned with perseverance and hard work. On the negative side, this culture is associated to: orientation to past, traditions, and social obligations. Also, long-term orientation entails a multi-chronic envision of time - being multitasking - which is a typical personality trait of women. Therefore, the positive side of long-term orientation favors female entrepreneurship and innovation, counteracting masculinity. According to Syed and Malik (2014) indulgent societies are likely to adopt innovations. Differently, we prove that indulgence helps to “generate” innovations: indulgence is the main cultural dimension favoring female entrepreneurship and innovation. Freedom and well-being are essential for female entrepreneurship and for progress.

Hence, it appears that innovation is feminine, tied to overture, to happiness, and to a slight dose of orientation toward being multi-tasking. Yet, history matters in innovation, in terms of path dependency (Thrane, Blaabjerg and Møller, 2010, Coomb and Hull, 1998, Freeman, 1990, Goumagias *et al.*, 2022).

By contrast, restrained cultures limit progress, innovation, gender parity, and women empowerment.

However, our research also digs to light another important result: female entrepreneurship and eco-innovation are negatively associated, differently from indulgence, whose positive association with eco-innovation is confirmed by findings of model 3. This unexpected scenario can be motivated by several factors. As instance, one reason can be that women have poor access to scientific careers and to high-tech intensive resources, as showed by 2021 Unesco data (see webliography for more information) and by research (Chipman and Thomas, 1987, Solomon, 1985, Fox, 1995). Also, women experience a lower access to capital (Brush and Cooper, 2012), lagged diffusion of female entrepreneurship compared to male entrepreneurship (Verheul, Stel and Thurik, 2006), issues of self-esteem and self-confidence (Garaika, Margahana, and Negara, 2019).

By and large, happiness and resilience seem to have a deep connection in terms of capacity to create resources and to improve life conditions. The positive relationship between indulgence and innovation can be interpreted in terms of hedonism, life style, and status: an indulgent culture is a culture where people continuously search an immediate satisfaction of their desires. Continuous

innovation answers to this need by generating a flow-experience. Hedonistic individuals buy emotions and innovations are emotions. Similarly, the relationship between indulgence and eco-innovation can be motivated by individual search for self-appraisal, for status, and life style as a personal qualification. Californians' lyfe style can be deemed an example and a pioneer behavior. Californians are usually perceived as active, outdoorsy, health-conscious, leaders in terms of innovation, technology, and social trends adoption. They prefer organic, gluten-free, lacto-free products, and slow food; they are obsessed with being fit, having an active lifestyle, and with self-image, and they always buy new technologies or support small local business and handcrafts. Not by chance, there is a huge number of high-tech companies and innovative start-ups in Sylicon Valley. They are the archetype of an indulgent society. According to this fashion, happiness emerges as a factor that paves the way for resilience. A resilient society is an indulgent, happy, free, innovative, entrepreneurial, gender unbiased, and sustainable society.

Understanding the motives of the gender eco-innovation gap, its roots, patterns of diffusion, locations, etc., is of a huge importance for achieving sustainable development goals, such as gender equality, environmental sustainability, societal development and progress.

4. Concluding remarks: contribution, impact, limitations, and future research suggestions

Current work extends and novel theory in many directions. Differently from prior research, we consider indulgence - happiness -, masculinity, and long-term orientation as moderators of the relationship between female entrepreneurship and innovation.

At at a theoretical level, we contribute to innovation studies by explaining the influence of happiness and indulgence to progress. Surprisingly, some previous works argued that there is a negative relationship between such constructs (Aldieri, Bruno and Vinci, 2021). In addition, we provide a causal view of the effect of culture on innovation, thus answering to the call of antecedent scholars (Büschgens, Bausch and Balkin, 2013). Then, we contribute to female entrepreneurship literature, by explaining how this form of entrepreneurship interplays with innovation and is moderated by context-based factors. Finally, we also contribute to studies on eco-innovation. Unprecedentedly, we prove that indulgence has a positive effect on eco-innovation, whereas female entrepreneurship has a negative association with it.

Current findings have also relevant social implications. Boosting the morale, improving quality of life, and removing structural obstacles that impair gender parity can have a fostering effect on the progress of society.

Thus, policy makers should promote gender parity, along with well-being, by means of incentives, regulations, and culture-based-actions, in order to thrive growth and sustainability. The use of archival data - a large-scale dataset - improves both robustness and replicability of the analysis. However, despite our findings are noteworthy, the analysis still has some limits.

As instance, our analysis is cross-sectional and it considers a limited number of countries/regions. Future research should extend the analysis by considering either longitudinal datasets or ulterior regions/countries. A number of factors may affect current results, as instance as: laws, demographic characteristics, negative economic conjunctures, educations, crises, etc. All these aspects deserve to be considered properly by future scholars. In addition, current analysis uses a linear model. However, the relationship among cosntructs may be non-linear. Thus, forthcoming studies should consider the existence of latent variables and non-linear relationships. Finally, we find a negative association between female entrepreneurship and eco-innovation. However, our model does not allow to provide grounded explanations of this result. Therefore, in future, researchers should provide solid motivation to this unusual result.

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Academic Engagement and the External Patenting of University Inventions[♦]

MARCO CORSINO^{*} SALVATORE TORRISI[♦]

Abstract

Framing of the research. *The external patenting of inventions developed with the use of university resources determines a loss of financial resources that a university could invest in future research or teaching activities.*

Purpose of the paper. *This paper analyzes the relationship between academic engagement and external patenting of university inventions at the international level.*

Methodology. *Multivariate regression analysis based on a logit estimator that draws upon survey and archival data concerning more than 500 research projects spawning a patent application.*

Results. *Patents developed in the context of direct scientist-firm relationships are more likely to be commercialized through non-university channels. The provision of outcome-based rewards to get university scientists involved in technology transfer and the pursuit of research partnership at the organizational level mitigate the effect of academic engagement on external patenting.*

Research limitations. *The cross-sectional nature of our data prevents us from interpreting the estimated associations as evidence of causal linkages.*

Managerial implications. *University administrators can resort to formal research partnerships and incentive systems to mitigate the phenomenon of external patenting determined by academic engagement.*

Originality of the paper. *Drawing on agency theory and exploiting an original dataset, the paper develops and empirically tests a conceptual framework that evaluates the role of university-firm relationships on the exploitation of university inventions.*

Keywords: *Tech Transfer & Commercialization; Intellectual property; Outside assignment*

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1. Introduction

Scholars in various disciplines underline that the allocation of intellectual property (IP) rights over university inventions bears major consequences on the transfer of scientific knowledge to the private sector (Eisenberg, 2003; Kenney and Patton, 2009;). Empirical evidence indicates that the institutional context influences IP rights allocation, which in turn impinges on the involvement of universities in IP management (Geuna and Rossi, 2011). For instance, the share of university-owned patents in countries embracing the professor's privilege system is lower than what observed in countries adopting institutional ownership as the default system (Lawson, 2013; Lissoni and Montobbio, 2015; Markman *et al.*, 2008).

However, the propensity of universities to claim patent ownership varies even within countries enacting the institutional ownership system. Some researchers conjecture that the phenomenon is the result of scientists' legitimate professional activities (e.g., consulting) carried out without the use of university resources (Thursby *et al.*, 2009). Other scholars investigate the conditions under which university scientists purposefully bypass the technology transfer office (TTO) and do not disclose their inventions even when these were developed with the use of university resources (Aldridge and Audretsch, 2010; Markman *et al.*, 2008). The literature refers to this phenomenon as external (or outside) patenting, which encompasses instances wherein university inventions are patented and commercialized through the backdoor rather than the institutional channels managed by the TTO. (Hayten and Feeney, 2017). A case in point is that of discoveries made at a university laboratory that the scientists privately sell or license directly to firms (Markman *et al.*, 2008).

Earlier research focused on the characteristics of the invention background (e.g., originality, technological value of the invention) as antecedents of external patenting (Thursby *et al.*, 2009). However, the literature reveals mixed and controversial results. Moreover, the evidence of opposite effects for the same antecedents (e.g., originality) across different contexts suggests that other factors may entail external patenting. Thereafter, additional investigation is needed to better understand the drivers of this phenomenon. This paper addresses a research question that lies at the center of the research agenda for academic entrepreneurship (Siegel and Wright, 2015): what are the implications of university-industry collaborations for the ownership of IP rights pertaining to academic inventions?

On a theoretical ground, the allocation of IP rights over inventions arising from university-industry collaborations depends on the underlying contractual terms (Aghion and Tirole, 1994). In this paper, we analyze the relationship between external patenting and academic engagement, that is, the various research services such as consulting and contract R&D that faculty members carry out for other organizations outside the framework of institutional collaborative agreements (Perkmann *et al.*, 2013). We focus on academic engagement because this type of collaboration entails a dual agency issue: university scientists involved in commercialization activities engage in research collaborations with firms, while holding their university role (Siegel and Wright, 2015). Drawing on agency theory (Eisenhardt, 1989; Jensen and Meckling, 1976), we conjecture that, in such a setting, asymmetric information and divergent goals between the academic scientist and her employer raise the risk that inventions developed in the context of scientist-firm relationships are commercialized through non-university channels (Gianiodis *et al.*, 2016).

This is a relevant topic for the following reasons. First, the external patenting of inventions developed with the use of university resources gives rise to a loss of financing (e.g., license fees) that a university could invest in future research or teaching activities. Second, an inventor who is aware of a limited TTO's ability to exploit the intellectual property generated by the invention will seek alternative, more efficient outside channels of commercial exploitation. Outside patenting then could be a signal of university TTOs inefficiencies.

Thus, it is important that universities find contractual and organizational solutions that foster a greater inventor's effort in technology transfer through institutional channels while mitigating the scientists' propensity to commercialize scientific discoveries through the backdoor (Bercovitz & Feldman, 2008; Lach and Schankerman, 2008). Hence, we hypothesize that the reward of university

scientists with outcome-based incentives and the pursuit of formal university-firm collaborative arrangements can mitigate the effect of academic engagement on external patenting.

To test these research hypotheses, we combine survey and archival data on 523 research projects that led to university patents, that is, patents in which at least one of the inventors is employed by a university (Lissoni *et al.*, 2009). Since our dataset encompasses universities in various countries (e.g., United States, France, Japan, etc.), it offers the possibility to assess the explanatory power of the antecedents under scrutiny while accounting for institutional differences.

On the empirical ground, we make two major contributions. First, we draw on a cross-country setting to present original, survey-based evidence on how academic engagement, formal research partnerships and incentive systems impinge upon outside patenting. Second, unlike earlier works we directly gauge the type of university-industry collaboration (i.e., whether the research leading to a patented invention is based on a formal joint research project), rather than inferring the nature of the collaboration from indicators based on information extracted from patent documents (Gianiodis *et al.*, 2016; J. Thursby *et al.*, 2009). By doing so, we address the concerns about measurement errors related with patent-based measures while gaining more precision and accounting for cross-country comparability in the assessment of academic engagement (Perkmann *et al.*, 2021).

2. Literature and hypotheses

The failure of universities to claim ownership of university patents is a concern for administrators and policy makers, especially in countries enacting institutional ownership as the default system for the assignment of IP rights. In this study, we consider scientists' individual level decision making as the main driver of external patenting (Gianiodis *et al.*, 2016). Accordingly, we draw on agency theory to investigate the extent to which patents developed in the context of scientist-firm relationships (i.e., academic engagement) are likely to be commercialized through non-university channels. Thereafter, we discuss how monetary incentives and formal research partnerships can moderate the effect of academic engagement on external patenting.

2.1 Academic engagement and external patenting

Academic engagement encompasses various research services (e.g., research contracts, academic consulting) that university scientists may carry out for other organizations (Perkmann & Walsh, 2007). Two features of academic engagement are worth considering for our purposes. First, university scientists can manage the transfer of knowledge to firms on an individual and discretionary basis (Bodas Freitas *et al.*, 2013; Link *et al.*, 2007). Second, a non-trivial share of activities carried out through academic engagement is not reported to the university administration (Perkmann *et al.*, 2015; Siegel *et al.*, 2004). These characteristics underscore a dual agency issue related to university scientists: they engage in research collaborations with firms, while holding their university role (Siegel and Wright, 2015).

University scientists do not typically enter relationships with firms to exercise control over their resources (Ankrah and AL-Tabbaa, 2015). Qualitative evidence shows that they rarely embark on a research program with the idea of patenting in mind (Agrawal and Henderson, 2002; Jensen and Thursby, 2001). Scientists pursue research services to reap monetary benefits (e.g., royalty payments, funding for laboratory equipment) and non-monetary rewards (e.g., learning about technological problems that are context-specific, recognition within the industrial scientific community) which may bear meaningful spillovers on their work (Meyer-Krahmer and Schmoch, 1998; Siegel *et al.*, 2004). When firms support academics with grants, research projects are more likely to generate patent applications than in the absence of industry financing (Bozeman and Gaughan, 2007). Consequently, firms have strong incentives to claim control over the resulting inventions.

As for the relationship between academic inventors and their parent university, two features are worth considering: i) academic inventors are university agents whose objectives may not align with those of the employer; ii) they must disclose scientific discoveries originating from their research to their employer (Jensen and Thursby, 2001). However, compliance with the duty of disclosure is by no means warranted. Inventors are often better positioned than TTO personnel in spotting promising application opportunities for an invention and finding industrial partners for commercializing it (Kenney and Patton, 2009). Inventors with an entrepreneurial orientation may be lured by business opportunities they deem profitable and try to exploit the invention autonomously. Overall, the joint presence of asymmetric information and divergent goals generate a principal-agent problem (Eisenhardt, 1989; Jensen and Meckling, 1976): academic inventors may behave opportunistically, bypass the TTO and commercialize the invention with the support of an incumbent firm or by founding a new venture.

The agency problem is exacerbated when academic inventors perceive the TTO as an obstacle to the formation of university-industry relationships (Siegel *et al.*, 2004). This happens when a TTO staffed with insufficient resources or a badly managed TTO hampers the technology transfer rather than fostering it (Owen-Smith and Powell, 2001). Or, when the TTO decision to patent or not a given discovery is influenced by university politics rather than made on a meritocratic basis (Kenney and Patton, 2009).

We acknowledge that academic engagement does not automatically imply that the inventor behaves opportunistically. Indeed, TTOs file patent applications only for a fraction of the unsolicited disclosures made by university researchers (Thursby and Thursby, 2002). When the TTO shelves a disclosed invention, faculties are entitled to proceed with an outside assignment to explore the commercial potential of the invention. Nonetheless, only a few patented inventions yield significant profits (Scherer and Harhoff, 2000) and a great deal of inventions disclosed to TTOs are deemed of questionable value (Jensen *et al.*, 2003). Thus, firms are unlikely to develop discoveries previously shelved by universities. Accordingly, we judge this type of outside assignment less widespread and relevant for our investigation. The discussion above leads to the following research hypothesis:

HP1. Academic engagement positively affects the probability of external patenting.

2.2 Moderating the effect of academic engagement

Universities can reduce the probability that academic engagement results in the external patenting of valuable inventions. Agency theory recommends the use of incentive systems and monitoring mechanisms to align the agent's behaviour with the principal's goals whenever asymmetric information and moral hazard prevent the principal from observing what the agent is doing (Eisenhardt, 1989; Jensen and Meckling, 1976). The nature of the academic profession makes monitoring systems an impractical solution to address the agency problem pertaining to university scientists. Instead, the adoption of outcome-based rewards to get university scientists involved in technology transfer is a viable option, for several reasons.

First, the knowledge and skills required to develop inventions are embedded in the inventor's mind and her cooperation is crucial to achieve successful commercialization. In these circumstances, outcome-based payments can effectively co-align the preferences of the two parties (Eisenhardt, 1989). Second, the inventive job is difficult to schedule, which implies that the appropriate inventor's behavior cannot be specified in advance. The inventor's behavior is also less readily observable, which makes outcome-based rewards more attractive (Eisenhardt, 1985).

The payment of attractive royalties on licensing agreements increases the inventor's propensity to disclose inventions (Jensen *et al.*, 2003). Nevertheless, a higher rate of disclosure does not ensure the success of commercialization since most university inventions are at the proof-of-concept stage. However, the inventor's participation in the development work is crucial for the successful commercialization of inventions. Rewarding inventors with royalties linked to the profits generated

by commercialization prompts them to disclose inventions and spend the desired level of effort in their development (Jensen and Thursby, 2001).

Drawing on this line of reasoning, Markman *et al.* (2008) and Gianiodis *et al.* (2016) examine the role of contingent pay to faculty and their departments in US universities. Adopting the university as the unit of analysis, the authors find that the higher the royalties awarded to scientists' departments, the lower the number of inventions commercialized bypassing the TTO. Incentive payments made directly to scientists also correlate negatively with bypassing, but their effect is only marginally significant. Thursby *et al.* (2009) and Hayten and Feeney (2017) concentrate on the patent as the unit of analysis: in none of these studies, the percentage of licensing revenues shared with the inventor correlates with the probability of external patenting. Thus, the available empirical evidence is scant and offers mixed results. Hence, we cannot derive any conclusion about the role of outcome-based rewards.

We conjecture that, beyond the direct link between incentives and outside patenting investigated by previous research, output-based incentives may interact with academic engagement. Conditional payments based on licensing can reconcile the goals of academic inventor and the university administration. On the one side, the expected utility of the inventor increases with the income she gets from a licensing agreement between the university and a licensee (Jensen *et al.*, 2003). On the other side, an increase in the royalty shares earned by inventors is positively related with the license income generated by universities and this effect works, in part, through a greater inventor's effort in commercialization activities (Lach and Schankerman, 2008).

Output-based rewards elicit a higher inventors' willingness to disclose inventions and collaborate in development activities, thus favoring more stable and productive interactions with the TTO. These interactions help the TTO build a positive reputation among university scientists, a necessary condition to establish technology transfer as part of the university culture (Owen-Smith and Powell, 2001). In these circumstances, asymmetric information is less likely to jeopardize the scientists-university relationship thus reducing the risk of opportunistic behavior. Accordingly, the inventor's propensity to commercialize inventions developed in partnership with firms through the backdoor will decline. Based on the discussion above, we formulate the next research hypothesis as follows:

HP2. Outcome-based incentives reduce the positive effect of academic engagement on external patenting.

Beyond outcome-based incentives, the organizational context (e.g., situational opportunities and constraints, norms and policies defining the way in which most members of the organization behave) may affect individual behavior either directly or interacting with other variables (Johns, 2006). The decision of faculty members to pursue patenting depends on their perceived benefits of seeking IP protection which, among other things, is shaped by the institutional environment in which academic patenting occurs (Azoulay *et al.*, 2007; Owen-Smith and Powell, 2001).

In this study, we consider formal, university-industry collaborations as a feature of the institutional context that affects the assignment of university patents. Specifically, we focus on research partnerships because they mark the onset of a joint-research project and are predetermined with respect to the time when patent applications are filed.

We expect that research partnerships directly affect external patenting of university inventions because contractual conditions underlying joint-research projects define the assignment of IP rights over future inventions (Sterzi *et al.*, 2019; Thursby *et al.*, 2009). However, we maintain that research partnerships also moderate the effect of academic engagement because they create an institutional environment supportive of technology commercialization through university channels. Several rationales support this conjecture.

Research partnerships may operate as an implicit monitoring system that encourages inventor's compliance with the duty of disclosure. Research partnership implies formalized and recurrent interactions between the TTO staff and the personnel of the partnering firms. These interactions make it difficult for the inventor to conceal agreements signed directly with firms on an individual

basis. Relatedly, they help the university spot instances of inventions not disclosed to the TTO. Knowing that the chances of spotting a conduct that violates the university rules are higher, the inventor will be concerned about the possibility of organizational sanctions and, in turn, less inclined to behave opportunistically. This line of reasoning rests on the observation that university scientists frame their decision to participate in commercialization activity by assessing the congruence between the entrepreneurial role identity and their extant role identity as academics (Jain *et al.*, 2009). When the rationales underpinning academic entrepreneurship conflict with the norms of the university environment, the latter tend to shape the behavior of scientists who adhere to organizational initiatives (Bercovitz and Feldman, 2008).

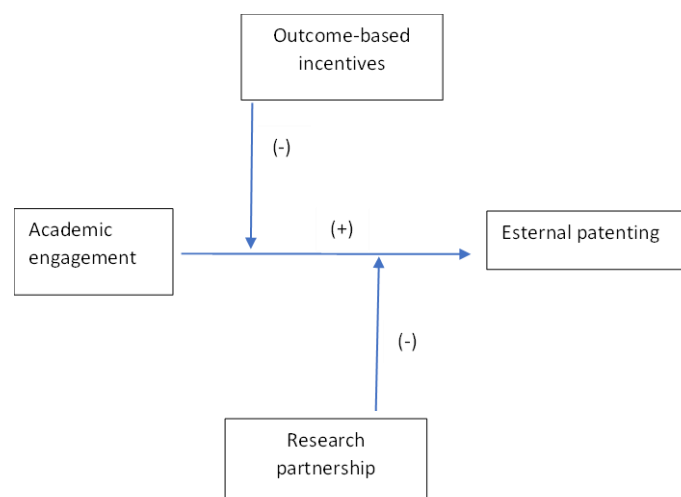
A salient reason behind the decision of university scientists to take part in commercialization activities is their willingness to safeguard novel technologies from improper applications (Jain *et al.*, 2009). This objective can be achieved more effectively through the effort of a dedicated organizational unit rather than relying on individual initiative. Thus, the management of research partnership by a competent TTO eases the deployment of resources and capabilities available in the organization (e.g., legal advice) against inappropriate actions of private entities.

University scientists, especially those with greater experience in a technological domain, could be involved in the negotiation process underpinning a research partnership. Their participation may favor the crafting of contractual terms that accommodate the intrinsic and extrinsic motivations of academic inventors while discouraging the pursuit of technology commercialization through alternative channels. Indeed, it is not rare to find faculty inventors drafting patent applications and/or being themselves patent agents (Owen-Smith and Powell, 2001). Drawing on the above discussion, we formulate the next hypothesis as follows:

HP3. Formal research partnerships between the focal university and a firm reduce the positive effect of academic engagement on external patenting.

Figure 1 shows a graphical representation of the model and summarizes the hypothesized relationships between the main concepts of our theoretical framework.

Fig. 1: Graphical representation of the model



3. Method

3.1 Data

The analyses carried out in this paper use data from the PatVal-EU II, PatVal-US, and PatVal-JP surveys conducted between 2010-2011 as part of the INNOS&T project (Torrisci *et al.*, 2016). These surveys collected data on the characteristics of invention processes that led to patent applications at

the European Patent Office (EPO), inventors' biographies and motivations for research, the patent value, commercialization, and other issues. Inventors in 20 European countries, Israel, the United States, and Japan were contacted and surveyed using a harmonized questionnaire across all regions. We drew the sample at the level of patent applications with priority dates between 2003-2005. After sampling the patents, we chose one inventor listed on the patent document at random. For the full-scale survey, inventors received a letter asking them to complete an online questionnaire. We received 23,044 responses, with a 20% response rate.

In this study, we focus on university patents, that is, patents in which at least one of the inventors listed on the patent document is affiliated with a university (Lissoni *et al.*, 2009). To single out these patents, we first identified university scientists through a survey question that asks the inventor: "What would best describe the type of organization/employer you were affiliated with at the time of the invention?" The inventor could select the option "university or other educational institution" among other types of organizations. Subsequently, we consider a second question asking: "Can you please indicate the name of the organization you were employed with at the time of the invention?" We standardized, homogenized, and cross-checked the inventors' answers. Finally, we carried out a validation exercise using external sources (e.g., published articles, profiles on LinkedIn) to check the reliability of survey data as for the inventor's affiliation at the time of the invention and the nature of her employer. Based on this procedure, we identified 791 patents developed by inventors affiliated with 416 universities.

External patenting is a phenomenon pertinent to countries where the assignment of IP rights over university inventions is based on the institutional ownership system, as opposed to countries where the system known as "professor's privilege" is in place. Accordingly, we restrict our sample to universities located in countries where institutional ownership was the default system between 2003 and 2005. To identify these countries, we rely upon taxonomies developed in early research (Geuna and Rossi, 2011; Van Eecke *et al.*, 2008). After applying this screening, we are left with 686 patents linked to 365 universities which are based in 18 countries (e.g., United States, Germany, France, etc.). Consistent with previous studies (Sterzi *et al.*, 2019; Thursby *et al.*, 2009), we discard 46 patents co-owned by the focal university and a firm: hence, we end up with 640 patents developed by scientists affiliated with 353 universities. Due to the presence of missing values in some variables factored into the regression model, the final sample comprises 523 observations. We do not observe statistically significant differences in the characteristics (e.g., number of backward citations, number of forward citations) of patent in the regression sample and those excluded because of missing values.

3.1 Variables

We use a dichotomous dependent variable, EXTERNAL PATENTING, which equals 1 if the patent is assigned to a firm, or it is owned by another research institution, or it is unassigned and thereafter owned by the inventor(s), and 0 if the focal university owns the patent. In the robustness checks, we consider a more restrictive version of the dependent variable by keeping in the outside patenting category only university patents assigned to a firm.

We rely on insights from the literature and a specific survey question to build a variable that gauges academic engagement. Previous studies suggest that linkages between university scientists and organizations that provide financing, lab equipment, or other services give rise to co-inventorship in patent applications (Azoulay *et al.*, 2007; Bozeman and Gaughan, 2007). While the attribution of inventorship often doesn't proceed according to the rule of law in the university context (Colyvas, 2007; Lissoni and Montobbio, 2015), legal requirements are more compelling in the private sector. Indeed, business organizations exert a strong control over the involvement of their employees in projects meant to outsource R&D. Hence, the listing of a firm's employee as a co-inventor in a university patent reveals the commitment of her employer in the research project. Thus, we argue that the appearance of corporate researchers and university scientists as co-inventors of university patents opportunely measures academic engagement (Chatterji and Fabrizio, 2012).

To operationalize the concept of academic engagement, we use a survey question that asks inventors: “At the time of the invention, were one or more of your co-inventors on this patent employed by organizations other than your employer/organization?” In the case of an affirmative answer, we carry out a manual check to establish if at least one of the co-inventors was employed by a firm. To accomplish this task, we start from the name of each inventor listed in the patent and verify her affiliation at the time of the invention through multiple sources (e.g., LinkedIn, scientific publications, biographies). Then, we build a categorical variable, COINVENTORS FIRM which equals 1 if at least one co-inventor was affiliated with a firm, 0 otherwise. The use of this variable allows us to address the standardization issue in the measurement of academic engagement while gaining precision and cross-country comparability (Perkmann *et al.*, 2021).

As for the first moderating factor (i.e., the use of an outcome-based incentive system) we include in the model the variable CONDITIONAL REWARD that equals 1 if the university awarded payments conditional on the commercialization of the invention (i.e., royalties from licensing), and 0 otherwise.

As for the second moderating factor, (i.e., research partnerships), we use a survey question which asks the inventor to indicate if there was any formal collaboration (i.e., collaborations involving written contracts) between her employer and other partners during the invention process. The phrasing of the question reminds the inventor to exclude collaborations with co-inventors. The respondent can indicate if the partner is a firm or other types of organizations (e.g., universities, government research organizations). Accordingly, we build a categorical variable, COLLABORATIONS FIRM, which equals 1 if a formal collaboration was established with firms, 0 otherwise.

Other antecedents may influence the assignment of university patents bypassing the TTO. In the remainder of this section, we describe the control variables factored into the model.

We control for two main dimensions of the invention background: basicness and technological importance. We gauge the basicness of the invention with two variables. The first variable, BACKWARD CITATIONS, counts the number of references to previous patents inserted in the patent document to describe the prior art over which the invention builds upon. According to Thursby *et al* (2009), the higher the number of prior art references, the lower the originality of the invention and the greater the opportunities for firms to find a market application for the invention.

The second variable, NONPATENT REFERENCES, counts the number of citations to non-patent literature (e.g., scientific publications) listed in the patent document. This variable measures the closeness of the technological components of the invention to science (Gittelman and Kogut, 2003). Patents that intensively cite non-patent literature describe more basic inventions for which a market application might not yet exist. Accordingly, the probability of external patenting is expected to decline with the number of non-patent citations.

We proxy the technological value of the invention with two variables: i) CLAIMS, which counts the number of claims included in the patent; ii) FORWARD CITATIONS, which counts the number of subsequent patents referencing the focal patent in the list of prior art. The extant literature conjectures that the higher the technological value of the invention, the greater the rewards that firms can reap from commercializing the invention, and the higher the chances for external patenting to occur (Gianiodis *et al.*, 2016; Markman *et al.*, 2008).

Given that legislations akin to Bayh Dole Act prescribe universities to claim title on inventions resulting from research supported by government fundings, we control if the research program from which the invention arises received government financing. To do that, we use a survey question that ask the inventor if the financing of the research leading to the invention comes from national or regional research programs. Hence, we construct a dichotomous variable, GOVERNMENT FUNDING, that equals 1 if public money supported the research activity, 0 otherwise.

Scientist characteristics may influence the decision to commercialize university inventions through the backdoor. For instance, “scientists with a particularly formidable scholarly reputation may be able to more easily attract and procure external support, thus reducing their dependence upon the university in facilitating commercialization” (Aldridge and Audretsch, 2010, p. 585). To

account for this possibility, we factor into the regression model two variables that capture prominent characteristics of the surveyed inventor.

We control for the academic profile of the inventor. Specifically, we exploit survey data and biographic data retrieved from external sources (e.g., curriculum vitae, researcher profile in Scopus, etc.) to construct the categorical variable **ACADEMIC POSITION**. The variable comprises three categories: 1 = the inventor was a graduate or Ph.D student at the time of the invention (**ACADEMIC POSITION: STUDENT**); 2 = the inventor had a researcher role (e.g., post-doctoral research fellow, research assistant, research scientist, etc.), but not a professorship (**ACADEMIC POSITION: RESEARCHER**); 3 = the inventor was either an associate or full professor (**ACADEMIC POSITION: PROFESSOR**). We generate and include in the regression model two dummies corresponding to the second and third categories of the variable **ACADEMIC POSITION**, while using the first category as the reference group.

The second inventor level variable, **RESEARCH EXPERIENCE**, considers the possibility that senior researchers can leverage their ability/reputation to carry out informal technology transfer outside of the TTO process. To construct this variable, we draw on a survey question asking: “In which year did you start to engage in research activities?” Accordingly, **RESEARCH EXPERIENCE** counts the number of years elapsed between the value reported for this survey question and the priority year of the patent.

At the university level, we control for the possibility that faculty perceptions of the organizational quality shape the attitude of academic inventors towards bypassing the TTO. Following Hayter and Feeney (2017), we construct the variable **ORGANIZATIONAL QUALITY** as a scale indicator based on responses to five ordinal survey items gauging the respondent’s perception of the availability of resources and competences in the organization where the invention was made. The inventor assigns a score to each item over a 5-point Likert scale ranging from 1 (Completely disagree) to 5 (Completely agree). The Cronbach’s alpha for the five items is 0.742. The variable **ORGANIZATIONAL QUALITY** reports the average value computed over the responses to the five items.

Two additional sets of dummy variables account for technological and institutional effects. At the technological level, we use a system of six dummy variables to control for the technological class of the focal patent as defined in the Observatoire des Sciences et des Techniques (OST) classification (Schmoch, 2008). At the institutional level, we consider a system of ten dummy variables that control for idiosyncratic country effects. In the econometric model, we use patents in chemistry as the reference group for the system of technological dummies, and US based universities as the reference group for the system of country dummies.

Table 1 provides a synoptic view and an accompanying description of the variables factored into the regression model. Descriptive statistics for the variables described above together with the matrix of pairwise correlation coefficients can be found in Table 2.

4. Results

We carried out a multivariate regression analysis based on a logit estimator because **EXTERNAL PATENTING** is a dichotomous variable. The regression model takes the form $\text{Prob}(\text{EXTERNAL PATENTING} = 1|x) = \Delta(x'\beta + z'\gamma)$, where Δ is the cumulative function of the logistic distribution; x is a vector of variables gauging the three types of university-firm relationships under scrutiny; and z is a vector of controls at the patent, inventor, and employer levels. In addition, β and γ are the vectors of parameters to be estimated.

Table 3 reports the estimated average marginal effects (AMEs) for the variables factored into the model. The specifications from Model 1 to Model 5 display the sequential inclusion of variables linked to the research hypotheses. We will comment on the AMEs reported under Model 5. Instead, Model 6 refers to a robustness check that will be described later in the text.

The AMEs for the explanatory variables support the research hypotheses presented in the previous sections. The variable COINVENTORS FIRM has a positive sign, and its effect is large and statistically significant. When an invention is developed in the context of academic engagement, the probability of external patenting increases of 48.8 percent points. Besides, we find that both outcome-based rewards and the pursuit of research partnerships moderate the effect of academic engagement as predicted in the theoretical sections. The estimated AME for the interaction between COINVENTORS FIRM and CONDITIONAL REWARD points to a reduction of 24.2 percentage points in the probability of outside patenting. Thereafter, when the focal university rewards scientists with payments conditional on the commercialization of the invention, it is more likely to retain IP rights on inventions developed in the context of academic engagement.

Tab. 1: Description of variables

Variable name	Description
EXTERNAL PATENTING	Dummy variable that equals 1 if the patent is owned by a firm, by another research institution, or it is unassigned and thereafter owned by the inventor(s), and 0 if the focal university owns the patent
COINVENTORS _{FIRM}	Dummy variable that equals 1 if at least one co-inventor was affiliated with a firm, 0 otherwise
CONDITIONAL REWARD	Dummy variable that equals 1 if the organization awards payments conditional on the commercialization of the invention, 0 otherwise
COLLABORATIONS _{FIRM}	Dummy variable that equals 1 if a formal collaboration was established with firms, 0 otherwise
BACKWARD CITATIONS	Number of references to previous patents inserted in the patent document
NON-PATENT REFERENCES	Number of citations to non-patent literature inserted in the patent document
CLAIMS	Number of claims included in the patent
FORWARD CITATIONS	Number of subsequent patents referencing the patent in the list of prior art
GOVERNMENT FUNDING	Dummy variable that equals 1 if public money supported the research activity, 0 otherwise
STUDENT	Dummy variable that equals 1 if the inventor was a graduate or Ph.D student, 0 otherwise
RESEARCHER	Dummy variable that equals 1 if the inventor was a researcher, 0 otherwise
PROFESSOR	Dummy variable that equals 1 if the inventor was a faculty member, , 0 otherwise
RESEARCH EXPERIENCE	Number of years elapsed between the value reported for this survey question and the priority year of the patent
ORGANIZATIONAL QUALITY	5-point Likert scale that measures the inventor's agreement with respect to statements pertaining to the availability of resources and competences in the organization where the invention was made (0=Completely disagree, 5=Completely agree)
TECH_CLASS _{ELECTRONIC ENGINEERING}	Dummy variable that equals 1 if the patent was in the technological field Electronic engineering
TECH_CLASS _{INSTRUMENTS}	Dummy variable that equals 1 if the patent was in the technological field Instruments
TECH_CLASS _{CHEMISTRY}	Dummy variable that equals 1 if the patent was in the technological field Chemistry
TECH_CLASS _{PROCESS ENGINEERING}	Dummy variable that equals 1 if the patent was in the technological field Process engineering
TECH_CLASS _{MECHANICAL ENGINEERING}	Dummy variable that equals 1 if the patent was in the technological field Mechanical engineering
TECH_CLASS _{CONSTRUCTION & CONSTRUCTION}	Dummy variable that equals 1 if the patent was in the technological field Consumption & Construction
UNITED STATES	Dummy variable that equals 1 if the university is located in the United States
JAPAN	Dummy variable that equals 1 if the university is located in Japan
ISRAEL	Dummy variable that equals 1 if the university is located in Israel
GERMANY	Dummy variable that equals 1 if the university is located in Germany
FRANCE	Dummy variable that equals 1 if the university is located in France
UK & IRELAND	Dummy variable that equals 1 if the university is located in UK or Ireland
SWITZERLAND	Dummy variable that equals 1 if the university is located in Switzerland
SPAIN	Dummy variable that equals 1 if the university is located in Spain
NETHERLANDS	Dummy variable that equals 1 if the university is located in The Netherlands
OTHER EUROPEAN COUNTRIES	Dummy variable that equals 1 if the university is located in other European countries

Tab. 2: Descriptive statistics and correlation matrix

	Mean	Std.Dev.	1	2	3	4	5	6	7	8	9
1 EXTERNAL PATENTING	0.482	0.500									
2 COINVENTORS _{FIRM}	0.228	0.420	0.48*								
3 CONDITIONAL REWARD	0.216	0.412	-0.17*	-0.15*							
4 COLLABORATIONS _{FIRM}	0.279	0.449	0.18*	0.23*	0.02						
5 BACKWARD CITATIONS	1.460	0.873	0.00	0.10	0.14*	0.06					
6 NON-PATENT REFERENCES	0.955	0.933	-0.16*	-0.08	-0.07	-0.12*	-0.02				
7 CLAIMS	2.819	0.648	-0.16*	-0.04	0.10	-0.06	0.20*	0.05			
8 FORWARD CITATIONS	0.868	1.969	0.04	0.05	0.13*	0.12*	0.21*	0.05	0.11*		
9 GOVERNMENT FUNDING	0.562	0.497	-0.23*	-0.20*	0.03	-0.07	-0.02	0.16*	0.12*	0.03	
10 STUDENT	0.143	0.351	-0.03	0.00	0.01	0.03	-0.04	0.01	-0.03	0.01	0.00
11 RESEARCHER	0.317	0.466	-0.06	-0.06	0.06	-0.08	0.08	-0.01	0.15*	0.12*	0.05
12 PROFESSOR	0.539	0.499	0.08	0.05	-0.06	0.05	-0.04	0.00	-0.12*	-0.12*	-0.04
13 RESEARCH EXPERIENCE	2.792	0.828	0.05	0.03	-0.04	0.02	0.05	-0.03	-0.01	-0.05	0.00
14 ORGANIZATIONAL QUALITY	3.014	1.061	-0.12*	-0.01	0.09	0.09	0.05	0.10	0.15*	0.04	0.12*
15 TECH_CLASS _{ELECTRONIC ENGINEERING}	0.143	0.351	0.05	0.14*	-0.06	0.05	-0.02	-0.11	0.00	-0.01	0.03
16 TECH_CLASS _{INSTRUMENTS}	0.237	0.426	-0.03	-0.10	-0.02	0.00	0.10	-0.13*	-0.02	-0.03	-0.08
17 TECH_CLASS _{CHEMISTRY}	0.459	0.499	-0.08	-0.02	0.00	-0.08	-0.02	0.39*	0.10	0.06	0.11
18 TECH_CLASS _{PROCESS ENGINEERING}	0.094	0.292	-0.03	0.04	0.07	0.08	-0.04	-0.14*	-0.05	-0.02	-0.03
19 TECH_CLASS _{MECHANICAL ENGINEERING}	0.040	0.197	0.13*	-0.04	0.01	-0.02	-0.03	-0.18*	-0.07	-0.02	0.02
20 TECH_CLASS _{CONSTRUCTION & CONSTRUCTION}	0.027	0.162	0.12*	-0.01	0.03	0.00	-0.07	-0.13*	-0.11	-0.03	-0.16*
21 UNITED STATES	0.201	0.401	-0.29*	-0.12*	0.26*	-0.05	0.24*	0.08	0.32*	-0.01	0.11
22 JAPAN	0.166	0.373	0.19*	0.04	-0.15*	-0.06	-0.16*	0.15*	-0.24*	-0.06	0.04
23 ISRAEL	0.025	0.156	-0.01	0.00	0.01	-0.07	0.03	0.03	-0.03	0.02	0.02
24 GERMANY	0.182	0.386	0.12*	-0.02	-0.07	-0.07	0.03	-0.12*	-0.12*	0.04	-0.04
25 FRANCE	0.065	0.247	0.06	0.08	-0.06	0.03	-0.06	-0.09	-0.03	-0.04	-0.05
26 UK & IRELAND	0.134	0.341	-0.18*	-0.09	0.01	0.04	0.01	-0.05	0.10	-0.02	-0.07
27 SWITZERLAND	0.046	0.209	0.03	0.14*	-0.05	0.05	0.01	-0.04	0.02	0.13*	0.03
28 SPAIN	0.029	0.167	0.04	-0.01	-0.09	0.00	-0.05	0.01	-0.04	-0.02	0.06
29 NETHERLANDS	0.055	0.229	0.02	0.01	-0.03	0.05	-0.08	0.04	0.03	0.01	-0.04
30 OTHER EUROPEAN COUNTRIES	0.098	0.297	0.11	0.08	0.06	0.13*	-0.04	-0.03	-0.08	-0.02	-0.05

Tab. 2: Continued

	10	11	12	13	14	15	16	17	18	19	20
11 RESEARCHER	-0.28*										
12 PROFESSOR	-0.44*	-0.74*									
13 RESEARCH EXPERIENCE	-0.61*	-0.14*	0.56*								
14 ORGANIZATIONAL QUALITY	0.13*	0.02	-0.11	-0.16*							
15 TECH_CLASS _{ELECTRONIC ENGINEERING}	0.02	0.00	-0.02	-0.06	-0.01						
16 TECH_CLASS _{INSTRUMENTS}	0.04	-0.02	-0.01	-0.03	-0.01	-0.23*					
17 TECH_CLASS _{CHEMISTRY}	-0.05	-0.06	0.09	0.10	0.06	-0.38*	-0.51*				
18 TECH_CLASS _{PROCESS ENGINEERING}	-0.02	0.10	-0.08	-0.03	0.02	-0.13*	-0.18*	-0.30*			
19 TECH_CLASS _{MECHANICAL ENGINEERING}	0.00	0.03	-0.03	-0.01	-0.06	-0.08	-0.11*	-0.19*	-0.07		
20 TECH_CLASS _{CONSTRUCTION & CONSTRUCTION}	0.03	0.01	-0.04	-0.02	-0.09	-0.07	-0.09	-0.15*	-0.05	-0.03	
21 UNITED STATES	-0.01	-0.03	0.04	0.03	0.13*	0.00	-0.04	0.13*	-0.06	-0.10	-0.05
22 JAPAN	-0.05	-0.10	0.12*	-0.01	-0.02	0.05	-0.01	0.02	-0.06	-0.01	-0.04
23 ISRAEL	-0.03	-0.03	0.05	0.08	0.04	-0.03	0.03	0.03	-0.01	-0.03	-0.03
24 GERMANY	0.02	0.01	-0.02	0.05	-0.11	-0.04	0.03	-0.15*	0.05	0.23*	0.08
25 FRANCE	-0.04	0.02	0.01	0.05	-0.08	0.05	-0.02	-0.02	0.02	-0.01	0.00
26 UK & IRELAND	0.02	0.14*	-0.14*	-0.04	0.10	0.02	0.08	-0.02	-0.03	-0.05	-0.07
27 SWITZERLAND	0.07	-0.05	0.00	-0.07	0.07	-0.01	0.09	-0.07	-0.01	0.05	-0.04
28 SPAIN	0.00	0.03	-0.03	-0.01	-0.02	-0.04	-0.01	0.05	-0.02	-0.04	0.04
29 NETHERLANDS	0.00	-0.06	0.06	-0.01	-0.08	0.00	-0.10	0.10	0.01	-0.05	0.01
30 OTHER EUROPEAN COUNTRIES	0.05	0.05	-0.08	-0.06	-0.06	-0.02	-0.05	-0.03	0.12*	-0.03	0.11

Tab. 2: Continued

	21	22	23	24	25	26	27	28	29
22 JAPAN	-0.22*								
23 ISRAEL	-0.08	-0.07							
24 GERMANY	-0.24*	-0.21*	-0.08						
25 FRANCE	-0.13*	-0.12*	-0.04	-0.12*					
26 UK & IRELAND	-0.20*	-0.18*	-0.06	-0.19*	-0.10				
27 SWITZERLAND	-0.11	-0.10	-0.04	-0.10	-0.06	-0.09			
28 SPAIN	-0.09	-0.08	-0.03	-0.08	-0.05	-0.07	-0.04		
29 NETHERLANDS	-0.12*	-0.11	-0.04	-0.11*	-0.06	-0.10	-0.05	-0.04	
30 OTHER EUROPEAN COUNTRIES	-0.16*	-0.15*	-0.05	-0.15*	-0.09	-0.13*	-0.07	-0.06	-0.08

Notes: Number of observations = 523. * p<0.01

Tab. 3: Probability of external patenting: AMEs from logit regression

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
COINVENTORS _{FIRM}		0.520*** (0.043)	0.485*** (0.040)	0.521*** (0.042)	0.488*** (0.038)	0.619*** (0.041)
COINVENTORS _{FIRM} X CONDITIONAL REWARD			-0.261** (0.105)		-0.242** (0.108)	-0.262** (0.106)
CONDITIONAL REWARD			-0.078* (0.045)		-0.087* (0.046)	-0.042 (0.043)
COINVENTORS _{FIRM} X COLLABORATIONS _{FIRM}				-0.206** (0.082)	-0.235*** (0.078)	-0.318*** (0.093)
COLLABORATIONS _{FIRM}				0.115*** (0.042)	0.115*** (0.040)	0.146*** (0.047)
BACKWARD CITATIONS	0.046** (0.023)	0.013 (0.022)	0.016 (0.022)	0.012 (0.021)	0.015 (0.021)	0.014 (0.018)
NON-PATENT REFERENCES	-0.065*** (0.024)	-0.054** (0.022)	-0.058*** (0.022)	-0.049** (0.022)	-0.052** (0.021)	-0.022 (0.018)
CLAIMS	0.005 (0.033)	0.003 (0.031)	0.007 (0.030)	0.016 (0.031)	0.019 (0.031)	0.018 (0.028)
FORWARD CITATIONS	0.010 (0.009)	0.010 (0.012)	0.011 (0.010)	0.007 (0.011)	0.009 (0.009)	0.006 (0.007)
GOVERNMENT FUNDING	-0.200*** (0.043)	-0.114*** (0.038)	-0.112*** (0.037)	-0.115*** (0.038)	-0.114*** (0.037)	-0.107*** (0.036)
RESEARCHER	-0.015 (0.066)	0.018 (0.056)	0.019 (0.056)	0.022 (0.057)	0.019 (0.057)	-0.036 (0.054)
PROFESSOR	0.009 (0.078)	0.037 (0.063)	0.028 (0.063)	0.028 (0.063)	0.017 (0.063)	-0.011 (0.057)
RESEARCH EXPERIENCE	0.031 (0.035)	0.013 (0.029)	0.014 (0.029)	0.011 (0.030)	0.012 (0.029)	0.031 (0.029)
ORGANIZATIONAL QUALITY	0.001 (0.019)	-0.000 (0.016)	-0.002 (0.016)	-0.007 (0.016)	-0.008 (0.016)	0.004 (0.016)
TECH_CLASS _{ELECTRONIC ENGINEERING}	0.051 (0.061)	-0.019 (0.059)	-0.026 (0.060)	-0.030 (0.059)	-0.037 (0.060)	-0.027 (0.050)
TECH_CLASS _{INSTRUMENTS}	-0.070 (0.054)	0.004 (0.051)	0.005 (0.050)	0.002 (0.052)	0.003 (0.050)	-0.016 (0.050)
TECH_CLASS _{PROCESS ENGINEERING}	-0.121* (0.067)	-0.137** (0.057)	-0.135** (0.057)	-0.133** (0.056)	-0.130** (0.056)	-0.133*** (0.043)
TECH_CLASS _{MECHANICAL ENGINEERING}	0.185* (0.102)	0.207** (0.091)	0.209** (0.092)	0.202** (0.092)	0.205** (0.093)	0.254*** (0.093)
TECH_CLASS _{CONSUMPTION & CONSTRUCTION}	0.168 (0.145)	0.196 (0.140)	0.199 (0.142)	0.197 (0.130)	0.201 (0.132)	-0.050 (0.083)
JAPAN	0.529*** (0.068)	0.440*** (0.073)	0.420*** (0.073)	0.454*** (0.071)	0.433*** (0.070)	0.325*** (0.081)
ISRAEL	0.274** (0.108)	0.211* (0.117)	0.197* (0.112)	0.257** (0.119)	0.246** (0.112)	0.319*** (0.111)
GERMANY	0.357*** (0.073)	0.288*** (0.073)	0.262*** (0.071)	0.311*** (0.074)	0.284*** (0.071)	0.256*** (0.071)
FRANCE	0.347*** (0.087)	0.233*** (0.087)	0.208** (0.085)	0.260*** (0.086)	0.237*** (0.083)	0.175** (0.086)
UK & IRELAND	0.051 (0.061)	0.052 (0.060)	0.029 (0.057)	0.052 (0.060)	0.029 (0.056)	0.101* (0.056)
SWITZERLAND	0.345*** (0.098)	0.083 (0.074)	0.046 (0.070)	0.079 (0.070)	0.038 (0.062)	0.068 (0.056)
SPAIN	0.457*** (0.122)	0.358*** (0.119)	0.326*** (0.120)	0.368*** (0.123)	0.333*** (0.122)	0.331** (0.143)
NETHERLANDS	0.315*** (0.085)	0.244*** (0.070)	0.222*** (0.068)	0.240*** (0.069)	0.216*** (0.066)	0.149** (0.061)
OTHER EUROPEAN COUNTRIES	0.444*** (0.081)	0.343*** (0.080)	0.334*** (0.079)	0.313*** (0.080)	0.306*** (0.078)	0.263*** (0.082)
Observations	523	523	523	523	523	447

Notes: Standard errors reported in parenthesis.

Similarly, the AME for the interaction between COINVENTORS FIRM and COLLABORATIONS FIRM indicates that an ongoing research partnership mitigates the effect of academic engagement. In this case the probability of external patenting is 23.5 percentage points lower. In a nutshell, the results support the idea that the adoption of incentive schemes and the pursuit of research partnerships with business organizations are viable options that universities can leverage to reduce the risk of losing control of inventions they are entitled to own.

The econometric analysis also shows that both moderating variables directly affect the probability of outside patenting, but their estimated effects go in opposite directions. The AME associated with the variable CONDITIONAL REWARD is -0.087, but it is only marginally significant. This result is consistent with findings in previous research (Hayter & Feeney, 2017;

Thursby *et al.*, 2009). Moreover, the comparison with the effect of the interaction term emphasizes that outcome-based incentives play a primary role in curbing the propensity of individuals to behave opportunistically in specific situations.

On the contrary, the AME associated with the variable *COLLABORATIONS FIRM* is 0.115 and it is statistically significant at the 1% level. This piece of evidence is consistent with the theoretical predictions in Aghion and Tirole (1994). According to their model, the allocation of IP rights over inventions arising from joint-research projects depends on the comparison between the contribution of the intellectual capital of university scientists and the contribution of the physical capital provided by the firm to the overall value of the invention. The relative contribution of the parties reflects their ex-ante bargaining power which, in turn, is shaped by several contingencies that strengthen the negotiating position of the firm (e.g., the extent to which a research projects accrues to a technological trajectory over which the firm has built a large patent portfolio).

We do not observe a systematic relationship between traits of the invention background and the probability of external patenting. However, we underscore a negative and significant correlation between the variables *NON-PATENT REFERENCES* and the variable *GOVERNMENT FUNDING* and the dependent variable. The effect estimated for the first variable (-0.052) supports the idea that the higher the basicness of the invention, the lower the chances that it will be commercialized through external patenting. The AME computed for the second variable (-0.114) underlines that, on average, universities in our sample endorse legislations that require them to claim IP rights over the outcomes of publicly funded research.

Our analysis shows that institutional differences play an important role in the allocation of IP rights over university inventions. The estimated AMEs for the set of country dummies support the idea that universities in the United States are more actively involved in claiming ownership of university patents. In our model, the dummy variable for United States represents the reference category. Apart from two exceptions (i.e., UK & IRELAND and SWITZERLAND), university in all other countries are less likely to retain ownership of patents with respect to their counterparts in the United States. For instances, the probability that inventions developed by scientists affiliated with German universities undergo external patenting is 25.6 percentage points higher than the value observed for the reference group.

As a robustness check, we estimate the full model on a more restrictive version of the dependent variable which contrasts university-owned patents versus university patents assigned to firms (Model 6). The sign and statistical significance of the estimated effects for the main explanatory variables are unchanged. We notice two changes in the magnitude of the AMEs that are worth considering. First, the presence of corporate scientists in the inventor team (*COINVENTORS FIRM* = 1) has a stronger correlation (0.619) with the probability of external patenting than what observed in the larger sample. Second, the marginal effect ((-0.318)) of the interaction term, *COINVENTORS FIRM* x *COLLABORATIONS FIRM*, is larger than what estimated for the whole sample. This piece of evidence corroborates the idea that the formal involvement of the university with the private sector lessens the probability that academic scientists will commercialize inventions through the backdoor.

In another exercise, we assess if the effects of the two moderating factors vary across countries. In the countries under scrutiny in this study, the enactment of the institutional ownership for the assignment of university patents occurred in different years (Geuna and Rossi, 2011; Van Eecke *et al.*, 2008). Then, we might expect variations in scientists' behavior involved in academic engagement with respect to the provision of monetary incentives and the pursuit of research partnerships. Indeed, results shown in Table 4 lend some support to this conjecture.

The interaction term *COINVENTORS FIRM* X *CONDITIONAL REWARD* is statistically significant only for a subset of countries. The largest effects pertain to universities based in the United States (-0.461), Switzerland (-0.369), and UK & Ireland (-0.317). These countries were early adopters of the institutional ownership system. The estimated marginal effects for universities in France and the Netherlands are also positive, although only marginally significant at the 10% level. The AMEs related to the remaining countries are not statistically significant. In this group we find

universities in Germany and Japan, two contexts where institutional ownership was adopted only at the beginning of the millennium.

Tab. 4: Marginal effects of the interaction terms by employer country

	COINVENTORS _{FIRM} X CONDITIONAL REWARD	COINVENTORS _{FIRM} X COLLABORATIONS _{FIRM}
UNITED STATES	-0.461*** (0.124)	-0.255* (0.143)
JAPAN	-0.119 (0.089)	-0.355*** (0.084)
ISRAEL	-0.121 (0.106)	-0.356*** (0.082)
GERMANY	-0.157 (0.112)	-0.359*** (0.087)
FRANCE	-0.224* (0.130)	-0.338*** (0.103)
UK & IRELAND	-0.317** (0.141)	-0.300*** (0.107)
SWITZERLAND	-0.369** (0.148)	-0.281** (0.120)
SPAIN	-0.116 (0.109)	-0.353*** (0.087)
NETHERLANDS	-0.252* (0.131)	-0.326*** (0.103)
OTHER EUROPEAN COUNTRIES	-0.152 (0.105)	-0.359*** (0.087)
Observations	447	447

Notes: Standard errors reported in parenthesis.

The estimated effects of the interaction term COINVENTORS FIRM x COLLABORATIONS FIRM are significant in all countries and their magnitude is similar. The only departure from the general pattern concerns US universities for which the AME of the interaction term is smaller (-0.225) than the effects observed in other countries, and it is significant only at the 10% level.

5. Discussion of results and Conclusions

The assignment of IP rights over inventions arising from joint-research projects between universities and firms bears major implications for technology transfer (Eisenberg, 2003; Kenney and Patton, 2009). Beyond the arrangement of knowledge exchanges at the organizational level, university scientists often organize and manage the transfer of knowledge to firms on an individual and discretionary basis (Bodas Freitas *et al.*, 2013). Indeed, a non-trivial share of activities carried out through academic engagement is not reported to the university administration (Perkmann *et al.*, 2015). These considerations suggest that scientists' decision over invention disclosure and engagement in individual, direct research activity with other organizations is an important driver of patent ownership (Gianiodis *et al.*, 2016).

However, the empirical evidence concerning the relationship between university-industry collaborations and the ownership of university patents is scant. Extant studies do not distinguish between the various mechanisms through which university-industry knowledge flows occur (Hayter & Feeney, 2017) and rely on patent characteristics to draw indirect insights about the role of faculties in commercialization activities (Thursby *et al.*, 2009). This is unfortunate because having a large share of university patents assigned to other entities is a major concern for university managers as well as policy makers (Aldridge and Audretsch, 2010).

This paper addresses this gap in the literature on both the theoretical and the empirical ground. Our theoretical framework builds on the observation that the involvement of university scientists in commercialization activities implies a dual agency issue: they engage in research collaborations with firms, while holding their university role (Siegel and Wright, 2015). As for the faculty-firm

relationship, typically university scientists are not interested in exercising control over the exchanged resources (Ankrah and AL-Tabbaa, 2015), whereas firms have strong incentives to claim control over the inventions developed through academic engagement. As for the faculty-university relationship, the joint presence of asymmetric information and divergent goals may lead academic inventors to behave opportunistically and commercialize scientific discoveries through the backdoor. Furthermore, several contingencies (e.g., a TTO enjoying a bad reputation among faculty members) can exacerbate the agency problem. The results of the empirical analysis support this conjecture: we find a strong and significant effect of the variable gauging academic engagement on the probability of observing an outside assignment of the focal patent.

Moreover, we extend the literature on university-industry collaboration by examining the moderating effect of incentives to researchers and the formal involvement of the university organization in research collaboration. Our theoretical framework hypothesizes that monetary incentives and research partnerships are viable mechanisms that universities can leverage to moderate the effect of academic engagement on the external patenting of university inventions. The econometric analysis lends empirical support to our research hypotheses.

Besides the contribution to research, our findings on the effect stemming from the pursuit of research partnerships are relevant for university administrators and TTO managers for at least two reasons. First, TTO managers should be aware that the rising involvement of universities in research partnerships with firms yields a positive side effect - i.e., moderating the opportunistic behavior of faculties involved in joint research with firms. Second, by mitigating the opportunism of academic inventors, research partnerships complement the incentive mechanisms that university administrators deploy to align the goals of researchers with those of the organization. In line with previous studies, our analysis shows that external patenting is a relevant issue even in countries that have adopted the institutional ownership system, which highlights the limits of the IP ownership regime in affecting the behavior of academic inventors. Our findings also inform university administrators that university's technology transfer policies can overcome the limits of the IP ownership system at the country level by using a mix of instruments at the organizational level to moderate the opportunistic behavior of academic inventors.

The empirical analyses carried out in this paper has limitations. First, the cross-sectional nature of our data prevents us from interpreting the estimated associations as evidence of causal linkages. Although the explanatory variables are predetermined with respect to the moment in which we observe the allocation of IP rights, we can hardly consider them as exogenous factors. Unobserved heterogeneity cannot be ruled out as an explanation behind the estimated correlations; we tried our best to control for this situation by factoring into the model controls at the patent, individual, organizational, and institutional level.

Second, we use co-inventorship to measure academic engagement. While an indicator based on archival information can handle the standardization issue plaguing survey-based indicators, it tends to overlook interactions that are not captured by administrative records and are usually focused on specific types of activity (Perkmann *et al.*, 2021). We account for this shortcoming by simultaneously factoring into the regression model a variable gauging formal collaborations at the organizational level.

Finally, the efficiency of TTO offices in monitoring and supporting the researchers' inventive activities is probably a crucially important factor in preventing outside patent assignment. Unfortunately, our data do not account for the 'quality' of the TTO offices. Future research should explore how this dimension mitigate the effect of academic engagement on outside patent assignment.

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The role of university linkages in the performance of Innovation Ecosystems' actors: the case of Italy

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Abstract

Framing of the research. *In the last 15 years the EU has set the development of innovation ecosystems as a pillar for its development plans. Nevertheless, some countries have still not improved their innovation performance over time, as in the case of Italy.*

Purpose of the paper. *The study analyzes this issue by exploring the relational dynamics of the Italian innovation ecosystem and whether the link of a new innovative firm with a university enhances its performance.*

Methodology. *We use panel data methodology to compare the performance in terms of sales growth of 244 Italian university spin-offs (USO) and 1487 Italian innovative start-ups (IIS) from 2014 to 2016.*

Results. *Our results show that university spin-offs perform worse than Italian innovative start-ups on average. However, this is not evident when USOs are also innovative start-ups. Therefore, the relationship with a parent university seems not yet to act as an enabling factor for innovative firms in Italy.*

Research limitations. *The sampling criteria reduced our sample size by more than 50%. Also, our study is a quantitative one, and it lacks many qualitative insights that could enrich our analysis. Finally, since the study is carried out in Italy, this may hinder easy generalizability in other contexts.*

Managerial implications. *The study provides interesting insights for policymakers and start-up and university administrators with data on the effectiveness of the linkages between universities and innovative firms.*

Originality of the paper. *Previous literature both focused on the creation and performance of spin-off firms and the comparison between different types of spin-off firms. Nevertheless, today the comparison between IISs and USOs in Italy remains unexplored, as does the comparison between these two types of firms and USOs that are classified as IISs.*

Keywords: *innovation ecosystem; university spin-off; innovative startup; ecosystem dynamics; panel data.*

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1. Introduction

Over the past twenty years, a new systemic and territorial view of innovation development processes has aroused growing interest among scholars and policymakers worldwide. New strands of literature regarding innovation (Adner, 2006; Carayannis and Campbell, 2009; Gomes *et al.*, 2018; Oh *et al.*, 2016) and entrepreneurial ecosystems (Acs *et al.*, 2017; Spigel, 2017; Stam, 2015) have tried to better explain the mechanisms of value creation and value capture that should foster the development of innovation and high growth entrepreneurship at the regional and national level.

Parallel to those advancements, the European Union (EU) has set the development of innovation ecosystems as a pillar of the past (2014-2020) and the present (2021-2027) programming periods. Institutes such as the European Innovation Council and the European Institute of Innovation and Technology have been engaged to work in synergy with innovative actions across different funding programmes to empower the European innovation ecosystem. Some countries, however, did not improve their innovation performance over time, compared to other member states, and among those the case of Italy is particularly significant. Despite being one of the major economies in the EU, it is still a moderate innovator (Hollanders *et al.*, 2012; 2014; 2016; 2019; Hollanders and Es-Sadki, 2017).

Italy lags in terms of public and private expenditure on R&D, the number of companies collaborating with other public and private partners, the number of new doctorate students, and the rate of private co-financing for public research activities (Hollanders *et al.*, 2020). Moreover, the small size of the venture capital market, the improper use of structural funds for research and innovation activities, and bureaucratic procedures in the entrepreneurial field contribute to hampering the Italian innovation capacity (European Commission - JRC, 2017).

In order to deal with these issues, the innovation ecosystem construct emerges as a suitable framework to give relevance to the role of regional actors in this regard, and to understand how the relationships among ecosystem actors may affect the overall performance (Granstrand and Holgersson, 2020; Gomes *et al.*, 2018; Brown and Mason, 2017; Autio and Thomas, 2014; Carayannis and Campbell, 2009; Granstrand and Holgersson, 2020; Adner, 2006). The success of innovation ecosystems, indeed, is based on the quality of their actors, activities, artifacts, and the interdependent relations between them. Thus, developing an ecosystem initially requires to understand whether and how the interactions between these attributes lead to creating value (Gomes *et al.*, 2018), enabling innovation and technological development (Jackson, 2012), and promoting an innovative culture (Carayannis and Campbell, 2009).

In Europe, universities play a central role in innovation ecosystems. Reichert (2019) sees them as “orchestrators” of local innovation networks, as they improve the quality of human capital, produce impactful research, and establish collaboration networks with other players. Beyond that, universities are being engaged to create their own spin-off firms, which yield both economic (Meoli *et al.*, 2013; Rasmussen *et al.*, 2006; Walter *et al.*, 2006) and societal benefits (Fini *et al.*, 2018; Fontes, 2005). However, the existing literature is not homogeneous in evaluating the performance of university spin-offs (USO). Different studies associate these companies with higher survival rates (Francois and Belarouci, 2021; Zhang, 2009; Toole and Czarnitzki, 2007; Rothaermel and Thursby, 2005), higher sales growth (Yagüe-Perales and March-Chordà, 2012; Lowe and Ziedonis, 2006), and higher employment growth rates (Francois and Belarouci, 2021; Czarnitzki *et al.*, 2014). Yet, other studies show that USOs have lower growth rates (Wennberg *et al.*, 2011; Ensley and Hmieleski, 2005) and lower profitability (Salvador, 2011; Bonardo *et al.*, 2010, 2011) in comparison with corporate spin-offs.

In Italy, a vital role in innovation ecosystems is played by innovative start-ups, which have been the subjects of policy interventions thought to create a more dynamic business environment (i.e., Law 221/2012, Decree 147/2013, Startup Act). Innovation-driven companies, indeed, positively impact economic growth, job creation (Bormans *et al.*, 2019; Humala, 2015; Colombo and Delmastro 2002), innovation processes, and cooperation among ecosystem actors (Mustar *et al.*, 2008; Rocha *et al.*, 2019; Spender *et al.*, 2017; Witte *et al.*, 2018). In addition, they contribute to

spreading a culture of innovation and entrepreneurship and capturing value in ecosystems (Hoffecker, 2019). If they have the necessary characteristics¹, USOs can be classified as innovative start-ups, too, thus representing a hybrid form between these two types of companies.

Although previous literature reports insights on the creation (Bigliardi *et al.*, 2013; Fini *et al.*, 2017; Lockett *et al.*, 2005; Mathisen and Rasmussen, 2019; Meoli and Vismara, 2016; Pirnay *et al.*, 2003) and the performance of different types of spin-off firms (Calvo *et al.*, 2013; Rodríguez-Gulías *et al.*, 2018; Salvador, 2011; Wennberg *et al.*, 2011), the comparison between Italian innovative start-ups (as defined by the Law 221/2012) and Italian university spin-offs remains unexplored, as does the comparison between these two types of firms and their hybrid form (i.e. USOs that are also innovative start-ups).

To address this literature gap and give a clearer and better view of the phenomenon, our study intends to explore the dynamics of the Italian innovation ecosystem by comparing the performance in terms of sales growth of the Italian university spin-offs and the Italian innovative start-ups (IIS).

In this context, we formulate the following research questions:

R1) *In Italy, how do university spin-off firms (USO) perform compared to innovative start-ups (IIS)?*

R2) *In Italy, how do USOs classified as IISs perform, compared to innovative start-ups or USOs alone?*

In both of our research questions, what interests us is whether the link of a new innovative entrepreneurial initiative with the university improves the firm's performance, compared to a firm that has no or little connection with the university. In particular, we seek to understand if this implication applies to the innovative start-up segment, which is a novelty element of the Italian innovation ecosystem. We rely on a unique panel dataset comprising of 149 Italian USOs, 1392 IISs and 95 USOs that are also IISs, all born between 2014 and 2016. This dataset allows us to use panel data methodology, which produces more robust findings regarding the differences in performance in terms of sales growth between these three types of firms.

By analyzing the financial performance of those actors and controlling for the effect that financial, industry- and time-related, and regional variables have on them, our results show that USOs perform worse than IISs on average. At the same time, this is not evident when a firm is both a USO and an IIS. In this perspective, therefore, the relationship with a parent university seems not to be yet an enabling factor for early-stage innovative firms in Italy. Both the access to technological resources not yet available on the market (Bierly *et al.*, 2009) and the support that the university offers to spin-offs² - given their importance in achieving a university's third mission and as a tool for creating value (Pitsakis *et al.*, 2015) - are not enough for early-stage USOs to have competitive advantage over non-academic early-stage innovative companies. This circumstance supports the assumption that USOs tend to be extended scientific laboratories, which are not yet acquiring the necessary business perspective to operate successfully in a market (Bolzani *et al.*, 2020).

From a country-specific point of view, our study provides insights into the performance of USOs and IISs in Italy and the effectiveness of the interactions in its innovation ecosystem. First, it offers scholars a starting point for exploring the relationships between actors in innovation ecosystems in Italy. Second, it provides interesting insights for start-up and university administrators, with data on the effectiveness of "parenting" in the case of the relationship between universities and IISs. These findings may be helpful to lead strategic and financial decisions related to the involvement of universities in entrepreneurial activities and regional innovation ecosystems. Finally, it provides

¹ See paragraph 2.3.

² This support includes the free assistance that universities offer to USOs regarding the use of tangible resources (e.g., (physical spaces, laboratory amenities) and intangible resources (e.g., brand).

policymakers with a key to understanding the investments needed to improve and stimulate the development of innovation ecosystems in Italy.

The remainder of the paper is organized as follows. Section 2 reviews the extant literature and outlines the research questions. Section 3 introduces the data and the chosen variables and presents the econometric model used to deepen the research questions. Finally, section 4 provides the outcomes of the empirical analyses, while Section 5 concludes and provides recommendations for practitioners and further research.

2. Literature background

2.1 *The Innovation ecosystem phenomenon*

Due to the rise of the knowledge economy and the growing importance of the regional approach to economic development, a new strand of literature regarding the eco-systemic view of entrepreneurship and innovation has emerged during the last two decades, attracting scholars and policymakers³. In particular, academics attempted to define innovation ecosystems (i.e., Granstrand and Holgersson, 2020; Autio and Thomas, 2014; Jackson, 2011; Carayannis and Campbell, 2009; Adner, 2006), often producing contrasting conceptualizations. Oh *et al.* (2016) tried to make clarity by conducting a critical review of the ‘innovation ecosystem’ idea and comparing it to the more traditional notion of ‘innovation system,’ recalling the need to bring rigorous meaning and operationalization to the concept. Gomes *et al.* (2018) added value to the discussion by conducting a systematic literature review, selecting the divergent theories, proposing a new conceptual framework, and distinguishing the innovation ecosystem construct from similar theories. Moreover, both Scaringella and Radziwon (2017), Thomas and Autio (2019), and Granstrand and Holgersson (2020) sought to offer greater conceptual rigor and new notions of innovation ecosystems. Despite these attempts, we are still far from obtaining a commonly shared version of the concept. Nevertheless, these multiple definitions describe innovation ecosystems from different points of view and may help us identify a set of common features.

First, as Jackson (2011) suggests, an innovation ecosystem’s final goal is to enable technology development and innovation. Moreover, while Adner (2006) states that business ecosystems are innovation ecosystems, Gomes *et al.* (2018) emphasize the difference between the two, indicating that while the former focus on capturing value, the last ones are committed to creating value. These observations help us define the first two features of innovation ecosystems - value creation and innovation and technology development.

In addition, for Adner (2006), innovation ecosystems should have an iterative innovation strategy. Indeed, many interconnected actors face different types of risks (i.e., interdependence, initiative, and integration risks)⁴ and their actions depend on the gravity of internal challenges. This view highlights the need for a strategy, and the possibility of facing hurdles and challenges while developing and fostering innovation ecosystems.

Finally, two definitions help us identify four more features of innovation ecosystems: evolutionary character, co-existence of multiple actors, artifacts and activities, interdependence, and value co-creation. Carayannis and Campbell (2009) define the innovation ecosystem as a hub where “[...] people, culture and technology meet and interact to catalyze creativity, trigger invention and accelerate innovation across scientific and technological disciplines, public and private sectors (government, university, industry and non-governmental knowledge production, utilization and renewal entities) and in a top-down, policy-driven as well as bottom-up, entrepreneurship-

³ Globally, governments have been including the innovation ecosystem construct in their innovation strategies. Examples can be found in the innovation policies in the U.S.A. (Wessner, 2005), or in the regional innovation strategies for smart specialization (RIS3) and the Horizon Europe’s pillar on innovation ecosystems in the E.U.

⁴ For a better understanding of such challenges, see (Moore, 1993), who deepens the cooperative and competitive challenges that each ecosystem face during each phase of the lifecycle.

empowered fashion.” On the other side, Granstrand and Holgersson (2020) define an innovation ecosystem as “[...] the evolving set of actors, activities, and artifacts, and the institutions and relations, including complementary and substitute relations, that are important for the innovative performance of an actor or a population of actors [...]”.

An innovation ecosystem, thus, can be defined as an evolving set of actors, activities, and artifacts that strategically create interdependent relations between them to create and co-create value, enable the development of technology and innovation, and promote the innovative performance of its actors.

Especially, when it comes to the actors that characterize an innovation ecosystem, the literature provides more than one definition, although the Quadruple Helix approach (Carayannis and Campbell, 2009) offers an appropriate framework. Based on Etzkowitz and Leydesdorff's (2000) work and with the addition of a new helix, it identifies four types of actors: academia/universities, industry, state/government, and media-based and culture-based public. In addition, Carayannis and Campbell (2009) stress the idea that an ‘innovation culture’ is vital for developing an innovation ecosystem. In confirmation of this, Jackson (2011) highlights different types of actors responsible for the formation of innovative entities too. The study refers to universities, engineering colleges, business schools, university-industry research institutes, venture capitalists, policymakers, and funding agencies. Similarly, Malerba and McKelvey (2020) consider universities, research organizations, users, suppliers, governments, and institutions (formal and informal) as responsible actors for improving innovation, profitability, firm growth, and so forth in a region.

Considering that these two most recent definitions are in line with the Quadruple Helix framework, then, for this paper we adopt the latter classification, and we consider their role as explained by Malerba and McKelvey (2020).

More precisely, since we are interested in firm growth and the value creation process in Italy, among the various actors we focus on universities, which play a central role in European innovation ecosystems (Reichert, 2019). In fact, on the one hand, universities are crucial for talent development. They produce knowledge, skills, and abilities for competitiveness (Goldstein and Drucker, 2006), attract and raise human capital (Huffman and Quigley, 2002), contribute to territory level education (Heinonen and Hytti, 2010), and educate students in diverse roles in future academic, professional, and leadership careers (Reichert, 2019). On the other hand, they contribute to innovation and technology development by producing and commercializing impactful research outputs (Rothaermel *et al.*, 2007; Rogers *et al.*, 2001), and creating advancements in new knowledge and technologies (Malerba and McKelvey, 2020). They also act as orchestrators of innovation ecosystems by developing their network with other ecosystem actors (Reichert, 2019; Heinonen & Hytti, 2010) with the aim of knowledge and value co-creation.

For the same reasons, we are interested in university spin-offs and innovative start-ups, as they are considered fundamental actors of innovation ecosystems, especially in Italy. Therefore, we discuss about them in the following paragraphs.

2.2 *The university spin-offs (USOs) phenomenon*

University spin-off firms are among the five university technology transfer mechanisms with the highest commercialization value (Rogers *et al.*, 2001) and they are created to commercialize research results (Pattnaik and Pandey, 2016; Rasmussen *et al.*, 2014; Swamidass, 2013; Van Burg *et al.*, 2008; Rasmussen, 2008). Despite being an old phenomenon, they have gained much attention over the last couple of decades (Etzkowitz, 2002).

Accordingly, various policies have tried to encourage and create a favorable environment for the involvement of universities in the commercialization of research outputs (Bolzani *et al.*, 2014; Grimaldi *et al.*, 2011; Rappert *et al.*, 1999). In response to this, and following their third mission, universities have been playing a pivotal role in transferring technology and research outputs to the industry, thus increasing their commitments to converting scientific discoveries into commercial opportunities through the creation of spin-off firms (Geoghegan *et al.*, 2015; Del Giudice *et al.*,

2013; Philpott *et al.*, 2011; Rothaermel *et al.*, 2007; O'Shea *et al.*, 2005; Mowery and Sampat, 2005; Etzkowitz and Leydesdorff, 2000). Moreover, the USO creation process has increased the linkages between academia and industry, representing a way to set up potentially high-growth firms with a relevant innovative and economic influence at regional and national levels (Vincett, 2010; Lawton Smith and Ho, 2006).

For the same reasons, the establishment of university spin-offs has become a consolidated phenomenon in Italy. This process started during the 1970s when university spin-offs resulted from pioneer initiatives of individual researchers with no or rare involvement from their universities (Balderi *et al.*, 2011; Bolzani *et al.*, 2014). Over the years, the phenomenon gained relevance through stages that led to acceptance, enthusiasm, development, and differentiation of such initiatives in all Italian universities. Above all, this has been possible thanks to some enabling policies (such as the Law 297/1999 and the Ministerial Decree 593/2000) that provided the regulatory framework for USOs aiming to commercialize the research results and gave discretion to the universities to control and regulate the policies regarding the employment status of academic entrepreneurs, intellectual property rights, and conflict of interest issues (Salvador, 2009).

Therefore, considering their connection with the university and the commercial world, and their propensity to value creation and value capture, USOs emerge as critical actors in innovation ecosystems, and as points of connection between entrepreneurial and innovation ecosystems. Indeed, these firms contribute to technology transfer (Bigliardi *et al.*, 2013), and catalyse the creation and development of impactful technologies, which can then be transferred to more recognized companies and produce economic benefits (Kane, 2012). USOs like Genentech (Mathisen and Rasmussen, 2019) not only contribute to economic development by creating employment opportunities and tax revenues, but also affect the dissemination of new technology indirectly, thereby increasing the absorptive ability of a region (Criaco *et al.*, 2014; Clausen and Rasmussen, 2013; Vincett, 2010; Hindle and Yencken, 2004; McQueen and Wallmark, 1982). Finally, USOs are also relevant from a social perspective, as they commercialize the research findings that may have remained unknown otherwise (Fini *et al.*, 2018; Fontes, 2005), thus contributing to the diffusion of research outputs.

2.3 *The Innovative start-up phenomenon*

Parallel to USOs, innovative start-ups are also recognized as important actors of innovation ecosystems, as contributors to economic growth, job creation (i.e., Colombo and Delmastro 2002; Humala, 2015; European Commission, 2019), innovation processes, and cooperation among ecosystem actors (Mustar *et al.*, 2008; Spender *et al.*, 2017; Witte *et al.*, 2018; Rocha *et al.*, 2019).

These can be described as new firms designed to find a repeatable, scalable, and profitable business model for a new product or service (Blank & Dorf, 2012), and they belong both to the innovation and entrepreneurial worlds, thus representing the perfect points of connection between entrepreneurial and innovation ecosystems, as in the case of USOs. Their social and economic impact, indeed, is relevant for multiple reasons.

First of all, innovative start-ups have a high potential to foster competition in a defined territory or market segment (Colombelli *et al.*, 2016), thus creating a solid link between entrepreneurship and economic growth (Wennekers & Thurik, 1999; Fritsch, 2011). Moreover, they are characterized by high levels of human capital, R&D activities and investments, and collaboration and alliances with other ecosystem actors (Audretsch *et al.*, 2020). That is also why innovative startups are strongly associated with firm growth, job creation, and other positive economic and societal impacts at the regional level. Also, despite being affected by the weaknesses typical of new and small firms, their innovativeness positively impacts their propensity for growth (Ali and Shah, 2015; Colombelli *et al.*, 2016; Fiorentino *et al.*, 2021), innovation and technology development, especially in the early stages of their lifecycle (Fritsch, 2011).

Due to these characteristics, policymakers have been supporting the creation of innovative firms through various policies and programs (Audretsch *et al.*, 2020), with the final goal of facilitating

innovation, boosting economic growth and employment opportunities at the regional and national level.

In Italy, too, the attention to science-based and technology-based entrepreneurship has increasingly played a significant role among policymakers (Bolzani *et al.*, 2014). In particular, since 2012, Italy has encouraged policies to support innovative start-ups, beginning with Law 221/2012. For the first time in the Italian regulatory body, this law defines innovative start-ups (IISs) as new or recently constituted limited companies located in Italy (or other European Union countries, but with a branch in Italy), whose objective is the production, development, and commercialization of innovative goods and services of high technological value (Scattoni *et al.*, 2019; Del Bosco *et al.*, 2021). Firms with one of these three characteristics fall in the category of innovative start-ups: a) R&D expenditures higher than 15% of the highest amount between the cost and the total production value; b) one-third of the workforce with a Ph.D. or Ph.D. student, or two-thirds of the workforce with tertiary education; c) ownership or licensing of a patent (Matricano, 2020).

Additionally, Law 221/2012 entitles these start-ups to a series of benefits, such as tax credits, flexible labor arrangements, and easier access to financial resources. As public and private money is progressively going to be invested in retaining the initiatives of the Italian government regarding the creation and regulation of start-ups (Bolzani *et al.*, 2014), policymakers need to understand how the process of commercialization of public research operates and to assess its impact.

3. Data and Methodology

This paper aims to contribute to the body of knowledge on the comparison of USOs and Innovative Start-ups in the Italian context and advance the knowledge on how to improve Italy's overall innovation performance and innovation ecosystems by focusing on USOs and IISs, which are among the most relevant actors in this regard.

We access two different databases to retrieve the desired data, and we integrate them with financial data from the Aida-BvD database and with secondary data coming from EU reports, the "Ministero dell'Istruzione, dell'Università e della Ricerca", and the websites of the Italian "Registro Imprese" and "Italian Contamination Lab Network."

The first database, provided by Netval, contains data on 1949 Italian USOs, including, among others: the name of the company, the date of foundation, the ATECO code (the Italian classification of economic activities), parent university, location, VAT number. In the database there are some missing data, mainly concerning not particularly sensitive information. However, most of the missing data regarding the ATECO codes and VAT numbers have been integrated thanks to a secondary data search. The second database, provided by the Italian Registro Imprese⁵, consists of data (e.g., name of the company, date of foundation, Ateco code, location, legal requirements) regarding 11.620 Italian innovative start-ups (as defined by the DL 18 ottobre 2012, n. 179, and enlisted in a special section of the Registro Imprese) from the year 2013 to 2020. In this database, the only missing data concern the website of some companies.

3.1 Exclusion criteria

Starting from this, after integrating the main databases with data retrieved from the sources mentioned above, we apply some exclusion criteria and draw three different samples. First, we select firms founded between 2014 and 2016 with at least the first three years of financial data per each and for which the VAT number was available. We adopt these criteria both because IISs were defined by law in Italy only in 2012 and also because we want to compare firms at the same stage of the company lifecycle - so we cannot include companies founded in 2013 and 2017 due to lack of enough data for comparison. Due to this, many companies are excluded because of missing data.

⁵ Data has been retrieved from www.startup.registroimprese.it

We also exclude cooperatives, consortia, social or agricultural companies, and companies that are (or were) experiencing bankruptcy (i.e., “in liquidazione” or “in scioglimento”). As a result, we extract a first sample comprising 244 USOs and a second sample containing 1.487 IISs. The third sample, instead, is the result of a cross-search in the two “clean” datasets, which provides a sample of 95 IISs that are also USOs. We integrate this data with an average Regional Innovation Score⁶ for the years 2012-2019, retrieved from EU reports (Hollanders *et al.*, 2012; 2014; 2016; 2019; Hollanders and Es-Sadki, 2017), in order to have information regarding the innovation level of every region of Italy, and with financial data retrieved from the Aida-BvD platform.

3.2 Dependent variable

We select firm growth as our primary dependent variable to analyze the different performance between USOs and IISs in Italy in their first years. In fact, although innovation ecosystems’ main goal is to enable innovation and technology development in a defined area, they also enhance innovative firms’ growth potential (Feng *et al.*, 2021), and this is a reason why growth is a good performance indicator in the context of this study. Also, the potential for growth in a firm is strictly connected to its age (Zhou and de Wit, 2009), and that is why firm growth is an appropriate performance indicator, as we only consider the first three years (due to dataset limitations).

Among the measures of firm growth, the growth of sales and employees seem to be the most widely used (Wiklund *et al.*, 2009). Following Wennberg *et al.* (2011) and Rodríguez-Gulías *et al.* (2018), our choice falls on sales growth and we measure firm growth as the natural logarithm of the difference in the sales of the firm between year t and year $t-1$.

3.3 Independent Variables

We also consider different independent variables. First, we consider a dummy variable that tells us if a company is a start-up, a university spin-off firm, or both. Then, following Garnsey *et al.* (2006), Rauch *et al.* (2005) and Shalit and Sankar (1977), we use variables related to firm-specific dimensions in terms of inputs and value of the firms, such as the number of employees, the tangible and the intangible assets, and the shareholders’ equity (i.e., respectively, `log_employees`, `log_tot_tan_assets`, `log_tot_int_assets`, and `log_shar_equity`).

Second, following multiple studies that underline the importance of the external environment on firm growth (i.e., Díaz-Santamaría and Bulchand-Gidumal, 2021; Zhou and de Wit, 2009; Coad and Rao, 2008; Gibcus *et al.*, 2007), we use the “OECD Taxonomy of economic activities based on R&D Intensity” (Galindo-Rueda & Verger, 2016) and variables related to the regional environment, and in particular those connected to universities and innovative startups. Following Varum *et al.* (2020), Tripathi and Oivo (2020), Reichert (2019), and Fini *et al.* (2017), we consider the number of universities, the number students of a given university, the number of contamination labs and the number of incubators/accelerators in a region (i.e. respectively `log_uni_nuts`, `log_stud_nuts`, `log_clab_nuts`, and `log_inc_nuts`).

3.4 Control Variables

Finally, we control for variables connected to the industry (i.e., the type of sector based on the Italian ATECO classification), the regional innovation ecosystem (i.e., geographical location and Regional Innovation Score), and the eventual macroeconomic shocks (i.e., year).

For what is about the control on geographical location, however, considering that we had to reduce the initial sample by more than 50%, we found it suitable to carry out the analysis based on the

⁶ The Regional Innovation Score (Hollanders *et al.*, 2012; 2014; 2016; 2019; Hollanders and Es-Sadki, 2017) is itself a compound index of different variables that measure the innovativeness of a defined region, and contains indicators related to human resources, research systems, finance and support, as well as firm investments, linkages and entrepreneurship, intellectual assets, innovators in a region, and the economic effects at the regional level.

NUTS1 territorial classification⁷, which helps us in keeping the number of companies high enough for a proper analysis. For the same reason, the variables related to the Regional Innovation Index, the number of Incubators, Universities, Contamination Labs⁸ (Secundo *et al.*, 2020), and Students are respectively the average and the total (per year) of each variable in the respective NUTS1 region.

3.5 Empirical methodology

The empirical approach relies on a panel data estimation of the earlier mentioned sample data. We had to exclude using a fixed-effects model because of collinearity issues, so we carried out a random-effects GLS regression.

In particular, our panel data structure allows us to control for time-invariant and unobserved factors specific to each firm. The estimated model is saturated by time and industry-specific effects or by a vector of industry-year effects. Then, we estimate a baseline, unbalanced panel model, including only financial indicators as predictors, along with industry, time, and region information as controls:

$$\Delta GROWTH_{i,t} = \alpha + \sum_{j=1}^k \delta_j X_{i,t} + \varphi_{i,k} + \gamma D_{industry} + \delta D_{year_t} + \mu D_{region} + FIRM + \varepsilon_{i,n,t}$$

where X(i,t) is the vector of variables representing firm-specific characteristics for firm i, operating in year t; D_industry are industry dummies to control for industry-specific effects; D_year t are yearly time dummies to control for time-specific effects; D_region are regional dummies to control for ecosystem-specific effects, and ε(i,t) is the error term for firm i in year t; FIRM is a dummy variable to control if a company is a USO, an IIS or a USO born as an IIS. With this model in mind, we carry out a regression analysis on companies established between 2014 and 2016 in the first three years of their lifecycle.

Tab. 1: Type of variables, description, name, and sources

Type of Variables	Description	Variable name	Sources
<i>Dependent</i>			
Financial	Growth in Sales	growth	Wennberg <i>et al.</i> , 2011 Rodríguez-Gulías <i>et al.</i> , 2018
<i>Independent</i>			
Type	Type of company: USO, Startup, USO & Startup	firm	-
Financial	Tangible Assets	log_tan_assets	Garnsey <i>et al.</i> , 2006
	Intangible Assets	log_tot_int_assets	Garnsey <i>et al.</i> , 2006
	Number of Employees	log_employees	Garnsey <i>et al.</i> , 2006 Rauch <i>et al.</i> , 2005
	Shareholders' Equity	log_shar_equity	Shalit and Sankar, 1977
Industry	R&D Intensity in the sector (and sector classification based on this)	rdint	Díaz-Santamaría and Bulchand-Gidumal, 2021 Zhou and de Wit, 2009 Coad and Rao, 2008 Gibcus <i>et al.</i> , 2007
Regional	N° of universities in the region	log_uni_nuts	Varum <i>et al.</i> , 2020
	N° of university students in the region	log_stud_nuts	Reichert, 2019
	Regional innovation score	log_ris	Hollanders <i>et al.</i> , 2012-2016 Hollanders and Es-Sadki, 2017
	Number of Contamination Labs	log_clab_nuts	Reichert, 2019
	Number of incubators/accelerators	log_inc_nuts	Tripathi and Oivo, 2020

Source: our elaboration

⁷ NUTS stands for “Nomenclature of Territorial Units for Statistics” and is a geographical classification that divides the EU territory. The NUTS1 include major socio-economic regions.

<https://ec.europa.eu/eurostat/web/nuts/background>

⁸ Contamination Labs are “[...] promising Entrepreneurship Education Centres which create programmes to develop an entrepreneurial mindset in students with different educational backgrounds and levels.” (Secundo *et al.*, 2020, p. 1)

4. Results

As previously described, this study seeks to understand how the performance of USOs and IISs differ, why this happens, and whether the parenting relationship with a university increases the growth rates of an innovative firm or not.

For both the research questions we use the same model explained in section 3. We use sales growth as the dependent variable, and we compute it as the natural logarithm of the difference in the sales of the firm between year t and year $t-1$. Instead, the independent variables and the controls are related to time-specific, firm-specific, industry-specific, and ecosystem-specific indicators. Besides the year, the R&D Intensity score (*rdint*), and the ATECO code (*ateco*), all of them are computed as their natural logarithm. Finally, we adjust the standard error for the five clusters encountered in the variable NUTS1, which contains the different macro-regions of Italy (Centro, Isole, Nord-est, Nord-ovest, Sud). Thus, we first compare the growth performance of IISs and USOs, and then we compare the performance of both of them with that of USOs that are also IISs.

As reported in Table 2, when we compare IISs to USOs, the performance in terms of sales growth is effectively explained by the variable *FIRM* of our regression equation. In particular, IISs in Italy clearly perform better than USOs. However, the difference in growth rates does not seem to be well-explained by the other variables, which do not show significant results. The only variable which is explanatory in this regard is the value of the total intangible assets. When it comes to comparing USOs and IISs with USOs that are also IISs, instead, the results are not as promising. As shown in Table 3 the variable *FIRM* does not explain the possible differences in the sales growth rate between USOs/IISs and USOs that are IISs.

These results, both in the first and the second analysis, may depend on several causes. In the first case, if we think about the role that the type of firm and the relationship with academia may have on a firm's growth, it seems that the "parenting" relation of academia with USOs does not lead to better performance, compared to other innovative firms, such as IISs. Therefore, although the greater propensity to R&D activities (especially due to the composition of the workforce - Ranga and Etzkowitz, 2013) and the access to research not yet available on the market should lead to higher growth rates, here we confirm what Leyden and Link (2013) stated, namely that the predisposition for innovativeness and the relations with academia do not lead directly to higher economic performance. While innovative companies perform better than other non-innovative peers (Fiorentino *et al.*, 2021), precisely, in their early stages they face many challenges connected to their newness and smallness (Audretsch *et al.*, 2020). Thus, R&D capabilities alone cannot lead to higher performances if not supported by the founding team's entrepreneurial, strategic, and commercial skills, new business development methodologies, a favorable environment, and a robust network of partners (Díaz-Santamaría and Bulchand-Gidumal, 2021; Iazzolino *et al.*, 2019).

Considering our second research question, instead, the results shown in Table 3 lead to different conclusions. First, both in the confrontation with IISs and USOs, the type of firm does not explain alone the differences in growth between them and USOs that are also IISs. This outcome can be explained by the circumstance that having the characteristics of an "innovative start-up" does not automatically boost a firm's performance. Indeed, although policy interventions thought to foster the development of innovative ventures in Italy offered a tool to recognize innovative start-up companies, those characteristics do not define a priori the potential for growth of a single firm, which instead depends on other critical factors, both internal and external.

Tab. 2: Results of a random-effects GLS regression that compares innovative start-up companies to university spin-off firms, all born between 2014 and 2016, with data from year 1 to year 3 of their business life cycle.

growth		Coefficient	P>z
firm	<i>Startup</i>	24.75635	0.000
year	2016	2.010249	0.898
	2017	-31.56854	0.309
	2018	-39.28827	0.227
rdint	<i>Low R&D</i>	2.230406	0.795
	<i>Medium R&D</i>	1.767358	0.843
	<i>Medium-High R&D</i>	6.510788	0.382
	<i>Medium-Low R&D</i>	-3.3470887	0.926
ateco		-.0238594	0.720
log_shar_equity		-1.040812	0.693
log_tot_tan_assets		-1.382591	0.211
log_tot_int_assets		2.5086	0.045
log_employees		-2.679912	0.334
log_ris		12.64022	0.413
log_clab_nuts		2.452275	0.905
log_inc_nuts		3.369878	0.877
log_stud_nuts		-1.956994	0.959
log_uni_nuts		-4.741227	0.853
_cons		-21.51	0.943
sigma_u		0	
sigma_e		128.21245	
rho		0	

Source: our elaboration

Following this, we look at the impact of the regional innovation ecosystem on an early-stage innovative firm's performance. In both the comparison between USOs and IISs, and that between IISs and USOs that are also IISs, the results show that the Regional Innovation Score, of contamination labs, universities, students, and incubators do not explain alone the differences in growth between the selected firms. This changes when we compare USOs to USOs that are also IISs. In that case, the growth rate is positively associated with the presence of incubators and the Regional Innovation Score, while it is negatively associated with the number of students and universities in a NUTS1 region. This result can offer a dual interpretation. On the one side, in Italy, innovative startups are less affected by a region's innovation level, and by the number of students, universities, contamination labs, and incubators, both because they might be less connected to the regional innovation ecosystem, and because they might be more autonomous on their early life. Indeed, an ecosystem's success in fostering firms' growth relies especially in the quality of the connections between its actors, actions and artifacts. Then, the simple presence of supportive infrastructures, high-skilled human capital, and academia is not able alone to influence the economic performances of all new innovative ventures.

Tab. 3: Results of a random effects GLS regression, that compares innovative start-ups and university spin-offs to university spin-offs that are also innovative start-ups, all born between 2014 and 2016, with data from year 1 to year 3 of their business life cycle

		IISs		USOs	
growth		Coefficient	P>z	Coefficient	P>z
firm	<i>Us&Startup</i>	-5.345357	0.272	5.777906	0.229
year	2016	-4.154902	0.932	-6.354571	0.181
	2017	-42.9123	0.186	-13.3557	0.167
	2018	-50.12202	0.130	-19.83343	0.164
rdint	<i>Low R&D</i>	1.688326	0.842	-3.73013	0.286
	<i>Medium R&D</i>	2.710009	0.789	-3.129683	0.433
	<i>Medium-High R&D</i>	7.550741	0.324	7.831438	0.302
	<i>Medium-Low R&D</i>	-1.337312	0.723	.2344194	0.887
ateco		-.0346356	0.616	-.0287173	0.209
log_shar_equity		-1.299865	0.612	-.827714	0.614
log_tot_tan_assets		-1.429029	0.210	.3817737	0.553
log_tot_int_assets		2.640432	0.026	.1821816	0.862
log_employees		-2.739235	0.326	1.161115	0.001
log_ris		9.273611	0.478	13.15648	0.068
log_clab_nuts		3.519914	0.880	4.735828	0.230
log_inc_nuts		6.198298	0.800	6.748216	0.083
log_stud_nuts		-4.833318	0.910	-17.20481	0.000
log_uni_nuts		-6.609435	0.822	-7.640144	0.006
_cons		44.16233	0.898	62.04734	0.185
sigma_u		0		0	
sigma_e		131.57285		26.241361	
rho		0		0	

Source: our elaboration.

On the other side, universities spin-off firms might be more positively influenced by the Regional Innovation Score and by the presence of incubators because of a closer linkage to the regional innovation ecosystem, and because they might be more likely to benefit from the help of an incubator. In general, these circumstances reveal the possible inefficacy of policy interventions focused on the quantity of support and actions, rather than their quality, confirming what other researchers have already said (Audretsch *et al.*, 2020; Colombelli *et al.*, 2016). Also, they confirm that a deeper exploration of the relationships between ecosystem actors, artifacts, and actions is necessary in order to be able to understand the causes of the low performance of the overall ecosystem.

5. Conclusions

This paper aims to enrich the conversation on the dynamics and issues of Italy’s innovation ecosystem by comparing two of its most influential actors and analyzing the impact that the linkage with a university has on their growth.

Despite the levels of funding and the number of actions directed toward developing a European Innovation Ecosystem, the EU still faces an extensive disparity in the innovation performance of its member states. In particular, Italy represents an interesting case: while being one of the major economies worldwide, it still lags behind other member states and is still a moderate innovator.

With this in mind, this paper contributes to providing theoretical and empirical insights into the performance of university spin-offs and innovative start-ups in Italy and the effectiveness of the interactions in its innovation ecosystem.

Starting from two datasets of 244 university spin-offs and 1487 innovative start-ups in Italy, we carry out a panel data regression that allows us to compare the performances of the two types of firms, measured by sales growth. On the one side, we find out that Italian innovative start-up firms perform better than Italian university spin-offs on average. The parenting relationship of universities with USOs, then, does not lead to higher financial results. On the other side, although not promising, the findings show how the simple characterization as an innovative start-up does not explain an increase in the firm's growth, on average. Instead, if we compare USOs to USOs that are IISs, this difference in sales growth is positively associated with the Regional Innovation Score and the presence of incubators, and negatively associated with the number of students, contamination labs and universities.

However, these results should be considered with caution, as multiple limitations affected our analysis. First, our study is a quantitative one, and it lacks important qualitative measures such as: the innovativeness of a firm; the quality of ecosystem actors, support infrastructures, and the relations among them. Moreover, we miss data on other ecosystem dimensions, such as funding, cultural base, and number of non-institutional supports. Also, the exclusion criteria necessary for the success of the study reduced our sample size by more than 50%, making it difficult to expand the analysis to a longer time range. Finally, as innovation ecosystems vary across regions, nations, and continents, and since the study is carried out in Italy, this may hinder easy generalizability in other contexts.

Still, despite these limitations, the paper offers interesting theoretical and practical insights. From a theoretical point of view, indeed, the study reinforces the definition of innovation ecosystem and advances the body of knowledge on the relations between the actors of the Italian innovation ecosystem. Moreover, it tests and proves the association of a few ecosystem-related variables to the increase in sales growth. Also, it confirms what other authors say about the lower performance of USOs compared to other companies more connected to the commercial world.

From a practical point of view, it gives interesting insights for entrepreneurs and university administrators, with data on the effectiveness of "parenting" in the case of the relationship between universities and innovative firms. University administrators might use these insights to understand how to direct new investments, define internal transformations and plan strategic collaborations. Entrepreneurs, instead, could use this to make strategic decisions on both the definition of the organizational structure and the external collaborations.

Finally, on the policy front it provides policymakers with a deeper understanding of the performance of innovative firms in Italy. Especially, it shows if an ecosystem-variable subject to policy intervention is strongly or poorly associated with the growth of early-stage innovative firms. Policymakers could use these insights to understand if and whether the regional investments in innovation are leading to successful results.

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United we stand, divided we fall.

A co-authorship analysis of management scholars in Italy

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Abstract

Framing of the research. Collaborations and co-authorships are more and more typical in scientific research. Scientific collaboration has several advantages with regard to productivity, but it also has drawbacks.

Purpose of the paper. In this paper, we analysed the Italian community of management scholars with the aim of investigating their areas of interest, main research themes and publishing journals. Secondly, we carried out a co-authorship analysis to investigate the evolution of their publishing behaviours and co-authorship dynamics.

Methodology. A Scopus search was performed on the 649 Italian management scholars identified for 2019 to collect their Scopus IDs, with each ID uniquely identifying a scholar. A total of 550 Scopus IDs were collected, representing 84.7% of the 649 scholars. We then downloaded all 5,294 publications from these scholars listed in Scopus for the period 2000-2019.

A social network analysis was then applied to co-authorship publication data to analyse co-authorship dynamics and publication behaviour in four windows. Various co-authorship behaviours were analysed via ego-networks.

Results. Italian management scholars increased their production in either quantity or quality from various perspectives during the period 2000-2019. However, co-authorship dynamics increased greatly during this period, underlining new publishing behaviours (at different job levels).

Research limitations. The analysis is limited to contributions found in the Scopus database and does not include books and Italian articles.

Managerial implications. The practice of co-authorship among management scholars may foster improvements in the quality and quantity of scientific research. However, co-authorship also has drawbacks and can lead to bias in research evaluations.

Originality of the paper. The study represents the first long-term analysis of publication production on the part of Italian management scholars and also includes a co-authorship analysis.

Keywords: bibliometrics, co-authorship analysis, ego-networks, management scholars, Italy.

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1. Introduction

In recent years, there has been ever-increasing pressure on researchers, in general, and in the social and managerial sciences, in particular, to increase publications in top international journals in an increasingly tight timeframe for obtaining jobs in academic and professional fields, individual evaluations and institutional prestige (Levecque *et al.*, 2017; Wieczorek and Mitreęa, 2017). Publications also affect the acquisition of the funds needed for research activities and related facilities in a regime of increasingly scarce resources.

This pressure to publish is even stronger for younger generations, who must compete for academic jobs in an increasingly open and dynamic international, as opposed to national, scenario. However, it should be noted that the national situation has traditionally been both more static and parched in the provision of resources and high-level positions (Van Dalen, 2000; Van Dalen and Henkens, 2012).

In this scenario, collaborations have become an increasingly common way forward in an attempt to meet the demands for increased quantities of, and quality in, scientific work (Newman, 2001; Barabasi *et al.*, 2002).

Thus, there have been profound changes in the behaviour of researchers as they have moved from traditional hierarchical and pyramidal structures to increasingly horizontal structures in growing numbers. The imperative of “publish or perish” has become increasingly stringent with the introduction of international evaluation criteria in the educational sector, the ranking of journals, and the widespread use of search engines in selection and evaluation processes, both in the public and private sectors.

Within this framework, we focus on the Italian community of management scholars with the aim of investigating their areas of interest and behaviour in co-authorship activities. Using a bibliometric analysis of the publications of these scholars, we investigate the main research themes and publishing journals of this community. Secondly, we carry out a co-authorship analysis to investigate the evolution of their publication behaviour and co-authorship dynamics.

In particular, a Scopus search was performed on 649 Italian management scholars to collect their Scopus IDs, where each ID uniquely identifies a scholar. The Scopus IDs of 550 management scholars were collected, representing the 84.7% of the Italian Ministry of University and Research (MIUR) universe. We then created a peer group of the 550 scholars and download all 5,294 publications associated with these scholars in Scopus for the period 2000-2019.

Next, a social network analysis was done on this co-authorship publication data to investigate co-authorship dynamics and publication behaviour in four windows (2001-2005-2010-2015-2019). Various co-authorship behaviours were then analysed through ego-networks.

This work is novel in some ways. First of all, the paper aims to contribute to the debate on co-authorship in the business and management communities (Casanueva and Larrinaga, 2013; Acedo *et al.*, 2006; Beattie and Goodacre, 2004; Merigó *et al.*, 2016). Furthermore, with respect to Italy, this research is the first work on the Italian management community with results that can be compared to those for the Italian economists (Cainelli *et al.*, 2015) and statisticians (De Stefano *et al.* 2013; 2017). Moreover, it is one of the first works to analyse authorship and scientific production across different positions within the university, highlighting a sort of ‘generational divide’. The results underline that Italian management scholars have increased either the quantity or quality of their publications from different perspectives in the period 2000-2019. Furthermore, with regard to collaboration strategies, using ego-network analyses, we have identified some interesting transformations identifying some different ideal types and highlighting a relevant generational shift. In the first windows, few collaborative activities emerged and were essentially related to the academic pyramidal structure with the full professor at the top, whereas, in the last two windows, a very dense networks of relationships has emerged, characterized by horizontal relationships between young researchers that were often random in nature. In general, co-authorship dynamics increase greatly during the period, underlining new publishing behaviours (at different position levels) that must be considered in the future.

2. Co-authorship networks analysis

Co-authorship network analysis has been of increasing academic interest in the last decades and has had some seminal contributions. One of the first contribution was made by Newman (2001), who used social network analysis to investigate the characteristics of several large co-authorship networks in biology, medicine, physics, computer science and so on in the period 1995-1999. This paper also verified the theory of small worlds (Watts and Strogatz, 1998; Milgram, 1967) Next, Barabasi *et al.* (2002) investigated the dynamics and evolution of co-authorship networks in mathematics and the neurosciences, introducing the theory of preferential attachment and scale-free networks. Since then, co-authorship networks have been studied using various approaches and across several disciplines (Kumar, 2015).

The literature on co-authorship analysis has grown exponentially, examining, for instance, the effect of an author's structural position within a co-authorship network on their performance or publication behaviour dynamics. The first bibliometric study to apply social network analysis was done by de Solla Price (1965), who examined networks for scientific papers. Since then, co-authorship analysis has been used to examine cohesion and connections in scientific communities (Kumar, 2015).

Co-authorship analysis allows researchers to investigate scientific research communities and how they publish and evolve over time. This trend began with Crane's work on the invisible college (1969). The concept of the invisible college refers to a group of scientists interacting and exchanging information from geographically dispersed locations (Price, 1965). These interactions are not necessarily confined to a single discipline. Indeed, science is often characterised by cross-fertilisation between different research areas (Crane, 1969). This form of analysis has largely thrived and been tested on several communities (Casanueva and Larrinaga, 2013; Sedita *et al.*, 2020)

In the last decades, social network analysis has shifted from examining small networks to investigating those with thousands or millions of vertices, while renewed attention had been given to the topologies and dynamics of networks (Newman, 2001; Albert and Barabasi, 2002). Most of these studies focus on macro-level network properties, that is, they seek to describe a social network's global characteristics and conceptualize its overall structural features (Yan and Ding, 2009).

There has also been research on co-authorship in the social sciences (Glanzel, 2002; Barnett *et al.*, 1998; De Stefano *et al.*, 2013, 2011, 2017), particularly in the areas of economics and management (Casanueva and Larrinaga, 2013), business process management (Reijers *et al.*, 2009), tourism and hospitality (Hu and Racherla, 2008; Racherla and Hu, 2010) and destination management (Capone, 2016).

Co-authorship is an increasing phenomenon in academia, including the social sciences. In general, the percentage of co-authored papers grew steadily between 1950 and 1994, going from 10% to 70% in this time period (Laband and Tollison, 2000). Recent studies have also underlined the increasing relevance of multi-author co-authorships (Van del Leij and Goyal, 2011). This phenomenon is related to the pressure on academics to publish in high-quality journals and is seen as a way to increase both the quality and quantity of scientific research.¹

Several authors have concluded that the increasing number of authors is due to: specialisation, an increased focus on multi-disciplinary research, synergy, opportunity costs, risk diversification values of co-authored papers exceeding $1/n$ of the n authors for promotion and evaluation and the chance for social interactions ((Cainelli *et al.*, 2015; Medoff, 2003). However, Cainelli *et al.* (2015) also conclude that co-authorships may have also negative effects and a 'dark-side' due to: compromises, organizational challenges, control issues, communication costs (Hudson, 1996) and reward structure (a solo article has double the expected citations of multi-author articles) (Hilmer and Hilmer, 2005).

¹ See Cainelli *et al.* (2015) for a review of the increases in the quality and quantity of publications due to co-authorships.

The economics and management fields have registered several works on co-authorship analysis. Casanueva and Larrinaga (2013) conducted an analysis of the invisible college of Spanish accounting scholars, investigating the selection of members of Ph.D. panels for the period 1994-2003. They could not confirm the existence of invisible college dynamics, underlining that high-profile scholars do not generate a disproportionate volume of new publications and therefore that the mechanism of preferential attachment was not active in this community. Acedo *et al.* (2006) conducted a co-authorship analysis for management and organizational studies focusing on the main international journals and pointed out a growing tendency of co-authored papers in the field of management, similar to those observed in other disciplines. Beattie and Goodacre (2004) studied publishing patterns in the UK and Irish accounting and finance academic communities across a 2-year period (1998-1999) using data from the British Research Register. They underline the increasing number of co-authorships in the community, pointing out the nearly two-thirds of academic articles were co-authored, with 25% of the contributions coming from outside the community. Merigó *et al.* (2016) conducted a bibliometric analysis of business and economics research according to the information found in the ISI Web of Science. They did not include a co-authorship analysis, but they did present the 50 most cited papers in business and economics, the 40 most influential journals, the 40 most relevant institutions and the most influential countries. Nizkad *et al.* (2011) studied scholarly networks for Iranian papers in psychology, management and economics during the period 2000-2009, applying SNA (Social Network Analysis) to visualize the co-authorship networks only. Podsakoff *et al.* (2008) presented an interesting analysis of the determinants of university and author impact in the management literature over the past quarter-century. Using bibliometric techniques, the authors examined 30 management journals to identify the 100 most-cited universities and 150 most-cited authors from 1981 to 2004. They confirmed the dynamics of preferential attachments by registering that a relatively small proportion of universities and scholars accounted for the majority of the citations in the field.

Fewer studies of this type have been conducted in Italy. Cainelli *et al.* (2012, 2006) conducted some of the very first work on co-authorship analysis by examining academic economists. Plumper and Radaelli (2004) analysed 89 political science journals indexed in the ISI Web of Science over the period 1990-2002. They investigated the publications and citations of all academics with Italian affiliations, although they did not conduct a co-authorship analysis. The works of De Stefano *et al.* (2011, 2013, 2017) and Fucella *et al.* (2016) were the first co-authorship analyses conducted on the Italian academic community of statisticians and examined intra-network community and scientific performances. Finally, Menardi and De Stefano (2021) presented a community detection analysis, underlining the importance of inter-network structure for scientific performances within the Italian community of statisticians.

There are even fewer works on Italian management scholars, for instance, Lazzeretti (2001) analysed the use and diffusion of empirical statistical methodologies in management. Lazzeretti *et al.* (2014) investigated the invisible college of cluster research, identifying main authors and the historical evolution of the community, while Sedita *et al.* (2018) used co-authorship analysis to investigate the evolution of the main research themes within the overall community.

Other works have focused on different, but still interesting themes, in Italy, for instance, Abramo *et al.* (2009) analysed gender differences in research productivity in Italy. Allesina (2011) measured nepotism through shared last names within the Italian Academy. Finally, Bagues *et al.* (2019) analysed the role of predatory journals within the Italian Academy with regard to national scientific evaluation (ASN).

From the above literature review, it is evident that the role of co-authorship in the scientific performances of academics is becoming more and more central in the debate on scientific productivity (Lee, and Bozeman, 2005), recruiting and university evaluations. This work aims to investigate the role of co-authorship in the productivity of Italian management scholars by examining the quantity and quality (network relational positions, and so on) of co-authorships.

3. Research design

To answer to the above research questions, we developed a case study on the publication behaviour and co-authorship dynamics of the community of Italian management scholars.

Co-authorship analysis may be conducted on informal or formal knowledge-exchange channels (Sedita *et al.*, 2018). Ad hoc surveys on the collaborative behaviour of scientists; mail-tracking systems; or participation in common research projects, workshops and conferences could potentially provide information on informal knowledge exchanges, whereas bibliometric or scientometric studies can identify patterns in collaborative work and clusters of specialisations in specific research areas through formal channels.

We adopted the second method, as bibliometrics offers a powerful set of methods and measures for studying the structure and process of scholarly communication. Furthermore, it is an increasingly accepted method for examining the sociology of science. From this perspective, bibliometrics can be used to investigate co-authorship dynamics among a group of authors and how the group publishes and evolves over time, including according to changing contexts and rules.

For these reasons, we collected information on 31/12/2019 for all (649) management professors and research assistants in public and private universities in Italy from MIUR. We searched Scopus for these scholars (at work in 2019) and found the Scopus IDs of 550 of them or 84.7% of the MIUR universe.²

We then created a peer group of these 550 scholars and downloaded all 5,294 of their publications from 2000-2019 found on Scopus. We decided to use Scopus and not the ISI Web of Science, as Scopus permits the creation of peer groups for download. Moreover, the Scopus database is typically larger than that of the ISI Web of Science, making it preferable (Capone, 2016; Leydesdorff *et al.*, 2010). Finally, Scopus permits all authors and co-authors to be disambiguated via their Scopus IDs.

Social network analyses were done on co-authorship publication data to examine co-authorship dynamics and publication behaviour in four windows (2001-2005; 2006-2010; 2011-2015; 2016-2019). Finally, co-authorship behaviour was analysed via ego-networks.

4. Results

4.1. Descriptive analysis and evolution of publications

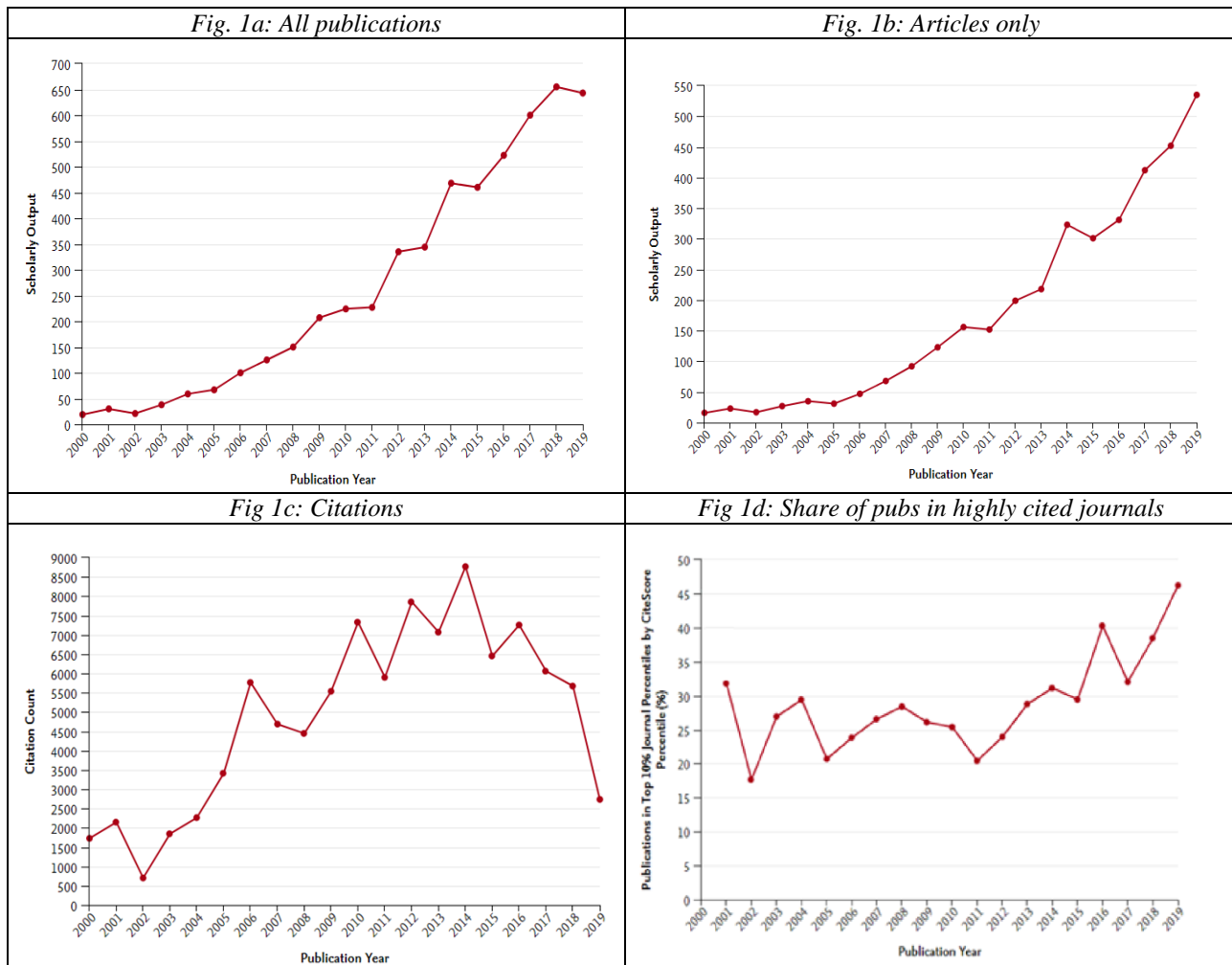
Figure 1 presents the evolution of scholarship production of the Italian management scholars in the period 2000-2019. Fig. 1a presents the evolution of all publications through time, while Fig. 1b focuses just on articles, omitting book chapters and proceedings. Fig. 1c presents the evolution of citations for this group, and Fig. 1d presents the share of contributions published in top percentile Journals, as calculated by CiteScore.³

All the figures show that production has increased either from a quantitative point of view or from a quality perspective. An incredible growth in the number of contributions published in journal in the Scopus database can be documented, starting from less than 50 or 100 in the first 5 years of the period (2000-2005) and arriving at more than 650 contributions yearly by 2019 (Fig. 1a). If we focus on just articles, the trend goes from less than 50 articles in 2005 to 550 articles in 2019, confirming the increasing internationalisation of the management community. This growth can also be related to recent recruiting policies, such as the National Scientific Qualification (ASN) in 2012 and the second University Evaluation Policy in the period 2011-2014 (VQR), which have gotten the community to focus on indexed international journals.

² Not all the Italian management scholars were found in Scopus. Some of them were simply not present in Scopus; others may have had homonyms, making it difficult to identify them; while some others may not have published a paper in 2019.

³ Introduced in 2016 by Elsevier as an alternative index to the Impact Factor. CiteScore measures the impact of indexed scientific journals, dividing the number of citations received in a given year by the articles in each journal published in the previous four years by the total of articles published in that same periodical in the same four-year period.

Fig. 1: The evolution of the publications of the Italian Management Scholars, 2000-2019.



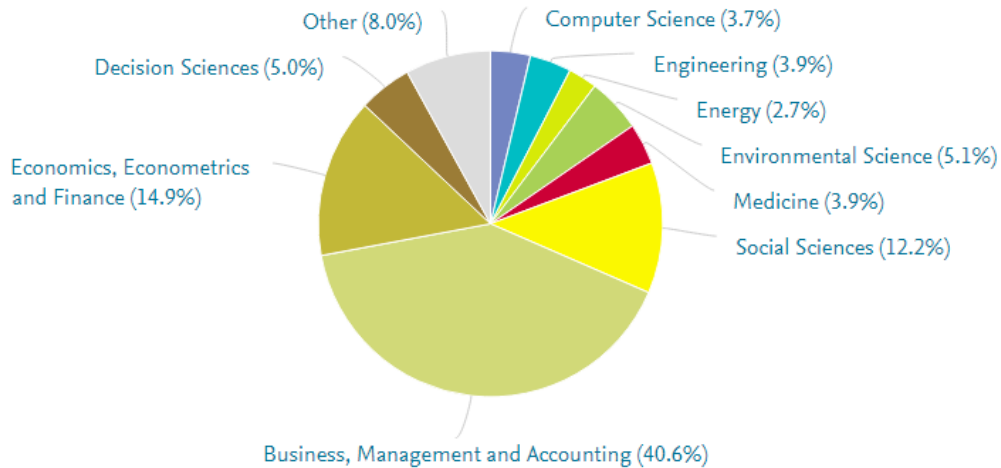
Source: our elaborations.

It should also be noted that the quantitative increase in production was followed an increase in quality. Fig. 1c underlines the growth in citations of the contributions published by the community.

Examining where the Italian management community publishes, we can also see that their contributions were published in better journals across time. Fig. 1d presents the share of publications in highly cited journals, according to CiteScore. In the 2000s, this percentage was around 25%, with a peak of around 30%, whereas, in the following decade, the percentage increased to 45%, oscillating around 40%. Thus, there was an increase in publication quality.

Figure 2 shows the scientific areas covered by the publications. As can be expected from a heterogeneous and wide community, most publications were in areas such as Business, Management and Accounting (40%) and Economics, Econometrics and Finance (14.9%), but other areas were also covered, such as Medicine (3.9%), Engineering (3.9) and Computer Science (3.7%). Thus, management scholars have been able to contribute to many areas.

Fig. 2: The scientific areas where the management scholars publish.



Source: our elaborations.

Table 1 lists the most commonly occurring topics for the 5,294 management publications. These general topics were used by the Scopus database, but some interesting themes can still be seen. For instance, the first theme, with nearly 180 contributions, concerns innovation and open innovation, both of which have been extremely important in the last decades. Some other important themes are value co-creation and service economy (tied for 2nd place) and family firms (3rd place). In 4th place, we find some further themes related to innovation, innovation networks and industrial district, while internationalisation and born global follow.

Tab. 1: The topics of the analysed publications

Topic	Pubs
Alliance Portfolios; Absorptive Capacity; Open Innovation	177
Product-service Systems; Service Economy; Value Co-Creation	135
Socioemotional Wealth; Family Firms; Familiness	133
Regional Innovation Systems; Industrial Districts; Innovation Networks	83
International New Ventures; Born Global; Export Performance	81
Cause-Related Marketing; Corporate Social Performance; Corporate Philanthropy	78
Entrepreneurial University; Academic Entrepreneurship; University Technology Transfer	75
Electronic Word-Of-Mouth; Online Reviews; Brand Community	74
ISO 14001; Environmental Management Systems; Eco-Management and Audit Scheme	51
Wine Tourism; Hedonic Price Function; Implicit Price	48
Luxury Brands; Counterfeit; Purchase Intention	47
Container Port; Short Sea Shipping; Seaports	46
Tourism Development; Ecotourism; Destination Management	45
Subsidiaries; Multinational Enterprises; Headquarters	44
Value-Based Pricing; Customer Perceived Value; Industrial Markets	43
Business Model Innovation; Sustainable Business; Digital Transformation	42
Brand Community; Consumer Culture; Netnography	41
Place Branding; Public Diplomacy; Brand Identity	39
Consumer Ethnocentrism; Country of Origin Effects; Country Image	37

Source: our elaboration.

Table 2 presents the main journals that Italian management scholars have published in. The table presents all the top journals without an “A” ranking on the ASN list⁴ (four journals) in bold. This list highlights how important it now is to publish in journals with the “A” ranking.

Not all the journals have a similar impact; in fact, some journals on the list have small impact factors. So, together with top international management journals, such as *Journal of Business Research*, *Industrial Marketing Management*, *Journal of Cleaner Production*, *Research Policy*,

⁴ Under the ASN recruiting policy, journals are classified in classes A (top) to E (bottom).

Technological Forecasting and Social Change, *Journal of Business Ethics* and *Strategic Management Journal*, there are also minor “A” ranked journals with smaller impact factors and SJRs (Scimago Journal Rating), such as *British Food Journal*, *TQM Journal*, *Management Decision* and *Journal of the Knowledge Economy*. Oddly, journals with lesser impact are somehow preferred.

To confirm this aspect, the last column of Table 2 shows the journal ratings of the Academic Journal Guide published by the Association of Business Schools (ABS) 2021. In the table, there are only two journals classified as 4*, while are classified as 3, 2 and even 1. Thus, while these journals are all in top ASN top “A” rank, in international ranking, not all of them are considered top journals. This situation can create opportunistic behaviour, as it incentivizes scholars to publish in less important “A” ranked journals, as they work for career advancement and have higher acceptance rates.

Moreover, note that the journal where the Italian community publishes most frequently is *Sustainability*, a well-positioned journal with aggressive marketing strategies (Bagues *et al.*, 2019). This journal offers very quick reviews and publishes thousands of particles every year in hundreds of special issues.

Finally, it is also interesting to examine the evolution of the most important journals across two decades, namely, 2000-2010 and 2011-2019. Dividing the analysis into these two periods, some journals that were present in the first decade disappeared in the second, such as *Journal of Management and Governance* and *L'Industria*. From this point a view, the ASN has increased the importance of the so-called “A” journals, which are now crucial in the Italian community, pushing the community, in general, and young researchers, in particular, to up their production and submit their work to top-quality journals. Unfortunately, some of the journals that disappeared in the second period had good Italian reputations. For instance, the *Journal of Management and Governance*, published by the Italian Business and Economics Association, disappeared in the second period.

Another important journal that is missing in both periods is *Sinergie - Italian Journal of Management*, which was not included in the analysis, as it was finalising its inclusion in the Scopus database (Pastore, 2021).⁵

Tab. 2: The main publishing journal

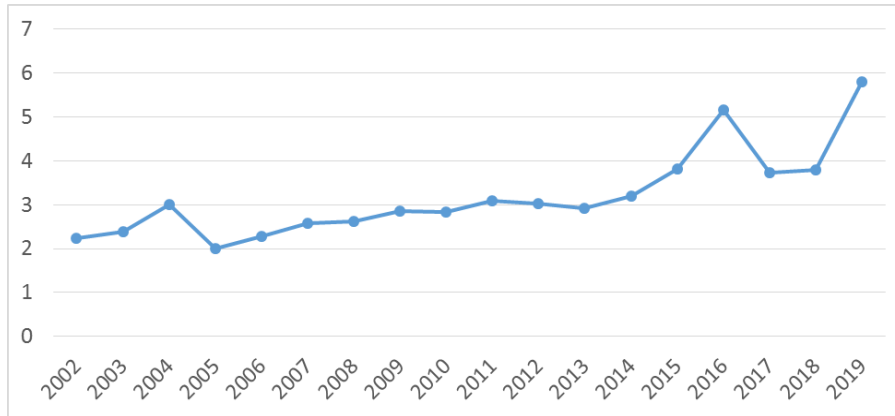
Pos.	Journals	Pubs	SJR (2019)	ABS Rating 2021
1	Sustainability	83	0.581	Not present
2	Journal of Business Research	78	1.871	3
3	Industrial Marketing Management	62	2.084	3
4	Journal of Cleaner Production	58	1.886	2
5	British Food Journal	56	0.579	1
6	TQM Journal	48	0.658	1
7	Management Decision	47	0.862	2
8	Research Policy	43	3.246	4*
9	Technological Forecasting and Social Change	38	1.815	3
10	Journal of Business Ethics	37	1.972	3
11	Strategic Management Journal	35	8.43	4*
12	Journal of the Knowledge Economy	34	0.576	1
13	European Planning Studies	33	0.953	2
14	Industrial and Corporate Change	33	1.120	3
15	Journal of Management and Governance	29	0.555	1
16	International J. of Globalisation and Small Business	28	0.276	1
17	Journal of Knowledge Management	27	1.752	2
18	Journal of Global Fashion Marketing	25	0.579	1
19	Lecture Notes in Inf. Systems and Organisation	25	0.125	Not present
20	Business Strategy and the Environment	24	1.828	3
21	European Management Journal	24	1.308	2
22	Industry and Innovation	24	1.738	3

Source our elaborations. Journals in bold did not have an “A” ranking on the 2021 ASN list.

⁵ Sinergie - Italian Journal of Management has been included in Scopus since 14th June 2021.

It is also interesting to point out the *average number of authors per article*.⁶ as doing so underlines the deep changes that the community was facing during the period. In fact, at the beginning of the period, an article had, on average, two to three authors, while, at the end of the period, the average had increased to nearly five to six.

Fig. 3: The average number of authors per article.



Source our elaborations.

4.2. A co-authorship analysis through graph and ego-networks: a generational divide

This section investigates the co-authorship dynamics and the different publication behaviours of management scholars for the period.

Publications can be used to identify networks of co-authors and may allow the analysis of co-authorship networks. The $N \times M$ authors per publication matrix is then transformed into the $N \times N$ authors per author matrix, where a relationship between two authors indicates co-authorship.

We divide the entire period into four windows in order to investigate four different co-authorship networks: 2000-2005, 2006-2010, 2011-2015 and 2016-2020. The use of windows is common in co-authorship and network analyses, as doing so avoids outliers and analysing collaborations over longer periods (Sedita *et al.*, 2020; Casanueva *et al.*, 2013).

Figure 4 presents some measures of the four sub-periods. For instance, the average degree (number of ties for each author) goes from 1.5 in the first period to 2.5 in the last one. As highlighted previously, the number of co-authors tended to grow during the full period.⁷

Note that the overall number of publications goes from 234 in 2000-2005 to 2.420 in 2016-2019, indicating huge growth. Also, the number of (unique) co-authors goes from 336 to 5.996, underlining one more time the huge number of collaborations. Furthermore, the maximum number of co-authors in the first period is 13, while, in the last window, it almost doubles, reaching 20.⁸

Tab. 3: The four different windows of analysis.

Period	Pubs	Authors (unique)	Co-authors	Avg. Degree	Max co-authors
2000-2005	234	223	336	1,5	13
2006-2010	806	705	1248	1,8	20
2011-2015	1834	1521	3391	2,2	15
2016-2019	2420	2367	5696	2,5	20

Source: our elaborations.

⁶ The average number of authors per article has been calculated for each year by dividing the total number of authors by the total number of articles.

⁷ Recall that the average number of authors per article is different from the average degree. If three authors publish three articles, always collaborating together, the average number of authors per article is 3 (i.e., $9/3=3$), while the average degree is 2 since each author has 2 co-authorship ties with others.

⁸ This article with more than 20 authors is published in *Research Policy* and concerns an EU survey on inventions and inventors.

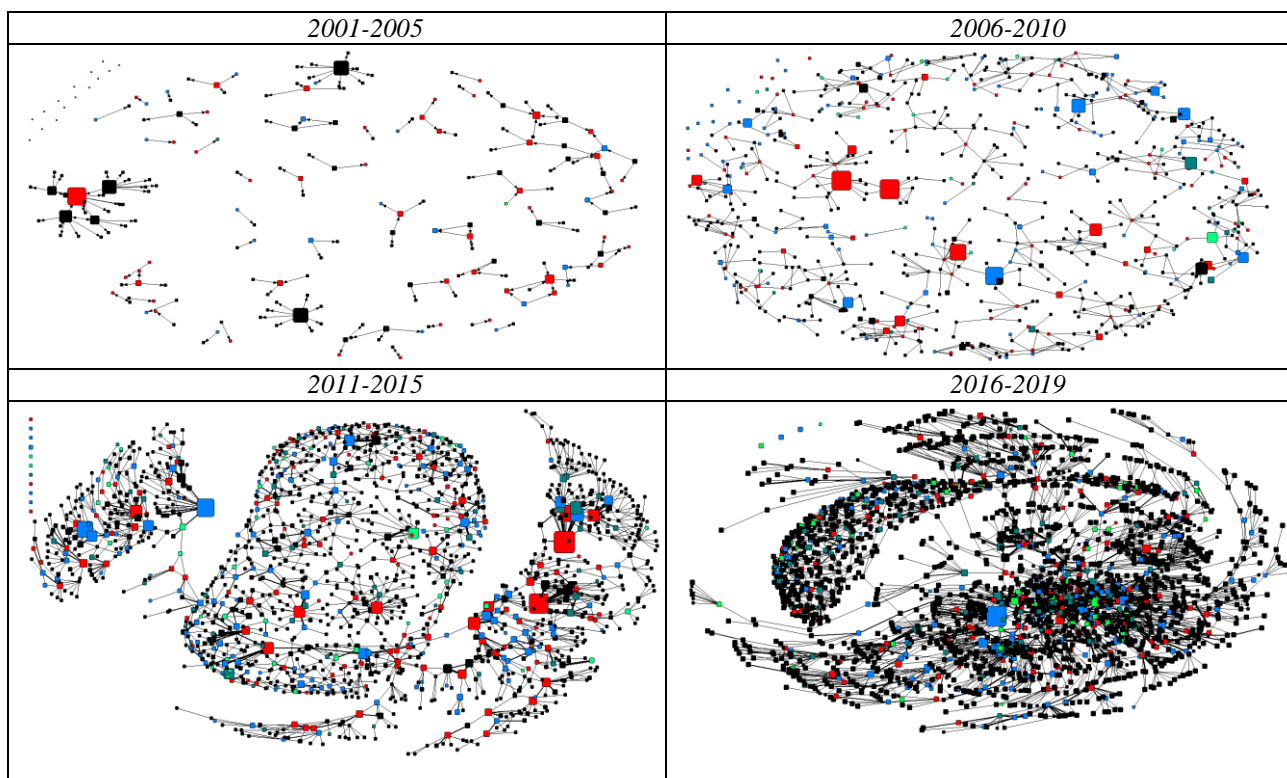
Finally, a social network analysis of the four sub-networks in the four sub-periods was conducted. Figure 4 presents the four sub-networks, as constructed by UCINET software. Each node represents an author, while the lines represent co-authorships.

First of all, it is possible to describe the evolution of the community in the four sub-periods. In the first window (2000-2005), there are small sub-networks that are mainly composed of isolated research groups. Collaborations are more stable and are developed among the same scholars in stable research groups.

By the second period (2006-2010), the structure has begun to change and stable groups of researchers are no longer in the majority. The overall network is not yet full connected, but a large macro network is starting to appear in the middle of the figure. The dimension of the network is increasing, perhaps indicating a widening of collaborations, most likely with international scholars.

The last two windows (2011-2015 and 2016-2019) emphasize the growing complexity of the management community with the appearance of a large and wide macro-network of collaborations among not only local and national scholars but also with international scholars and other communities. The community of management scholars is now a wide and large community, where there is an increasing propensity toward collaborations and co-authorships. The existence of stable and continuous collaborations is not as visually evident as before. The figure highlights how the community has changed its co-authorship behaviour over time.

Fig. 4: The co-authorship networks in four sub-periods.



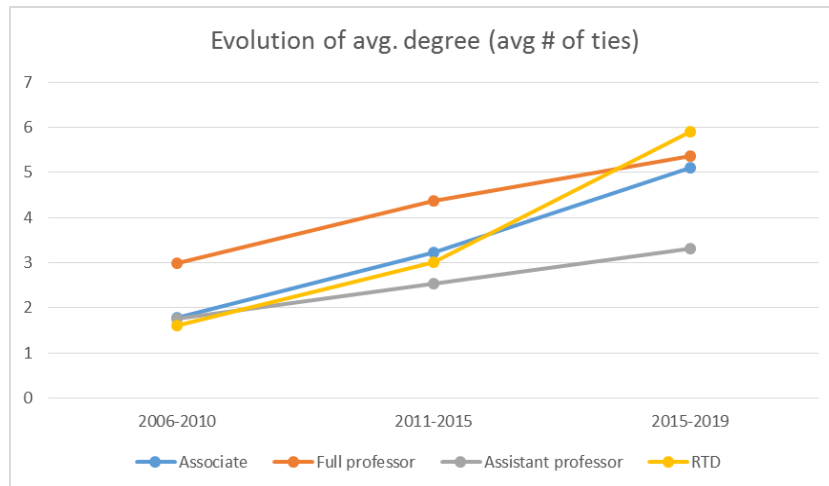
Source: our elaborations. Legend: Red nodes: full professors; Blue nodes: associate professors; Green nodes: assistant professors.

Finally, note that in Figure 4, the prevailing roles change across the windows. In fact, in the first two windows, the largest nodes and therefore those with more collaborations belonged to the full professors (red nodes) as well as some important associate professors (blue nodes). However, in the last two periods, these nodes include more associate professors (blue nodes) and assistant professors (green nodes).

This phenomenon is also highlighted in Figure 5, where the average degrees for the various job positions are compared across the last three periods. It can be seen that in the first period, the full

professors had more co-authorships than those in other job positions. This effect gradually fades away and in the last period, the assistant professors have more co-authorships than both the associate and full professors. Most likely, this phenomenon highlights the urgent need for those in the most precarious jobs to publish at all costs, pushing them to expand collaborations in order to “publish and not perish”.

Fig. 5: The evolution of average degree among different job positions.



Source: our elaboration.

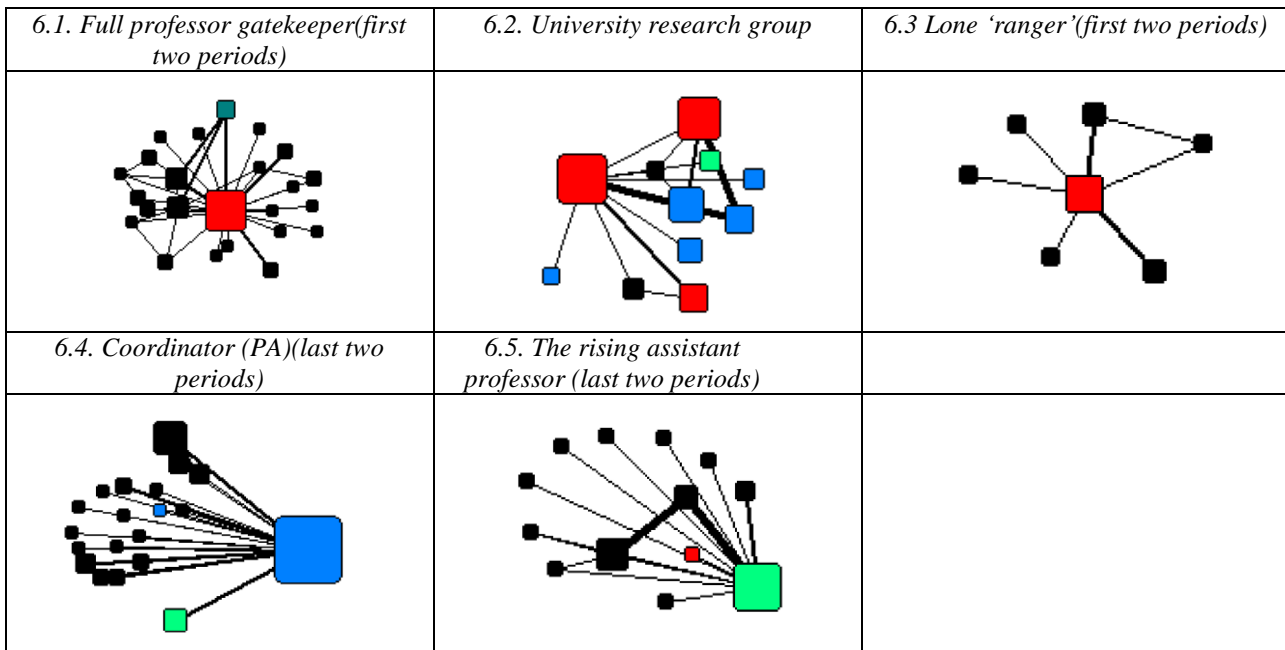
In order to further highlight this ‘*generational divide*’ in terms of position, ego-networks were investigated. An ego-network is a network consisting of a focal node (“ego”) and the nodes to which it is directly connected (called the “alter” nodes) and the bonds, if any, between the ego and alters. These networks are also known as personal networks or ego-centric networks (Freeman, 1982). An ego-network can be obtained by extracting a sub-network from a full network and allows researchers to focus on the relationships within that single network.

This analysis does not aim to be representative of the entire community and generalizable, but it can serve to highlight the presence of some ideal types of behaviours in the various periods (Capone *et al.*, 2018). In order to identify different behaviours in the establishment of publishing co-authorships, all ego-networks of management scholars were analysed, and the ideal types of the most common structures were identified for the different periods.

Figure 6 highlights some ego-networks. In the first row, some networks typical of the first two periods are presented. Figure 6.1 depicts a full professor as the research director of a research group composed of assistant professors and other external collaborations (probably PhDs, research fellows and foreign scholars). This ego-network is mostly present in the first two periods. Figure 6.2 presents an ego-network that is found in all periods, that is, one at a single university with local collaborations. This network is composed of full professors, associated professors, assistant professors and probably some PhD students (PhDs) or research fellows. Figure 6.3 highlights another characteristic ego-network present in this community, which we have named the ‘*lone ranger*’, that consists of a full professor who works exclusively with outsiders (PhDs and foreign scholars, most likely).

These ego-networks are quite traditional and highlight where the community once was, whereas Figures 6.4 and 6.5 highlight ego-networks that emerged in the last two periods. Figure 6.4 highlights the role of a research directorship held by an associate professor in collaborations with assistant professors and externals. Figure 6.5 shows a further change in perspective, in which the research director with a large number of collaborations and publications has morphed into an assistant professor, that is, a young scholar. This phenomenon most likely emerged in response to the need for the those in the most precarious positions to publish at all costs.

Fig. 6: Some ego-networks of publishing behaviours.



Legend: Red: full professor; Blue: associate professor; Green: assistant professor.

5. Conclusions

The aim of this paper was to present the evolution of the Italian management community's publications in international journals and to investigate the role of co-authorships against the backdrop of the growing use of collaborations in scientific research.

The first result of the research highlighted the growth in publications, both in quantity and quality, from Italian management scholars. The community has made important strides in terms of the number of articles published in international journals and in terms of the number of articles published in international journals with high impact. The study period lasted about twenty years and showed a clear evolution in the community.

The second result is related to the analysis of co-authorships. through social network analysis we analysed the co-authorships network of the community in four time windows, highlighting the differences between each period. This analysis was also based on the study of some ego-networks characteristic of the various periods.

Using ego-network analyses, we identified some different ideal types that highlight a relevant generation shift. In the first period, we had few collaborative activities and essentially related to the academic pyramidal structure, with the figure of the full professor at the centre. in the second period very dense networks of relationships emerge characterized by horizontal relationships among young researchers often random in nature. This generational divide is also present in the co-authorships and is the most relevant results of the analysis.

The last result concerns the analysis of co-authorships. In general, co-authorship dynamics changed considerably, underlining new publishing behaviours within the management community. These different behaviours were observed across different positions, highlighting the increasing use of co-authorships by those in the most precarious positions within universities.

In particular, in the last of four windows during this period, assistant professors (fixed-term) exceeded full professors in terms of research collaborations. This phenomenon can be related to the 'publish or perish' theory, where those in the most precarious jobs need to publish at all costs or leave academia.

As for future trends, those in precarious university positions will be placed under even more stress, encouraging opportunistic behaviour and short-term goals to the detriment and impoverishment of the researcher role and of profound consequence for the future of recruited scholars.⁹

Finally, the study had some limitations in that the analyses were limited to papers appearing in the Scopus database, that is, articles in indexed international journals. They did consider books and articles in Italian journals that are important to Italian management scholars, such as *Sinergie - Italian Journal of Management*, which just recently finalised the process for inclusion in Scopus (Pastore, 2021). Moreover, an analysis based on the quality of publications, for instance, the number of citations, was not conducted. Such an analysis could reveal interesting patterns.

In addition, a benchmarking analysis comparing the Italian scholars with another community or the same community in another country could enhance the research and allow a comparison of publishing and co-authorship behaviours.

Notwithstanding the limits of this work and possible improvements, this article presents a first interesting investigation into the publishing behaviour and dynamics of the Italian management community, and it sheds light on some critical and important issues related to the community's evaluation and recruiting policies.

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⁹ For instance, the Italian Association of Management Scholars (SIMA) has published a document entitled 'Profession and career of the management scholar', where it is generally advised that scholars publish articles "with a number of authors not exceeding 4" (p. 7).

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Organizing for resilience: an empirical analysis in context of SMEs

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Abstract

Framing of the research. *Firms are increasingly compelled to rethink their resilient approaches in response to the challenges raised by today's unpredictable environments .*

Purpose of the paper. *This paper aims to investigate the benefits of combining agile and lean approaches to foster more robust and resilient responses by firms when dealing with unexpected market changes.*

Methodology. *The article adopts a multiple-case study research design based on the analysis of 13 Italian SMEs operating in different sectors.*

Results. *This research proposes the lean-agile approach to resilience, and identify its key dimensions that boost an organization's ability to respond to unforeseen situations.*

Research limitations. *Given the qualitative and exploratory nature of this work, it is necessary to conduct further theoretical and empirical studies to improve the generalization of our findings, as well as test the proposed dimensions of the lean-agile approach.*

Managerial implications. *The dimensions of the lean-agile approach can be used as a guideline to improve the complementary implementation of agile and lean approaches into firms' strategy and operations, and, thus, support managers in augmenting their capacity to rebuild competitiveness in today's complex times.*

Originality of the paper. *Our study illuminates the significance for SMEs to develop lean-agile approaches to be more resilient when addressing the uncertainty following crises. We argue that ignoring the combination of lean and agile approaches and avoid a deep digital transformation path can be problematic for organizations. We invite scholars to advance knowledge on this important line of inquiry, since gaining a deeper understanding of the impact of agile and lean approaches on firms' resilience can provide further theoretical and practical insights in the management literature.*

Keywords: *Agile; lean; lean-agile; resilience; uncertainty; multiple-case study; SMEs.*

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1. Introduction

Managers and practitioners are increasingly compelled to rethink their competitiveness in response to the challenges raised by today's unpredictable landscapes. The last two years the spread of the Coronavirus (COVID-19) pandemic has upended entire health, safety, and economic systems at a global level, thereby forcing organizations worldwide to redesign their ways of doing business to prevent collapse (Blackburn *et al.*, 2020; Moi and Cabiddu, 2020; Sharma *et al.*, 2020). Accordingly, there is the necessity to enhance a firm's resilience in response to volatile environments and be more prepared to address the next normal (Diedrich *et al.*, 2021; Liu *et al.*, 2020; Mithani, 2020; OECD, 2020a; Soluk *et al.*, 2021).

Resilience refers to "a firm's ability to absorb complexity and emerge from a challenging situation stronger and with a greater repertoire of actions to draw from than were available before the disruptive event" (Lengnick-Hall *et al.*, 2011, p. 244). Resilient firms can formulate customized responses to adapt and recover from disturbances swiftly (Boin *et al.*, 2010; Lengnick-Hall and Beck, 2005), "in a way that positively adjusts and maintains functioning prior to, during, and following adversity" (Williams *et al.*, 2017, p. 742).

According to scholars, the capacity to be resilient is empowered by agility (Birkinshaw, 2020; Holbeche, 2018; Liu *et al.*, 2020; Rapaccini *et al.*, 2020). Organizational agility is the ability to renew and transform business models by profiting from unexpected market changes (Doz and Kosonen, 2010), to redeploy and adapt resources and capabilities more effectively for value creation (Teece *et al.*, 2016). Agile organizations employ flexible and rapid ways to deliver customer value (Ganguly *et al.*, 2009; Moi and Cabiddu, 2021a, 2021b; Rigby *et al.*, 2016), and are able to spot and react to sudden shifts in the marketplace in a timely fashion, thus managing to thrive in complex environments (Debellis *et al.*, 2021; Holbeche, 2018). The concept of agility is often complemented by leanness (Bhamra *et al.*, 2020). Leanness means reducing waste and costs to focus thoroughly on value creation (Schonberger, 2019; Shah and Ward, 2003; Shepherd and Gruber, 2020), hence improving a firm's overall efficiency and productivity (Womack and Jones, 1997).

Literature claims that firms that address unforeseen environmental circumstances need to employ agility and leanness simultaneously (Ivanov, 2021; Srinivasan *et al.*, 2020). Indeed, considering agile and lean approaches in a complementary manner brings meaningful benefits to organizations, "such as to deliver value efficiently for a customer; discover better ways of working to continuously learn and improve; transparently connect strategy and goals to give teams meaningful purpose; and enable people to contribute and lead to their fullest potential" (de Raedemaeker *et al.*, 2020). However, there are still few theoretical and empirical insights about how to combine agile and lean approaches to design more effective resilience response in time of uncertainty. This paper addresses this gap by investigating how adopting agile and lean approaches fosters more robust and resilient responses by firms. The research question examined is as follows: "How do organizations combine agile and lean approaches to foster resilient response to market uncertainty?"

We opted for a multiple case study research design focusing on 13 Italian small and medium-sized enterprises (SMEs) operating in different sectors. Our findings provide the conceptualization of the key dimensions of a Lean-agile approach to resilience. Thus, we extend prior literature on resilience by explaining how implementing both agile and lean approaches may boost an organization's ability to respond to unforeseen situations. From a practical perspective, we provide managers with a reliable foundation to decide how to simultaneously adopt agile and lean approaches when adapting to dynamic and complex business contexts. In other words, this study may assist them in redefining their strategic and operational efforts, learning how to become more resilient in today's volatile and uncertain environments.

The remainder of the paper is structured as follows. We first review the literature on agile and lean approaches. Therefore, we discuss the details of our research design and the key findings of our empirical analysis. We end with our study's theoretical and practical implications, limitation and future research opportunities.

2. Theoretical background

In trying to stay “intact” or unharmed in case of unpredictable events, organizations need to give significant attention to resilience (Gölgeci *et al.*, 2019), the capacity to absorb environmental impacts, or to react to unexpected disturbances by adopting new practices or configurations to maintain the continuity of operations, thus recovering or returning into a desirable state in the long-term (Ahmed and Huma, 2021; Dewald and Bowen, 2010; Meyer, 1982; Ponomarov and Holcomb, 2009). Resilient firms are able to proactively detect signals and patterns emerging from the marketplace (Chadwick and Raver, 2018; Kurtz and Snowden, 2003; Mitroff, 1988; Wieland and Wallenburg, 2012). They are characterized by fast decision-making processes of teams (e.g., speed in the implementation of new tactical plans, more rapid flux of information) (Eisenhardt, 1989b) and greater collaboration in the monitoring of market segments (e.g., sharing of the business objectives across teams) (Vargo and Seville, 2011). Conversely, low resilient firms exhibit rigid governance systems, like autocratic and centralized decision hierarchies (Bourgeois III and Eisenhardt, 1988), and are slowest to adapt to the situation underway.

Previous studies underscore that both agile and lean approaches help to reach higher levels of resilience, especially under uncertain and risky circumstances (Ahmed and Huma, 2021). Notably, leanness improve operational performance in a predictable demand environment by reducing costs and waste, minimizing the lead time for value creation (Ghezzi and Cavallo, 2020; Sharma *et al.*, 2021). Lean firms proactively identify and eliminate non-adding value activities facilitating the systematic improvement of all operational processes’ efficiency (Lee, 2002). However, adopting only lean approaches reduces organizations’ responsiveness to shifting customer demand (Vonderembse *et al.*, 2006). Indeed, when performing in complex and volatile contexts, firms need to nurture agility (Gölgeci *et al.*, 2019; Moi and Cabiddu, 2021a, 2021b), the ability to adjust, adapt, or even reinvent business models in ever-changing environments (Linnenluecke, 2017). Resilience is then the degree to which a firm is agile in overcoming adversities, hence, willing to stay in the market and innovate despite the unpredictable environmental conditions (Weber and Tarba, 2014). Firms with high levels of agility rapidly accelerate their reaction time to market changes (Lin *et al.*, 2006; Overby *et al.*, 2006; Swafford *et al.*, 2006), thus reducing the impact of unpredictable external hostilities (Ivanov *et al.*, 2014; Wieland and Wallenburg, 2013).

Therefore, despite their positive impact on resilience, implementing lean approaches could lead firms to focus on tighter scheduling, whereas agility might be cost-ineffective for firms (Ahmed and Huma, 2021; Al Naimi *et al.*, 2021; Sharma *et al.*, 2021). Furthermore, agility improves the ability to directly respond to the market during uncertainty, while lean works better when demand is stable (Lee, 2002). Hybrid approaches searching for the right combination of both concepts may help create stronger resilience capabilities (Ahmed and Huma, 2021) are still not well developed by the existing literature.

3. Methods

3.1 Research Design

To investigate how adopting agile and lean approaches fosters more robust and resilient responses by firms, we perform a multiple exploratory case study research approach. The chosen method favors addressing “how” and “why” lines of inquiry (Yin, 2003). Moreover, it allows gaining in-depth understanding and holistic empirical insights of complex social phenomena, and detailed contextual information (Eisenhardt, 1989a). Multiple-case study analysis enables also cross-case comparison, facilitates rich theory-building, and improves the generalization of findings (Eisenhardt and Graebner, 2007).

3.2 Research Setting and Case Selection

Our research context is grounded in insights from small and medium-sized enterprises (SMEs), as they have a flexibility advantage in times of uncertainty and economic downturn (Bartz and Winkler, 2016; Dewald and Bowen, 2010; Gunasekaran *et al.*, 2011; Smallbone *et al.*, 2012) with respect to larger firms, which are often slowest to adapt in conditions of high dynamism (Bierly and Daly, 2007; Matthysens *et al.*, 2005). Furthermore, it represents a compelling research setting in which to study resilience, as the recent lockdown of all non-essential businesses due to the Coronavirus pandemic both limited or wholly torn down opportunities for SMEs (Fairlie, 2020).

As concerns the country, we focused on the Italian context, where SMEs traditionally play a central role in the economy (Goodman *et al.*, 2016), contributing to almost 70% of the overall value-added (OECD, 2020b). Furthermore, it represents a compelling case to study this topic as Italy has been one of the first European countries to be forced by the Government to a total lockdown since the first moments of the Coronavirus spread¹.

Finally, to facilitate rich theory building and improve the generalizability of the findings (Eisenhardt and Graebner, 2007; Yin, 2003), we have selected firms from different industries (e.g., IT, services, Hospitality and Leisure), and with a dissimilar digital presence, as we recognized that the Covid-19 pandemic has accelerated the pervasiveness of digital technologies necessary to implement more effective resilience responses (Klein and Todesco, 2021; Rapaccini *et al.*, 2020). We classified firms on the basis of the following categories: Brick and Mortar (B&M), Click and Mortar (C&M), and Click-only (C). The first category of firms (B&M) refers to traditional retail stores (Enders and Jelassi, 2000), namely, companies with a physical presence where it is possible to buy, sell, transfer, or exchange products, services, and information, e.g., a shopping center (Dennis and Sandhu, 2002). The second category (C&M) embraces firms characterized by the integration of the Internet channel into traditional retailers (Bernstein *et al.*, 2008), and uses webpages as an expression of organizational identity (Powell *et al.*, 2016). Finally, C firms are those that only sell on the Internet without a physical store (Mahadevan, 2000). To aid case selection and reach theoretical saturation, we opted for combining a purposive and snowball sampling (Patton, 2002). The theoretical saturation was reached with 13 cases.

3.3 Data collection

We combined and triangulated data from different sources (Eisenhardt, 1989a; Miles and Huberman, 1984). Primary data were collected through semi-structured interviews with the key respondents. The interviewees were representative of their respective firms (Eisenhardt and Graebner, 2007; Yin, 2003), and were chosen because highly knowledgeable about the topic of interest and “able and willing to communicate about it” (Kumar *et al.*, 1993, p. 1634). Involving respondents from different roles (e.g., managers, CEOs, founders) allowed us to triangulate empirical data, thus improving the validity and reliability of our results. Interviews followed an open semi-structured protocol comprised of questions to investigate how organizations perform in a constantly changing and unpredictable business context. The interview protocol was iteratively revised and refined during data collection. During the interviews, further explorative questions were asked to enrich information. A total of 13 interviews were conducted between October-December 2020, lasting between 27 and 54 minutes. The interviews were properly recorded, transcribed, and coded through NVivo 10 software (Bazeley and Jackson, 2013). We stopped collecting data when we reached theoretical saturation (Corbin and Strauss, 2014).

Secondary data were collected through official websites, social networking sites (Facebook, Instagram, LinkedIn), press releases, and meeting notes, covering the period up to March 2021. Table 1 summarizes the information on the overall data collected.²

Tab. 1: Case studies and Data Sources³

¹ <https://www.nbcnews.com/health/health-news/coronavirus-timeline-tracking-critical-moments-covid-19-n1154341>

² The names of the sampled firms and interviewees presented here have been omitted to protect their anonymity (Coffelt, 2017).

Case Description				Primary Data Sources		Secondary Data Sources
# of case	Sector	Firm size	Category	Interviewee	# of minutes	
Case-1	Service	Small	C&M	Manager	30 minutes	<ul style="list-style-type: none"> ▪ Official website ▪ Facebook (347 posts) ▪ LinkedIn (4 posts) ▪ Archival Data (meeting notes)
Case-2	Financial services	Small	C&M	Co-founder	54 minutes	<ul style="list-style-type: none"> ▪ Official website ▪ Facebook (767 posts) ▪ Instagram (95 posts) ▪ LinkedIn (24 posts) ▪ Archival Data (meeting notes)
Case-3	Service	Small	C&M	Founder	30 minutes	<ul style="list-style-type: none"> ▪ Official website ▪ Facebook (269 posts) ▪ Instagram (281 posts) ▪ Archival Data (press release, meeting notes)
Case-4	Service	Small	C&M	Owner	27 minutes	<ul style="list-style-type: none"> ▪ Official website ▪ Facebook (93 posts) ▪ Instagram (44 posts) ▪ Archival Data (press release, meeting notes)
Case-5	Service	Small	C&M	Owner	40 minutes	<ul style="list-style-type: none"> ▪ Official website ▪ Facebook (65 posts) ▪ Instagram (31 posts)
Case-6	Service	Small	C&M	Co-founder	53 minutes	<ul style="list-style-type: none"> ▪ Official website ▪ LinkedIn (8 posts) ▪ Archival Data (meeting notes)
Case-7	IT	Small	C	Director	45 minutes	<ul style="list-style-type: none"> ▪ Official website ▪ Facebook (612 posts) ▪ LinkedIn (6 posts) ▪ Archival Data (press release, meeting notes)
Case-8	IT	Medium	C	Director	46 minutes	<ul style="list-style-type: none"> ▪ Official website ▪ Facebook (9 posts) ▪ LinkedIn (5 posts) ▪ Archival Data (press release, meeting notes)
Case-9	Financial services	Small	C&M	Manager	46 minutes	<ul style="list-style-type: none"> ▪ Official website ▪ Facebook (889 posts) ▪ Instagram (282 posts) ▪ LinkedIn (101 posts) ▪ Archival Data (meeting notes)
Case-10	Service	Small	C&M	CEO and Co-Founder	46 minutes	<ul style="list-style-type: none"> ▪ Archival Data (meeting notes)
Case-11	Hospitality and Leisure	Small	C	Co-Founder	51 minutes	<ul style="list-style-type: none"> ▪ Official website ▪ Facebook (5981 posts) ▪ Instagram (41 posts) ▪ LinkedIn (9 posts) ▪ Archival Data (meeting notes, press release)
Case-12	Service	Small	C&M	Co-Founder	50 minutes	<ul style="list-style-type: none"> ▪ Official website ▪ Facebook (32 posts) ▪ Instagram (24 posts) ▪ LinkedIn (15 posts) ▪ Archival Data (meeting notes, press release)
Case-13	Service	Small	B&M	Co-Founder	30 minutes	<ul style="list-style-type: none"> ▪ Facebook (584 posts) ▪ Instagram (456 posts) ▪ Archival data (meeting notes)

Source: our elaboration

³ We define small and medium-sized enterprises (SMEs) as those firms with less than 250 employees. Notably, a small firm as one with 10–49 employees, and a medium-firm as one with 50–249 employees (see: <https://data.oecd.org/entrepreneur/enterprises-by-business-size.htm>).

3.4 Data analysis and rigor

To conduct data analysis, we followed both inductive and deductive approaches (Kennedy and Thornberg, 2018), proceeding through three rounds of coding, moving from the particular to the general (Saldaña, 2021).

In the first stage of coding, we deeply analyzed the primary and secondary data of each case individually (within-case data analysis) (Eisenhardt, 1989a). We looked for descriptive codes about what kind of practices have been implemented by each firm when dealing with an unpredictable business environment. The outcome of this first stage of coding was a list of descriptive codes from the analysis of each interview (e.g., “building products or services tailored to solve customers’ needs,” “reduction of business frictions).

In the second stage of coding, we checked whether the primary codes could be grouped into a set of cohesive patterns and meanings (Boyatzis, 1998), and looked for similarities and differences across cases (cross-case analysis) (Eisenhardt, 1989a), allowing us to view the data at a higher level of abstraction and creating second-order themes (e.g., “internal flexibility”, “customer engagement”, “business process digitalization”) (Clark *et al.*, 2010).

In the third step, second-order themes were aggregated into overarching dimensions, i.e., agile or lean aggregate dimension, capturing the most relevant and constituent elements to understand agile and lean approaches to resilience (Yin, 2003) (see an extract of the coding process in Table 2).

Tab. 2: Data Coding Tree (selected evidence)

First-Order Codes	Second-order Codes	Aggregate dimensions
<ul style="list-style-type: none"> ▪ Personalization of products and services to client features “We study the customer (...) we must identify (ourselves) with the restaurant, or the doctor, the accountant, or the clothing store” “The winning key is consulting and listening (...) they help you to understand how much time can be invested, therefore if there is real mutual interest, or if there are possibilities of evolution of the product (...)” ▪ Building products or services tailored to solve customers’ needs “We will transform you into a brand by creating a strong identity for you” “The new website has been created (...) making it responsive and adaptable to various computer and mobile media such as iPad and iPhone” ▪ Flat and cooperative organizational structure “From the organizational point of view, the fluidity of a team, the ability to work in synergy with very different experts and personalities is an added value (...)” “Humanly we have been closed each other (...) When tensions arose, we helped each other, talking, explaining, heartening, reassuring” ▪ Transversal competencies involved around common projects “(…) today to carry out a work focused on communication it takes a series of skills, and they are transversal and equally specific skills, therefore, if you want to offer the best (...) there are many specificities that you have to look for (...)” “We create a work team based on his/her project, whose members vary according to the skills required by the project” 	<p>Customer-centric adaptability</p> <p>Teamwork synergy</p>	Agile
<ul style="list-style-type: none"> ▪ Persistent improvement/innovating of products and services to better address new market conditions “2021 will be a year of changes for us: we have revamped the website, so that it resembles more our character and reflects our personality. Because our services have changed to better meet the needs of the market, which are yours” “A circular and recursive process of conception, design, implementation, analysis and reworking, aimed at continuous improvement and growth of your business” ▪ Prototyping new products or services with market tests “(…) plans that in any case are also sustainable, tailored to the customer (...) after the delivery there may be adjustments in the course of work (...) and then the project is closed” ““They are all processes of co-creation of value (...) already from the MPV (...) you have to do it together with potential customers, with a well done market analysis, a study of the personas, a very targeted targeting (...) if you don’t know the need from the inside (...) if you don’t study purchasing behavior, consumer behavior, etc., you are unlikely to insert ... in a poke” 	Continuous testing and experimentation	Lean

Source: our elaboration

Finally, during the cross-case comparison we observed how firms in our sample combined the agile and lean approaches to respond to unforeseen situations. Accordingly, we identified four distinct dimensions characterizing the Lean-agile approach to resilience: “market adaptability”, “cross-functional synergy”, “alertness to ecosystem dynamics”, and “co-created awareness”.

Tab. 3: Lean-agile Approach: Features and Description

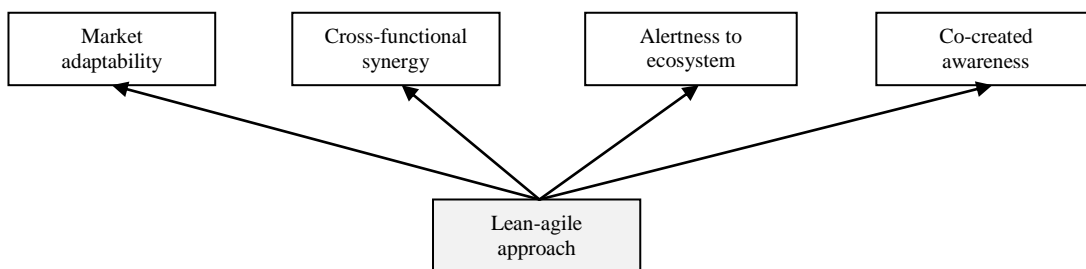
Feature	Definition
Market adaptability	The firm constantly adapts business processes to changing client needs
Cross-functional synergy	Teams across organizational levels cooperate around common objectives and flexibly adjust resources and operations to accomplish new market trends and developments
Alertness to ecosystem dynamics	The firm promptly fine-tunes operations to exploit new business opportunities or cope with unexpected issues from the external environment
Co-created awareness	The firm creates an empathetic connectedness with customers, involving them in all operations and creating an open dialogue about unexpected issues

At each coding stage, we checked the robustness of the research analysis by running a Coding Comparison Query. We discussed the inconsistencies until the Kappa coefficient’s value was above 0.75 (Bazeley and Jackson, 2013). To perform data analysis, we employed numerous tactics to comply with the qualitative criteria of *confirmability* (e.g., triangulating data from multiple sources), *credibility* (e.g., conducting several peer debriefings to clarify the researchers’ interpretation), *dependability* (e.g., conducting data analyses and data coding simultaneously and independently by the co-authors), and *transferability* (e.g., running interviews with strategic respondents) (Lincoln and Guba, 2013; Shah and Ward, 2003).

4. Findings

Our analysis has revealed that implementing combining agile and lean practices via *lean-agile* approach enabled the organizations in our sample to foster more robust and resilient responses to market uncertainty, such as the pandemic crisis underway. In this section, we illustrate the characteristics that comprehensively contribute to defining a lean-agile approach to resilience, namely: “market adaptability”, “cross-functional synergy”, “alertness to ecosystem dynamics”, and “co-created awareness” (see Figure 1).

Fig. 1: The Lean-agile Approach Framework



4.1 Market adaptability

Empirical evidence reveals that, when exposed to market uncertainty, organizations alter their offer adapting their business processes to volatile customer needs. Hence, the first dimension characterizing lean-agile approach is **market adaptability**, which means ensuring customer-values fit, as the firm constantly adapts business processes to changing client needs.

Firms are committed to understand what customers want, and implement, if necessary, any modifications or improvements of products or services to satisfy changing market requirements (Case-1; Case-4; Case-10; Case-13). Therefore, such customer-centric adaptability encompasses

high personalized products and services, attained through a deep and careful listening of the real needs of market demand: *“Customer satisfaction is something that derives from the ethical tension of the company (...) it takes common sense, it takes work ethics (...) Customer satisfaction is obtained not only by taking care of these aspects, but by putting oneself in his/her shoes, trying to follow him/her (...) I have to do what the client really needs, strip myself a little of the entrepreneurial aspect (...) and therefore I can serve him/her in one way or another, I have to find the correct way by mediating the needs of the company”* (Case-2).

Fulfilling changes in customer needs is supported by the digital technologies embedded into business processes. Drawing on such transparent and open relationships, as well as strong technology integration in customer value creation, firms manage to build tailored solutions that reflect customers’ needs and requirements (Case-2; Case-5; Case-11). The use of digital technologies and online platforms simplify and streamline both internal and external operations with a focus on actions that bring real-value to the customer, strengthening the firm’s position on the market as well as the capacity to adapt changes in customer needs. Firms actively grasp and collect detailed information, useful to identify what customers need or expect in that specific moment. Also, they foster an ongoing dialogue with customers through regular meetings to ensure quick updating and evaluate the progress of the initiatives to be taken (e.g., Case-5; Case-7; Case-12). Organizations not only are then open to change, but proactively craft new initiatives or differentiated products or services based on what is best for customers.

4.2 Cross-functional synergy

According to our analysis, another crucial aspect that characterizes a lean-agile approach is represented by **cross-functional synergy**, which implies that teams across different functions and departments cooperate to achieve common objectives and flexibly adjust resources and operations to accomplish new market trends and developments. There is an active and ongoing sharing of information, responsibilities and efforts among people: *“Love means to look in the same direction (...) a solid company is based on the sharing of the same goals by people who work there (...) A winning team is made up of people who work in harmony to achieve a common goal. The common goal of our team is: To offer the best possible financial service to our clients”* (Case-9). Cross-functional synergy enables to create synchronized workflow, and a flat and digital-based structure. Teams including different specialists rely on digital tools (e.g. Trello, Skype, Whatsapp) to share info and updates for mutual reporting about to specific projects (Case-1; Case-3; Case-13). Hence, if a product or service is not appreciated, they study in-depth the reasons behind, so that the necessary re-elaborations can be made to improve it (Case-2). Furthermore, the use of software make communication more reliable and transparent (Case-4; Case-9; Case-10), and enables to carry out and schedule jobs and tasks more effectively (Case-1), contribute to enhance knowledge enhancement and sharing.

4.3 Alertness to ecosystem dynamics

A lean-agile approach is also based on detecting, recognizing, and addressing promptly the new market conditions. This aspect is known as **alertness to ecosystem dynamics**, that we define as the firm’s capacity to promptly fine-tunes operations to exploit new business opportunities or cope with unexpected issues from the external environment. As the Manager of Case-1 explains, *“(...) we reflected not so much on what we were going through, but on what our potential customer could go through, this has pushed to reflect on the proposal of new services that could be linked to responding in a timely manner (...) therefore we have taken care of this approach much more on: ‘You are experiencing this, we offer you this’”* (Case-1). Our findings show how the responsiveness to ecosystem dynamics enables constant market analysis and proactivity in anticipating product development to satisfy actual and potential customers’ current and future needs. Firms do not wait for a change; rather, they engage in anticipating what can be useful for customers (Case-5) through

fast-decision making in response to uncertain business circumstances (Case-8). To seize real-time market requests, firms rely on technologies. Digital tools enable firms to serve clients in multiple ways, and optimize time and resources in proposing quick solutions in line with market changes as firms proactively set what type of efforts are needed to concentrate and focus closely on creating customer value (Case-2; Case-7; Case-11).

4.4 Co-created awareness

Moreover, in our findings, the lean-agile approach was manifested through **co-created awareness**, that implies building in-depth and empathetic relationships with customers. Firms try to create an open dialogue with them when discussing about unexpected issues. The owner of Case-5 explains: *“Surely the relationship with the customer is the first, in the sense that for years we have tried to keep this way of working, creating a direct relationship with the customer who becomes almost a friend, this is because often it is necessary to try to explain some specific issues”*. Moreover, they involve customers in the implementation of all operations. Starting from the design of an MVP (Minimum Viable Product) in which the key features of a product or service are provided, firms rely on customer engagement via customer feedback systems to get market insights and learn about shifts in customer tastes throughout the process of customer value creation (Case-12). Hence, if a product or service is not appreciated, they study in-depth the reasons behind, so that the necessary re-elaborations can be made to improve it (Case-2). Testing and experimentation are enhanced by digital tools, accelerating productivity, improvement, and a flexible value creation process. Without such constant renewal, organizations would not be able to prosper and survive under changing conditions.

5. Discussion and conclusion

In this era marked by the pandemic crisis still underway, resilience has become the new imperative for firms to overcome overwhelming, unexpected events successfully. Our multiple case study-based research has revealed that by combining agile and lean approaches, firms develop stronger resilience capacity to address market uncertainty, turning threats or unforeseen situations into new opportunities for improvement or growth, thus rebuilding competitiveness in innovative ways. Furthermore, effective combination of agile and lean approaches is ensured by embedding a strong digital component within a firm’s strategy and operations.

By conceptualizing the key dimensions of a lean-agile approach, we make several contributions to existing research and practice.

Previous literature acknowledges that organizations may opt for agile and lean approaches when setting their operations under uncertain and risky circumstances (Ahmed and Huma, 2021). With agility, they enhance the capacity to respond rapidly to ever-changing environments, adapting business models to fluctuations in the market demand to create higher value (Doz and Kosonen, 2010; Teece *et al.*, 2016; Weber and Tarba, 2014). Through leanness, firms reduce costs and waste, and eliminate non-adding value activities, thus improving operational efficiency (Ghezzi and Cavallo, 2020; Lee, 2002; Sharma *et al.*, 2021). We contribute to extending previous research by showing that is not necessary to opt for an agile or a lean approach, but the combined adoption of both approaches makes a firm more resilient. Indeed, adopting only a lean approach limits the firm to focus strictly on efficiency, which can be achieved with a stable demand, while agility may be costly for firms (Ahmed and Huma, 2021; Al Naimi *et al.*, 2021; Lee, 2002; Sharma *et al.*, 2021). We argue that considering both approaches simultaneously within the dimensions of a lean-agile approach not only solve the challenges or limits related to each approach taken individually, but also helps create stronger resilience capabilities, renewing business models definitely.

Furthermore, although previous work recognized the important role of both the agile and lean approaches to cope with market uncertainty (Ivanov, 2021; Srinivasan *et al.*, 2020), they fail to

define what could be the main dimensions of a lean-agile approach. By extending prior studies, this work empirically explores the specific features depicting the lean-agile approach to resilience, namely: “market adaptability”, “cross-functional synergy”, “alertness to ecosystem dynamics”, and “co-created awareness”.

We enhance prior literature by adding a crucial insight into the debate of resilience. To recover successfully from challenges, it is necessary not only the combination of agile and lean approaches, but also the presence of a strong digital component. With the outbreak of the ongoing pandemic, we have assisted in the rapid acceleration of technology adoption by firms into business operations (Rapaccini et al., 2020). The empirical evidence of this study highlights that the degree to which lean-agile approach is developed depends on the degree to which digitalization is boosted by firms. Resilience facilitated by the combination of lean and agile approaches was reached by those firms that were equipped digitally.

Managing unexpected events represent a critical challenge for organizations in all sectors. The lean-agile approach that combines lean and agile philosophies, which have seen a strong interest both in the academia and practice, may hold the key to change this tide. With the present study, we provide crucial insights for managers and practitioners that aim at improving their capacity to address unforeseen issues that may put at risk the stability of their core business. In particular, by conceptualizing the lean-agile approach, we assist managers in increasing their resilience to adversities or challenges. We provide crucial advices that will help companies to become both lean and agile and enhance their response to market disturbances. The lean-agile approach that we propose can be used as a diagnostic tool to self-assess the level of lean-agile implementation and design a suitable strategy to be followed in turbulent times. Notably, our framework could increase managers’ awareness towards the path to be taken when exposed to unexpected events, welcoming agile and lean approaches as well as an in-depth digital transformation of business operations to move to higher levels of resilience. Given the entrepreneurial fabric mainly composed of SMEs, this work may represent guidance for such type of firms, encouraging a definite shift towards technological improvement and organizational structures with flat ownership, a faster sharing of information, and a customer orientation based on the value creation structure.

Although we believe that our research can contribute to advance the understanding of how firms should develop lean-agile approach to resilience, we acknowledge that our work owns some limitations.

From a methodological perspective, this study analyzed firms and their responses to crisis in a limited period of time, i.e., adopting a cross-sectional design. Future research may extend the data collection period and observe the lean and agile resilience responses and their changes longitudinally.

Moreover, using an inductive approach limits the generalization of our findings; hence we suggest extending the investigation of this topic to other types of firms based on their size or country of origin. We also encourage future empirical validation and testing of the proposed framework. It would be interesting to test this framework and develop appropriate measurement scales of the resilient agile and lean approaches.

Finally, our research has shown that digitalization plays a critical role in the adoption of lean-agile approaches. Thus, future research may expand this study, for example by asking whether the timing of digital adoption (before a crisis or during a crisis) influences the response of firms to resilience.

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A management profile for ethical choices - A *model* to test an «organizational system» based on the Legislative Decree No 231/2001[♦]

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Abstract

Framing of the research. The work focuses on the relationship that more and more seems to emerge among «company organization» and the safeguarding of some «fundamental values», as, for example, environment or health, that concerns the «ethical dimension» of the question.

Purpose of the paper. The paper aims to investigate the contribution made by some rules and laws, in particular the Legislative Decree No 231/2001, in the business context and their role to develop business platforms that can foster «sustainable development».

Methodology. The hypothesis was tested on a sample of data from a survey administered to managers of public and private Italian companies. The proposed approach is based on models that are simulated employing a «structural equation modeling».

Results. The «goodness indices» of the model have shown that an «organizational system» that contemplates tools, levers and rules, such as those envisaged by artt. 6-7 Legislative Decree No 231, represents a set of «ppractice» able to induce the management adopting «ethical behaviors».

Research limitations. Some limitation of this work deals with the uncertainty that surrounds the judicial assessment of the MOG ex art. 6-7 of the Decree, and the tendency of judges to conclude for a “structural organizational negligence “ of the company when an offence has been committed. The risk is that this uncertainty will act as a counterthrust to the virtuous mechanism introduced into our legal system by Decree No 231.

Managerial implications. The results contemplate a series of practical managerial implications such as the adoption of principles of conduct, procedures, protocols, operating instructions, delegations and powers of attorney and, more generally, of company rules, which must govern all the conduct of company staff in the daily work (i.e., hiring processes, conducting in public tenders, invoicing preparation, and so forth).

Originality of the paper. The research is developed following an interdisciplinary approach aimed at analyzing some aspects of the issue of the compliance, both from a management, organizational and legal perspective.

Keywords: Legislative Decree of 8 June 2001 No. 231; Corporate social responsibility; Carroll's pyramid; Causal models; Structural equation modeling (SEM)

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1. Introduction

For a long time, the widespread belief was that the company's main task was to serve its shareholders economic interests. As time passed, a strong link has emerged between «company organization», interests of third parties and «sustainable development». ». It is not a coincidence that in the academic literature, «corporate social responsibility» (hereafter CSR) has established itself as a conceptual paradigm, which has evolved into the belief that the primary responsibility of business is to create «shared value» (Latapí *et al.*, 2019). This is evidenced by the growing interest in both teaching and research about business ethics topics of business schools (Matten and Moon, 2004), although the theoretical concept is often debated, also because empirical studies only involve limited aspects (Lindgreen and Swaen, 2010).

Going further, one can go so far as to state that the study of CSR, with reference to *sustainable development*, is becoming an area of great interest on an interdisciplinary level, although it is still recent and not fully studied, as shown by in-depth bibliometric analysis using *CiteSpace* software (Ye *et al.*, 2020). Going even further, it can also be said that the emergence of the ethical dimension of doing business has led to company organisation being one of the key intersection areas between *economics* and *law* (Manacorda, 2012; Pasculli, 2013). This convergence has even gone so far as to involve the branch of criminal *law*, which was traditionally applied just to *natural persons and not to companies as such*.

In other words, there has been and there is a progressive intensification of the relationship between «company organization» and the safeguarding of some «fundamental values», as, for example, *environment* or *health*. This represents the «ethical dimension» of the business activity, which is closely related to the CSR and, as far as we are concerned here, to *Legislative Decree No. 231 of 2001* too (Manacorda, 2007).

When we talk about «CSR» we usually refer to a series of optional «measures» that companies decided to adopt, and which express a virtuous approach in doing enterprise. CSR is strictly connected to the issue of «corporate organization» and «sustainable development» whenever it results, for example, in the adaptation by companies to technical standards aimed at respecting «valuable assets» such as the *health* and *safety of workers* or the *environment* (Riverditi, 2010). We will see below that *Legislative Decree No. 231/2001* also fits into this reasoning. This *decree*, in fact, has aspects that differentiate it from CSR but also aspects that bring it very close to CSR and which gives it an ethical dimension. It is no coincidence that at the end of this paper the entrepreneur's choice to adopt the measures provided for in the *Legislative Decree No. 231* (the MOG) will prove to be a criterion for identifying ethical management.

It is worth mentioning the CSR *framework* introduced by Archie Carroll (Carroll, 1991), the *pyramid of social responsibility* (hereafter *pyramid*). The model offers an overall reading of the *ethical question* in the broader vision that considers the fundamental *economic aspects* as well as the *legal* and *philanthropic* ones. Thanks to the Carroll Model, the nature of *Decree No. 231* and its connection to ethical business management will be better investigated and clarified.

The concept of *economic performance* is at the bottom of the *pyramid*; Carroll denoted this level with the motto «be profitable». «Obeying the law» is the motto denoting the next level of the *pyramid*, since business is expected to represent the codification of *acceptable* and *unacceptable* behaviors of society. «Be ethical» is the third level of Carroll's *pyramid* and translates the obligation to do what is right. «Be a good corporate citizen» represents the highest level of the *pyramid* produced by the vision of the American scholar, according to which the company is expected to provide financial and human resources to the community, contributing to improve its quality of life (Carroll, 1991).

Two aspects of Carroll's *model*, among others, are worth highlighting. First, the *pyramid*, apart from the level of the *law*, distinguished by the *motto* «obeying the law», represents a case of «voluntary behavior». In other words, it is not imposed by *law* and its omission does not imply a sanction. It is therefore more plausible to speak of «sensitivity», or «social attention», rather than

responsibility (Riverditi, 2010). The second aspect worth highlighting, is that Carroll's pyramid demonstrates that the idea of a business that is not a slave to profit struggles to assert itself.

Business *management* is increasingly aware of the importance of CSR and *ethical choices*, also motivated by the number of *tools* (e.g., board of directors, organization actions), *levers* (e.g., cultural) and *rules* (e.g., protocols, certifications, law decrees) that are available. However, management has a hard time identifying the set of *best practices* to adopt within the organization of the company. For instance, they have been proposed changes on the priority of the levels of Carroll's *pyramid*, arguing in favor of the primacy of *economic responsibility*. Some scholars have highlighted the importance of *ethical responsibilities*. Carroll, however, supports the idea that the concept of «ethics» permeates its pyramid (Carroll, 2016).

This paper aims to investigate the contribution made by the *Legislative Decree of 8 June 2001 No. 231* (hereafter *Leg. Decree No 231*), in the business context and its role to develop a business support that can foster «sustainable development» (Gios, 2022; Baccarani and Golinelli, 2011; Baccarani and Golinelli, 2013).

The *working hypothesis* is that an «organizational system», which, for example, is based on *tools*, *levers*, and *rules* such as those introduced above (e.g., *board of directors*, *anti-corruption protocols*, *SA 8000 certification*, dissemination of a marked *culture of ethics*), and that adopts protocols such as those envisaged by artt. 6-7 of the *Leg. Decree No 231*, it would favor «codes of conduct», on the part of management, with the possibility of adopting «ethical behaviors», such as, for example, «look for new markets to abandon markets that are recognized as ethically compromised», or «support higher costs for environmental prevention and land conservation, even when it is not mandatory by law», and so forth.

Such a *conceptual framework*, as outlined above, requires an in-depth study of the *Leg. Decree No 231*, starting with the reasons that led the legislator to issue it. Indeed, among the *tools*, *levers*, and *rules* mentioned above, the *Decree No 231* has a particular relevance both because (in the part where it punishes violation of the law) it is mandatory, and because it concerns a very wide range of companies (all private companies and public economic entities). It also requires a specific investigation because it represents two levels of Carroll's pyramid: «obey the law» and «be ethical». This double soul requires an explanation, which will be provided below. This explanation will show precisely that the *Leg. Decree No 231* can be placed not only on the second level of *Carroll's Pyramid*, but also on the third level. Indeed, we will understand that the ethical dimension of the *Leg. Decree No 231* is not debatable.

The paper is organized as follows. In Section 2, *Leg. Decree No 231* is introduced. In particular, the Section discusses, albeit briefly, the context in which it was born and the reasons that led the legislator to enact it. Its main pillars will also be introduced, as well as its implications for the spread of a *culture of legality*. The Section concludes by trying to outline a brief *conceptual framework* of good *organizational practices*, useful for company management, which can be given by *Leg. Decree No 231*. Section 3 introduces a *computational model* where the *Leg. Decree No 231* is read in context with other *tools/levers*. The model represents a preliminary attempt aiming at easy the adoption of *Leg. Decree No 231* and clarify, to management, the «organizational model» to be adopted to favor a «code of conduct» inspired by «ethical behaviors». The approach proposed in this Section is based a *structural equation modeling*. Section 4 outline the conclusion also highlighting the limits of the proposed work.

2. Beyond the dogma *societas delinquere non potest*: the *Legislative Decree No 231*

The *Leg. Decree No 231* starts from the assumption that the company, with its *organization*, may in certain cases facilitates the crime or, even, that it represents the means, let's say the tool, for committing crimes. To prevent corporate crime, the *Decree No 231* introduces a direct corporate responsibility and, at the same time, stimulates a business ethics culture precisely to avoid this pathology. Therefore, as said, it partly overcomes the dogma *societas delinquere non potest*,

introducing a new liability dedicated to companies (De Simone, 2012). This first part of the *Decree* expresses the motto «obey the law» or you will be punished and it belongs to the second level of the *Carroll's pyramid*. Nevertheless, within the same *Leg. Decree No 231*, the legislator establishes that if companies are able to prove, in the criminal trial, that they had adopted an «internal organization» to prevent the crimes listed in the *Decree* by artt. 24 ff. (e.g., Modello di organizzazione, gestione e controllo or “MOG”, envisaged by art. 6-7), then they can be exempted from sanctions. This point combines (criminal) law, business organization and ethics and expresses the motto «be ethical» so as to place the *Decree* on the third level of the *Carroll's pyramid*.

Wanting to draw a parallel with CSR, as mentioned above, the *Leg. Decree No 231* differs from other CSR measures as it holds companies responsible for the crimes listed by *Leg. Decree No 231*, when they are committed by an employee or by a top manager of the company itself, in the interest or for the benefit of the company itself (art. 5).

However, there is a strong connection with CSR in so far as the *Decree* grants the company impunity if it organizes itself in preventively in order to safeguard and guarantee «fundamental values», such as, for example, *health, environment, public economy, good performance of the public administration, adequate working conditions* from the wage point of view, economic interest (also of the EU), and so forth. The *Decree* provides “enhanced” protection for these values: if the company doesn't adopt compliance programs (i.e. “MOG”) and these values are harmed, then the company can be convicted.

The main principle is: the top management must assess the risks for external values, such as environment, health and so forth, and organize the company to eliminate, or at least reduce, these risks. Herein lies, as we shall see, the ethical dimension of the *Decree* and the point of convergence with CSR.

2.1 The Legislative Decree No 231 and the differences with CSR: a partial view

Probably, given the strong affinities with the *good practices* contemplated by the CSR, it is worth highlighting some specificities to which legal scholars like to draw attention (Riverditi, 2010), to differentiate the *Leg. Decree No 231* from the canonical actions contemplated by the CSR.

Indeed, even if only at first glance, the ethical dimension of *Decree No. 231* may be questioned drawing, again, a parallel with the CSR. From this perspective, it makes sense to mention that *Leg. Decree No 231* aims to avoid crimes (i.e. offences against fundamental interests which the law severely punishes). Therefore, at a first glance, it does not require companies to do anything else other than what is required by law, unlike contemplated by some CSR models such as *Carroll's pyramid*.

In addition, the whole *Leg. Decree No 231* is supported by legal institutes that encourage companies to adopt «organizational systems» based on respect for legality, in order to obtain legal benefits: from the exemption of liability to various discounts on the sanctions.

Therefore, the logic of cost-benefit analysis is at the core of the *Decree* (Riverditi, 2010; Arcuri and Pardolesi, 2002; Montani, 2005). Indeed, the choice for virtuous conduct (i.e. adopting an internal organization to safeguard fundamental assets) may depend on the relationship between utility achieved and utility expected (Riverditi, 2010). In other words, looking at the discipline of *Decree No. 231*, the adoption of ethical models might not be entirely spontaneous as would be required by the CSR.

2.2 The pillars of Legislative Decree No 231: ethics and business culture

What has been said so far does not imply that the *Leg. Decree No 231* and its compliance system have no ethical implications; far from it. The attempt to address «ethical issues» is the reason why the Italian legislator has chosen to adopt this model of discipline (Santoriello, 2015; Assumma, 2021). In other words, the intent of the legislator was to stimulate an «ethical business culture» by adopting a sanctioning/punitive perspective. Indeed, the rationale of the *Decree* is to stimulate the

respect for legality and therefore for all the values involved in economic activity, even if they represent an obstacle to profit. The ultimate goal is the development, within the companies, of ethical models suitable to fight daily, bit by bit, the «culture of deviance». This stimulus to the adoption of virtuous organizations comes through a series of legal benefits promised to companies that adopt the MOG, such as impunity. After all, according to some literature, the ethical dimension of doing business has positive effects on business itself. In this sense, taking up the adjoining case of the CSR again, there are those who have pointed out that the latter, when exercised towards external stakeholders, influences organizational performance and corporate social responsibility reporting (Adnan, Hay, van Staden, 2018)

2.3 Tools, levers, and protocols: Legislative Decree No 231 and organizational rules for company's management

If it is true that the *Leg. Decree No 231*, along with the *anti-crime management systems* mentioned above, requires compliance with criminal law (i.e., *rectius do not commit crimes*) and no more, then it is also true that companies are strongly stimulated to provide procedures, protocols and rules that govern all the conducts of company personnel such as, for example, *hiring processes, conducting in public tenders, invoicing preparation*, and so forth, and which together form the MOG.

In other words, companies are required to adopt internal organizational rules that require active, transparent and correct behaviors from company staff in carrying out its tasks. In this perspective, the compliance with *Decree No 231* translates into «ethical» organization, which goes far beyond the mere respect of criminal law. The MOG's rules, in fact, impose correct and transparent behavior at stages where the dilemma 'I obey or I break the law' does not yet arise. They are in fact stages of activity that represent spaces still free from the law. The company must do much more than just to not violate the criminal law: this *Decree* push to allow the emergence of *organizational systems* that can foster respect for *fundamental values* (Paliero, 2008; Paliero and Piergallini, 2006) that can support a sustainable development (Ye *et al.*, 2020).

In addition, the MOG represents a tool helping companies to abide by the «ethical principles» set forth in the «ethical code» adopted by the company. This aspect highlights the link between «compliance» and «ethics», demonstrating that these compliance systems, indisputably, aim at the diffusion and rooting of a culture of legality.

Lastly, it is important to point out that is not mandatory to adopt the MOG: its non-adoption is not sanctioned. In other words, even though it may be convenient once the offence has been committed (this in order to enjoy exemption from liability), adopting the MOG remains a free choice of the company. In other words, the company may choose to adopt the MOG and in so doing may choose to adhere to the motto «be ethical».

3. A management profile for ethical choices: thought experiment and causal model

3.1 Method

The model discussed in the following aims to investigate *levers, tools and rules*, such as the *Leg. Decree No 231*, that may favorite a set of «good practices» for the management who want to be guided by «ethical choices», as supported by Carroll in his work (Carroll, 1991), according to the overall objective is managing with «stakeholders in an ethical or moral fashion».

The goal of the this *experimental setting* is to verify if these *tools/levers/rules*, on the whole, could have trigger a solution to the «ethical dilemma», characterized by the emergence of *attitudes* towards a «moral management» *profile*, that inspires decisions that can be placed in the highest part of the Carroll's *pyramid*, those marked by the mottos «be ethical» and «be a good corporate citizen», which captures the idea of *philanthropic responsibility*.

In summary, the *model* aims to test whether a *management profile* is «reflected in» *rules* such as *Leg. Decree No 231* or *190*, *tools* (e.g., *board of directors*) and *levers* (*SA 8000*) can induce *ethical choices* «reflected in» decisions such as «choose not to withhold earnings to avoid laying off some employees», or «support higher costs for environmental prevention and land conservation, even when it is not mandatory by law», or «apply safeguards to reconcile work/family action».

To this end, a simulation (Cohen, 2005; Mach, 1897), conducted by means of *Structural Equation Modelling* (SEM), has been performed (Kyriazos, 2018). In other words, SEM was employed to verify the plausibility of a *model* that represents, in turn, an «ethical dilemma» useful for company's management during its *decision making*. As known, when employing SEM, the relationship among the *constructs* makes the so-called *structural model*, which, together with the *measurement model*, generated by the relationships between *indicators* and *constructs*, generates the SEM. For instance, in Figure 1, the arrow that starts from the *construct* «organizational system», the *cause*, is directed towards the construct «codes of conduct», that is the *effect*.

3.2 Data

The *dataset*, which comes from a survey run among Italian managers, through the period of time among February 2015 and October 2015, is made of 149 observations, and it is described by 72 variables. During the pre-processing step, 5 variables have been deleted because they were incomplete and with noise, so the final number of variables amounts to 67. The answers were given on a *Likert scale* from 1 to 7, in which 7 represents the highest degree of adhesion between «ethics» and related concepts.

Table 1 shows a selection of 9 *response variables* of the dataset. Those shown in the left column of the table are the variables in which the «organizational system» is «reflected in», while the one on the right are the variables «reflecting in» «code of conduct», the second *construct*, representing the management choices, and triggered by the previous one.

3.3 Simulation and results

The *working hypothesis* is that an «organizational system», represented in the *model* as a *construct* based on *tools*, *levers*, and *rules* such as the *board of directors*, *anti-corruption protocols*, *SA 8000 certification*, *culture of ethics*, and the *Leg. Decree No 231*, it would favor a «code of conduct», on the part of management, which adopts «ethical behaviors», such as, for example, «look for new markets to abandon markets that are recognized as ethically compromised», or «support higher costs for environmental prevention and land conservation, even when it is not mandatory by law», and so forth.

Let's recall that, in terms of SEM, the *working hypothesis* is that when the «organizational system» *construct*, «reflected in» the variables of the left side, is active, then it can «trigger» the *construct* «code of conduct» that is «reflected in» the variables reported in the right part of Tab. 1.

Tab. 1: Response (observable) variables and constructs involved in the «thought experiment»

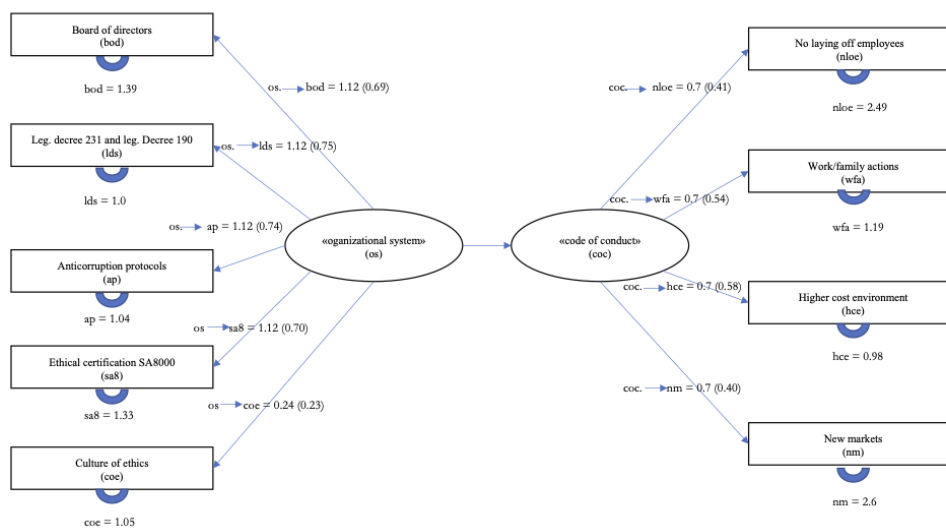
Board of directors	«Organizational systems» (construct)	«Code of conduct» (construct)	Choose not to withhold earnings to avoid laying off some employees
D.L. 231/2011 on corporate responsibility and 190/2012 for public administrations			Apply safeguards to reconcile work/family actions
Application of laws/guidelines anti-corruption protocols			Support higher costs for environmental prevention and land conservation, even when it is not mandatory by law
Ethical certification SA 8000			Look for new markets to abandon markets that are recognized as ethically compromised even if they are at a high profit
Organizational actions to spread the culture of ethics			

Source: our elaboration

Figure 1 depicts the model that is simulated through SEM. Model's aim is evaluating the contribution of *tools*, of a «regulatory nature», at different levels, starting with the adoption of *best practices* at the corporate level (i.e., «*organizational actions to spread the culture of ethics*»), to pass to any protocols and/or certifications (i.e., «application of laws/guidelines anti-corruption protocols» and «ethical certification SA 8000»), up to the point of evaluating the specific contribution of law decrees (i.e., «the D.L. 231/2011 on corporate responsibility and 190/2012 for public administrations»).

The goal of the *experiment* was to verify if these *tools*, overall, could have trigger a «code of conduct», characterized by the emergence of *attitude* towards a «moral management» profile, the highest of Carroll's pyramid, marked by the *motto* «be a good corporate citizen», which captures the idea of *philanthropic responsibility*.

Fig. 1: SEM model that explains the relationship among the «organizational system» construct and the triggered «code of conduct»



Source: our elaboration

Table 2 reports the «goodness» of the model represented in Figure 1. Results show that proposed model «explains» the *causal* relationship among «organizational system» and «code of conduct» constructs, since the scores of all the fundamental *indices* reach the highest admissible values (column of *reference scores*).

Tab. 2: goodness of the model of Fig. 1

Fit index	Score	Reference Scores	
		Good	Acceptable
χ^2/df	1,157	$0 \leq \chi^2/df \leq 2$	$2 \leq \chi^2/df \leq 3$
CFI (Comparative fit index)	0.96	$0.97 \leq NFI \leq 1.00$	$0.95 \leq NFI \leq 0.97$
TLI (The Tucker-Lewis coefficient)	0.956	As close as possible to 1	
RMSEA (Root mean square error of approximation)	0.044	$0 \leq RMSEA \leq 0.05$	$0.05 \leq RMSEA \leq 0.10$

Source: our elaboration

Sustainability policies, such as the «ethical certification SA 8000», and that emerge from the model of Figure 1, are consistent with the work carried out by (Murmura *et al.*, 2017), which showed how companies adopted this *standard* in order to increase their relations with external stakeholders and with the internal working environment. Some authors show the importance of other CSR *tools* and *sustainable policies* such as the D.L. 231/2011 on corporate responsibility and D.L. 190/2012 for public administrations, whose relevance is also highlighted by other literature

(Lombardi *et al.*, 2019). Other two *indicators* «reflect in» the «organizational system» *construct* of Figure 1, that are the *board of directors*, and *organization action to spread the culture of ethics*. As regarding the former, (Lombardi *et al.*, 2019) showed its role in both for adopting and applying legislation, also considering *the Leg. Decree 190/2012* and the “*Leg. Decree No 231*”.

On the whole, the *experiment* reproduced in Figure 1 demonstrates the possibility of having a «code of conduct», on the part of management, which can favorite the adoption of «ethical behaviors», such as, for example, ok for new markets to abandon markets that are recognized as ethically compromised», or «support higher costs for environmental prevention and land conservation, even when it is not mandatory by law». Since the SEM model adopted is a «reflective», as well known, unlike the «formative» approach, in the *reflective* approach all indicators have equal dignity, that is, they are all necessary for the *construct* that, in this case, «organizational system». Obviously, the «organizational system» *construct* reflected in the indicators of the Figure 1 is only one of the possible models that can emerge. The proposed organization model, as a whole, is a working hypothesis, confirmed by the simulation, capable of activating a management «code of conduct» that solves the dilemmas reported on the right side of the model by adopting a moral management profile. In other words, a management that favors «no laying of employees», «work/family actions», «higher costs to safeguard environment» and «looking for new market» if the old one is compromised.

4. Conclusion

The paper aim was to investigate the contribution of some *tools* and *laws*, in particular the «*Leg. Decree No 231*», in the business context and its role to develop a set of *best practice* that can foster «sustainable development».

The hypothesis was that an «organizational system» based, for example, on *tools*, *levers* and *rules* such as *board of directors*, the *SA 8000 certification*, and that adopts protocols such as those envisaged by *Leg. Decree No 231*, it would favor, on the part of management, «codes of conduct» able to induce «ethical behaviors», such as, for example, «look for new markets to abandon markets that are recognized as ethically compromised», or «support higher costs for environmental prevention and land conservation, even when it is not mandatory by law», and so forth.

The hypothesis was tested on a sample of data from a survey administered to managers of public and private Italian companies. A *Structural Equation Modelling* was used for verification. The «goodness indices» of the model have shown that the working hypothesis is extensively verified on the available data. Otherwise said, an «organizational system» that contemplates *tools*, *levers* and *rules*, such as *Leg. Decree No 231*, represents a «platform» able to induce the management adopting a conduct that contemplates different «ethical behaviors», such as those listed above.

As noted above, *Leg. Decree No 231* stimulates sustainable business activity by encouraging companies to organize themselves in order to avoid offending fundamental values. This is achieved by following two strategies: on the one hand, the threat of severe sanctions, in the event of conviction for listed offences committed by an employee or by a top manager of the company itself, in the interest or for the benefit of the company itself; on the other hand, the promise of the exemption from liability if companies adopt and implement a valid MOG before the crime.

The decision whether to adopt this form of virtuous organization (i.e. the MOG), is up to the company and it is aimed at avoiding risky situations in compliance with the code of ethics. This decision can therefore express a real choice for a business model that is not only law-abiding but also ethical, interested in establishment a legality mindset. Moreover, staff training, based on ethics and legality, is an essential part of the MOG-231. More generally, this decision involves principles of conduct, procedures, protocols, operating instructions, delegations and powers of attorney and, more generally, of company *rules*, that govern all conducts of company staff in the daily work such as *hiring processes*, *conducting in public tenders*, *invoicing preparation*, and so forth.

Some limitation of this work include the uncertainty that surrounds the judicial assessment of the MOG *ex art.* 6-7 of the *Decree*, and the tendency of judges to conclude for a «structural organizational negligence» of the company when an offence has been committed. The risk is that this uncertainty will act as a counterforce to the virtuous mechanism introduced into our legal system by *Leg. Decree No 231*. In fact, companies incur considerable ‘costs’ in order to comply with this *Decree*: economic, organizational and management costs. We simply need to think at the duty often imposed by the MOG-231 to refuse an important investor if the latter does not pass *cum Laude* to the company’s examination (legality screening) usually set by MOG’s internal organizational rules aiming at preventing serious offences, such as «criminal association» listed by *Decree No. 231*. The frequent rejection of MOG by judges may therefore discourage companies from incurring these costs, even if they wish to be virtuous.

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To be ethical let's think Bayesian

A case study from management[♦]

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Abstract

Framing of the research. *Management deals with actions/decisions such as, for example, «supporting higher costs for environmental prevention and land conservation, even when it is not mandatory by law». What are the «conditions» that could favor these types of choices, which, as «common sense» suggests, are to be considered «ethical behaviors»? The existence of a range of tools (e.g. board of directors), levers (e.g. social example of direct manager) and rules (e.g. protocols, certifications), is challenging for the management that aims to select «ethical behaviors», perhaps in the form of «best practices, which are useful for running its business, just as the «common sense» of the manager or entrepreneur sometimes suggests.*

Purpose of the paper. *The scenario depicted above gives an idea of the importance of having methodology, as rigorous as possible, capable of allowing an overall assessment of various tools, levers, and rules. The introduction of this kind of methodology, and some preliminary experiments, is the purpose of this work.*

Methodology. *The methodology is based on «Bayesian belief networks», an implementation of the Bayesian paradigm. Starting from data collected through surveys, representing management's perception, it is possible to update beliefs and generate suggestions of «ethical behaviors», proposed in the form of simple heuristics.*

Results. *The emerging conceptual framework shows how, starting from a series of beliefs, belonging to the «common sense» of management, can emerge «conceptual maps» of belief and behaviors, under the form of «heuristics», data-driven, that can support management in its daily decision making.*

Research limitations. *The proposed methodology needs to be verified with managers decision making while acting in their daily workplace.*

Managerial implications. *The proposed models, readable in the form of simple «heuristics», may play a chief role for education and training purposes and work as reference best practice for human resource management units during the hiring processes.*

Originality of the paper. *In a nutshell, in the case dealt with in this paper, we could say that the paradigm introduced would allow us to have a method that, starting from the ethical management of common sense, would pass to the ethical management based on evidence, of which the common sense is the custodian.*

Keywords: *Management ethics; Common sense; Ethical dilemma; Causal models; Bayesian belief network; Experimental thoughts.*

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1. Introduction: let's start with *common sense*

What does it imply to «be ethical» in the management of a business? In principle, as it is known, *ethics* deals with what is *good* and *evil*, or *right* and *wrong*.

In the case of *management*, these principles have the role of supporting the guidance and governance of the actions of people and/or groups, such as, for example, *behavioral rules* that can guide managers in their daily actions. And the «belief» that the interests of *shareholders* and other *stakeholders* no longer represent the company's only priorities has become «common sense». They are increasingly important, at least in the *common sense* of management, *attitudes* and *best practices* that take account of *customer relations*, adopting «values» such as *integrity*, *compliance* with *organizational expectations*, helping colleagues to cope with *ethical dilemmas*, or seeking the advice of others.

One of the objectives of *ethics*, applied to *management*, for instance, is to treat employees and customers *fairly* and *equitably*, with the aim of promoting an improvement in the business. Adherence to such a type of *business management* can also have the effect of stimulating the motivational climate of the work environment. Acting «ethically», when applied to business daily, implies, first, *respecting the law*, interacting with others *honestly* and without being *deceptive*.

Since companies have different *ethical standards* from each other, the management supports, more and more, to increase the sharing of the standard, under the form of an *unwritten code* or that of a *real document* (i.e., *written code*) shared within the business context.

Companies, increasingly aware of the importance of having «codes of conduct», sometimes written in the wake of some form of scandals, come to consider it so important that they update it periodically, sometimes on an annual basis. After updating their *code of conduct*, all staff of the company should read it so that they can make it their own, and adopt it in their *individual conduct*, when operating in the company or on its behalf with external stakeholders.

As mentioned above, the ethical component, in practice, concerns most of the decisions taken daily, both in public and private environments. And this is a fact well known to managers, who are called to set a good example for other employees. It is precisely this *attitude*, on the part of managers, that can stimulate other employees to follow a similar conduct. To foster this type of climate, more and more companies are resorting to *training programs* for their managers, both in-house, in the case of large companies, and outsourced, for companies that cannot satisfy these paths with their own internal units of *human resources*. It is a fairly canonical practice that companies offer managers training courses in *ethics*, even before being hired. Indeed, sometimes the hiring of the manager is even conditioned to the success of the training course attended.

Common sense is equipped when called upon to answer about what «ethical behaviors» are, as already mentioned above. For example, manager's *common sense* knows the case when can speak of «integrity behavior», in other words when exhibiting *personal honesty* and *courage* in making their own decisions. When managers are asked to exhibit «fairness», they know that this behavior contemplates a *tolerant attitude* and being *open to diversity*. Managers also know well how important it is to have «reliable behavior», that is, keeping *promises* and *commitments*. Managers and executives know how important it is trying not to *deceive* their interlocutors with *half-truths*, *omissions*, or other *underhanded means*. In other words, it is well known how important it is assuming an «honest behavior». When in their business practices managers follow state rules and laws, they know the importance of a «lawful behavior». *Respect* and *dignity* for one's interlocutor are two criteria that managers adopt, regardless of *gender*, *race*, or *ethnicity*, when they know the importance of a «respectful behavior». Many managers know well how important the other person is, even if they are not a direct collaborator (stakeholder) of their company. In other words, they know when it is important their willingness to *help people in need*, or that they achieve their business goals, causing *minimal damage* to people and property. In a nutshell they know the importance of «kind behavior».

Companies, even the smallest ones, and their management, have become so aware of the importance of *training* and *education* in ethical content that, by now, *training programs* centered on ethical issues for management are increasingly in demand.

Unfortunately, relying on *common sense*, even if it represents the starting point, and as such is should be always requested and welcome, for the daily management of a business *common sense* is not always enough. This is also true in the case of small businesses, where the owner's example can be more easily imitated, as the absence of complexity in the organization of the business allows for easier dialogue between entrepreneurs and collaborators. Even in such cases, however, it is becoming increasingly important to codify the «best practices» of *common sense*, so that the various *stakeholders*, both internal and external to the company, can interact through shared «codes of conduct» capable of favoring an activity more «sustainable» from a *social, economic, and environmental* point of view.

Section 2 introduces some proposals for models born as responses to the need to systematize and interpret good «ethical practices» that emerge from management's «common sense». First mention is made of *Carroll's pyramid* model. Then there are models inspired by Carroll's proposal, but which try to consider situations of everyday life in which the manager is called to decide (i.e., *ethical dilemmas*). As we will see, in this case the possibility of having data capable of capturing the «perception» of managers with respect to «ethical behaviors», or in any case considered as such, and how they could have given rise to more or less «sustainable choices», is of crucial importance (i.e., «I choose not to take profits to avoid firing collaborators»).

The simplicity of these interpretative models, according to the literature cases cited, also shows benefits when they must be adopted in management *training programs*. Section 3 proposes a preliminary experiment that tries to tackle a methodological problem. Starting from the examples of *common sense*, briefly mentioned above, it is understandable that the «perception» of ethical issues and the related behaviors to be adopted can change over time. A manager may perceive a «kind behavior» or an «integrity behavior» in a different way, perhaps because his set of *beliefs* has changed or because objective situations have changed, due to the introduction, for instance, of new *laws, regulations, or protocols*. In this case, it is necessary to update the *beliefs* and related «rules of conduct» based on new evidence. And here the solution proposed with the preliminary experimentation comes into play. Starting from data collected through surveys, it is possible to update *beliefs* and *behaviors*, proposed in the form of simple *heuristics*, using *Bayesian belief networks*, part of the broader homonymous *paradigm* proposed, for the first time, by the Reverend Thomas Bayes. Finally, Section 4 draws the conclusions, considering both the brief, and by no means exhaustive, literature cases of Section 2 and the preliminary results of the methodological approach of Section 3.

2. Beyond «common sense»: pyramids, experimental thoughts, and their simulations

According to several scholars, from different disciplines, to overcome the current systemic crisis, it should be rethought the relationship between *economy* and *society*, based on the recovery of «ethical values». This vision has favored the affirmation of *corporate social responsibility (CSR)*, an area of «social conduct», which inquiries about *ethical implications* within the strategic vision of the company.

Companies can engage in CSR conduct for *strategic* or *ethical* purposes. According to the first point of view, the goal is, on the one hand, to increase *profits* in the long term, and, on the other hand, to strengthen stakeholder *confidence*. As regards the second point of view, however, the *ethical* one, companies could adopt CSR *policies* and *practices*, thanks to the ethical convictions of the management, such as, for example, in the case of a CEO who considers the damage to the environment ethically questionable.

What just mentioned above, can give an idea of the close connection between CSR and *business ethics*, the part of *applied ethics* that examines the *ethical principles* and *dilemmas* that emerge in the business environment.

2.1 The pyramid

The *pyramid of social responsibility* of Archie Carroll (Carroll, 1991), is an attempt to reorganize the «foundational» aspects of the CSR. The chief point of Carroll's work is the vision of «pyramidal structure» according to which CSR is organized. At the bottom of the *pyramid* is the concept of *economic performance*, named «be profitable». The *motto* of the next level of the *pyramid* is «obeying the law». «Be ethical» is the third level of Carroll's *pyramid* and translates the obligation to do what is right. «Be a good corporate citizen» represents the highest level of the *pyramid* produced by the vision of the American scholar. This last concept captures the idea of «philanthropic responsibility».

It is important to briefly mention another aspect that Carroll has developed in his work, concerning the *descriptive categories* of three «types» of managers or *management*: «immoral», «amoral» and «moral». The first *category*, the «immoral manager», is the one whose *behaviors* suggest an active opposition to what is considered «right» or «ethical». The second *category* identified is the «amoral management», that is not sensitive to the fact that his daily *business decisions* can have detrimental effects on others. The third *profile* traced by Carroll, the «moral management», which employs *ethical norms* that respect a high standard of behavior. Carroll, in his work, points out that the «goal is to accentuate the *moral management* approach by contrasting it with the other two types» (Carroll, 1991). When an *ethical dilemma* arises, the «moral manager» succeeds in assuming a *leadership* position for his company or organization (Carlson and Perrewe, 1995; Mihelic et al., 2010; Kaptein, 2019).

Some attempts have done nothing but look for a solution within the Carroll paradigm, perhaps moving the different levels of responsibility «up and down the pyramid», to testify the recognition and validity of Carroll's model. Others have highlighted the importance of the primacy of ethical responsibilities. Carroll, however, supports that the concept of «ethics» permeates its pyramid (Carroll, 2016).

One important aspect taken up by Carroll in this work is the «pyramid shape» of its model. Carroll argues that «the pyramid was selected as a geometric design because it is simple, intuitive, and built to withstand the test of time». Another important aspect relevant for this work, is represented by the «descriptive categories» of management mentioned above (Carroll, 1991), through which Carroll aims «to isolate the ethical or moral component of CSR and relate it to perspectives that reflect the three major ethical approaches to management». Thanks to them, Carroll supports the overall objective of managing with «stakeholders in an ethical or moral fashion» (Carroll, 1991) (p. 39).

The first aspect just mentioned above, is particularly suitable for *education* and *training programs*, as also supported by Baden, according to the *pyramid* proved to be strategic not only for management, but also for *educational* purposes (Baden, 2016). Meynhardt and Gomez (2019) are in line with the previous work when highlight the «heuristic» value of the pyramid, which, it is, in effect, a way «to replace mental shortcuts», allowing the transformation of complex problems into «intuitive» managerial actions, *à la* Simon (Simon, 1990), which, as a whole, looks as a very fertile ground for *corporate training programs*.

The second aspect mentioned above, concerning the «descriptive categories» of management, is particularly important for identifying *attitudes* and *behaviors* of managers aimed at fostering a climate that can allow interaction with «stakeholders in an ethical or moral fashion», just like advocated by Carroll. The definitions proposed by Carroll, despite representing a clear and well-defined picture of the various «descriptive categories», are not always sufficient to define a *conceptual framework* of reference to identify a management called to assume ethically relevant behaviors. «Ethical behaviors» that are even more complicated to identify in light of the complexity

that management faces, such as that made up, above all, in the light of the number of *tools*, *levers* and *rules* available.

Next paragraph briefly introduces an experimental framework that tries to overcome such a kind of issue, providing an empirical methodology to identify Carroll's «categories» of management, bottom-up, employing *tools*, *levers* and *rules* whose perception is captured through *data* collected from *survey* among managers.

2.2 *Experimental thoughts* and their simulations: «Ethical behaviors» in action

The existence of a fairly wide range of *tools* (e.g. *board of directors*, *organizational actions*), *levers* (e.g. *cultural*, *social example of direct manager*) and *rules* (e.g. *protocols*, *certifications*, *decrees law*), is challenging for the management that aims to select «ethical behaviors», perhaps in the form of *best practices*, which are useful for running its business, just as the «common sense» of the manager or entrepreneur sometimes teaches.

For instance, let's consider a possible *action/decision* the management is dealing with such as, for example, «supporting higher costs for environmental prevention and land conservation, even when it is not mandatory by law», or «apply safeguards to reconcile work/family actions». What are the «conditions» that could favor these types of *choices*, which, as «common sense» teaches, are certainly to be considered «ethical behaviors»? Surely, taking «responsibility» by the *board of directors* could represent an important response in this sense (i.e. one of the *tools* referred to above). It could be equally important to involve *top management*, where it exists, so that it can contribute with the *social example of direct manager* (i.e., one of the *levers* mentioned above). Not to mention, then, the contribution that some form of *certification* and/or *protocol*, the so-called *rules* mentioned above, could give. Even more interesting, then, would be to consider the multiple contributions of several *factors* among those just mentioned.

What has just been said, as well as the scenario introduced above, gives an idea of the importance of having methodologies, as rigorous as possible, capable of allowing an overall assessment of various *tools*, *levers* and *rules*, such as those introduced in the scenario above. Such a methodology should make it possible to intercept the *process* underlying the manager's *decision making*, also allowing the possibility of playing on the change in the *course of actions*. Such a methodological tool would thus allow us to explore plausible alternatives, to evaluate the contribution of factors that can trigger the different alternatives, all this allowing us to work with *models* that, starting from the *data* (e.g., survey data), could result in plausible *explanations* of these.

A work that has tried to follow this methodological approach is the one proposed by D'Avanzo, Franch and Borgonovi (2021). The authors employed a *structural equation modeling* approach (SEM) to test three *causal models*, which represent, in turn, *thought experiments* simulating «ethical dilemmas» that management deals with during *decision making*.

A first type of «ethical dilemma» taken into consideration can be exemplified with the following two instances: «keep the secret of known pollution effects for reasons of competitiveness to safeguard the survival of the company and the work of its employees» or «do not punish/sanction the behaviors of collaborators who have violated ethical rules not for their own interests but to bring more profits to the company».

These *choices* are triggered by «circumstances» based on *beliefs* such as «in Italy the corruption/bribery phenomenon is a widespread practice to obtain advantages in the relationships between companies and public administrations», or «there has been a lot of talk in Italy in recent years but little has been done to combat corruption/bribery». In essence, these are *circumstances* that can be enclosed in the Mozart's *formula* of «All Women Do It» (also known as «the School for Lovers»). In other words, since everyone behaves badly, in the same way, then there is nothing wrong with safeguarding our workplace or company, even if this implies a series of impacts on people and/or the environment.

It should be noted, in this first model reported by the authors, how the *belief* according to «the phenomenon of bribery/corruption is mainly linked to the culture of a country and is not strictly economic» plays a fundamental role. In other words, with the first *thought experiment*, the model states that when an «ethical dilemma» arises, the management probably will adopt «unethical behaviors» when these are believed useful for the company, as expected by the lowest level of Carroll's pyramid.

The second *thought experiment*, proposed by the authors, shows the existence of an «imitative behavior», but for a good purpose. In fact, in this case, the type of «ethical dilemma» taken into consideration can be exemplified with the following instances: «choose not to withhold earnings to avoid laying off some employees», «apply safeguards to reconcile work/family actions», «support higher costs for environmental prevention and land conservation, even when it is not mandatory by law», or «look for new markets to abandon markets that are recognized as ethically compromised even if they are at a high profit». It is worth taking a look at what are the *beliefs* of management, within the *thought experiment*, capable of *triggering* these choices. One is «the example of the behavior of a direct boss». In other words, management asks for a model to imitate. The presence of «social network», also represents a chief *belief*, based on *reputation*, able to trigger «ethical behaviors». «The spread of markedly corporate culture» is another *belief* that indicates the importance, once again, of the *educational* and *training* path within the company.

According to the second thought experiment when an ethical dilemma arises, if the appropriate *social* (i.e., reputational) and *cultural* conditions exist, the manager succeeds in assuming a *leadership* position for his company (Carlson and Perrewé, 1995; Mihelic, Lipicnik and Tekavcic, 2010).

Models above are readable in the form of simple «heuristics» and may play a chief role for *education* and *training* purposes. However, the management supports, more and more, the sharing of new *beliefs*, coming from «common sense» knowledge, and as such it emerges the need to easily update all *levers*, *tools* and *rules*, mentioned above, that are based on «new beliefs».

In this sense, the «Bayesian paradigm» and one of its increasingly widespread *tools*, namely the *Bayesian belief networks*, both introduced in the next Section, seems particularly promising.

3. How Reverend Bayes perceives ethics: modeling manager's *belief*

As known, the overall idea behind the *Bayesian paradigm*, also named as a *Bayes' theorem*, or *Bayes' rule*, is that many quantities, apparently unknown, possess a *probability distribution*, updateable based on *new evidence* soon as available.

Bayesian paradigm, allows to change the *belief* based on the *data*, then contemplating *falsifiability*, which is so «conjectural» and subject to change, *à la* Popper. The *Bayesian view* contemplates that the *probability* measures the strength of a *belief*, as, for example, «the diffusion of the ethical sense depends mainly on the culture of the countries». Unlike *frequentist view*, a *Bayesian* can treat individual events, such as, for example, «the diffusion of the ethical sense depends mainly on the individual values of people», even in the absence of sample data available with examples of the same type. This *belief*, however, could change over time. For example, a sudden socio-health situation could have changed the «conduct» of the majority of stakeholders, *internal* and *external* to their company, for better or worse, such as the tightening of the sense of competitiveness. Such a situation, in addition to inducing a change in the *beliefs* of the individual manager, or in the entire management of the company, could also require an update of «protocols», «codes of conduct» and reassessment of roles within the company.

Bayesian paradigm, thanks to the practical implications that it offers in different fields, attracts more and more interdisciplinary interests. It is considered a «normative» *model of rationality*, to be aspired to, perhaps through training courses. Some authors have even provided arguments in favor of the «cognitive plausibility» of Bayesianism, such as, for example (Gopnik et al., 2004), according to which children seem to use a Bayesian model of *learning*.

Today, however, the exponential growth of the data we use to *hypothesize* models on which decisions are based, including those adopted in management, makes the use of *decision support systems*, perhaps based on the *Bayesian paradigm*, more plausible. These systems, in fact, allow a rapid formulation of *hypotheses*, automatically. The resulting *decisions* can be easily explored and used by management.

Thanks to this paradigm, management has a methodology for making data-driven decisions, in a simple way, knowing that they can be updated as soon as the company network or the world around it changes.

In a nutshell, in the case dealt with in this paper, we could say that such a paradigm would allow us to have a method that, starting from the ethical management of common sense, would pass to the ethical management based on evidence, of which the common sense is the custodian.

The next section introduces an embryonic *conceptual framework*, based on «belief networks», which represent a particular implementation of the *Bayesian paradigm*. The aim is to show how, starting from a series of beliefs belonging to the «common sense» of management, it is possible to reconstruct «conceptual maps», or «heuristics», *data-driven*, because based on data from questionnaires, which, in turn, represent the «perceptions» of management, and that are able to support management in its daily *decision making*.

3.1 Method

In the preliminary experiments reported in the following It has been employed a Bayesian Network (BN) methodology. This kind of networks are graphical models of knowledge in an *uncertain* domain. They are probabilistic models structured as *directed acyclic graphs* (DAGs). BNs are widely used in cognitive science and the field of artificial intelligence. Such models are particularly suitable for reasoning tasks under uncertainty conditions, overcoming the limitations of traditional rule-based systems (Pearl, 1988), (Pearl, 1995), (Pearl, 2011), (Holmes & Lakhmi, 2008).

In a BN nodes represent the variables of interest, and directed links represent the causal dependence between them. Each node is associated with a table of conditional probabilities, given the parents' node.

As already mentioned above, BNs are handy whenever the problem cannot be wholly described due, for example, to a lack of information. Network's topology represents both the knowledge base of the environment, in which events may occur, and the general structure of the causal process in the domain without providing details about a specific element. Each node of the network, given its immediate ancestors, is conditionally independent of any other than its descendants.

Among the advantages of applying BNs there are the compactness of the representation, the causal dependency link, the fact that they are tools with well-defined semantics, and the possibility of making descriptions even when there is not enough deterministic-type information about how the system works. Furthermore, BNs can be used, once the model is determined, to make four kinds of inferences: 1) *Diagnostic* (i.e. from effects to causes), 2) *Causal* (i.e. from causes to effects) 3) *Intercausal* (i.e. between causes of a common effect), and 4) *Mixed* (i.e. a combination of the previous cases).

The structure of the BN is usually determined by an expert of the domain. However, over the time, automatic methods and heuristics have been proposed to induce it directly from the dataset. In particular, in the following experimentation, it has been used the *Bayesian search structure learning algorithm*, introduced by (Cooper & Herkovitz, 1992), and modified by (Heckerman, 1995), aimed at constructing a probabilistic network from a set of records. The overall procedure is implemented in the Genie Tool¹. This algorithm is one of the earliest and widely used approaches for determining the structure of a BN. The procedure is based on a «hill climbing» procedure, exploiting a scoring heuristic that, in the case of the used tool, is the log-likelihood function.

The methodology gives as an outcome an *directed acyclic graph* (DAG) that achieves the highest probability, according to the heuristics score of the data, given the found structure of the graph.

3.2 Data

The *dataset*, obtained from the experimentation carried out by D'Avanzo, Franch, Borgonovi (2021), comes from a survey run among Italian managers.

The *survey* was run through the period of time among February 2015 and October 2015. The resulting dataset is made of 149 observations, and it is described by 72 variables. During the pre-processing step, 5 variables have been deleted because they were incomplete and with noise, so the final number of variables amounts to 67. The answers were given on a *Likert scale* from 1 to 7, in which 7 represents the highest degree of adhesion between «ethics» and related concepts.

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In particular, the list of the variables is shown in Table 1 .

Tab. 1: The table reports the variable of the dataset, with a short description for each of them. Adapted from D'Avanzo, Franch and Borgonovi (2021)

Observed variable/item name	Code	# of items
Degree of coincidence / coherence of the concept of ethics with the nouns proposed - Correctness	V55	39
Degree of coincidence / coherence of the concept of ethics with the nouns proposed - Morality	V56	40
Degree of coincidence / coherence of the concept of ethics with the nouns proposed - Legality	V53	37
Degree of coincidence / coherence of the concept of ethics with the nouns proposed - Impartiality	V58	42
Degree of coincidence / coherence of the concept of ethics with the nouns proposed - Justice	V57	41
Degree of coincidence / coherence of the concept of ethics with the nouns proposed - Legality	V54	38
Degree of coincidence / coherence of the concept of ethics with the nouns proposed - Meritocracy	V59	43
Keep the secret of known pollution effects for reasons of competitiveness, knowing however that there may be risks (not certainties) for the health of workers and / or inhabitants, to safeguard the survival of the company and the work of its employees	V44	30
Finding formally correct ways to get bribes or other forms of corruption to avoid the risk of bankruptcy of companies / organizations or to dismiss a significant number of employees (eg over 50%)	V35	21
In order not to pay back debts (eg debts to suppliers, debts to the tax authorities) decide to plan the bankruptcy of the company and then establish another	V40	26
Keep the secret on known pollution effects, which however have no direct impact on the health of workers and inhabitants, to safeguard the survival of the company and the work of its employees for reasons of competitiveness	V43	29
Finding formally correct ways to get bribes or implement other forms of corruption at international level when it is considered that this is the general practice	V42	28
Don't punish/sanction the behaviours of collaborators who have violated ethical rules not for their own interests but to bring more profits to the company	V37	23
Optimize / maximize results, given certain constraints, such as market constraints, competition for companies, laws and policy choices in public administrations, resources available from donations and contributions for non-profit institutions, etc.	V73	44
Board of directors	V75	46
The example of the behavior of direct boss	V84	52
Social network	V82	51
The spread of markedly corporate culture	V87	54
Organizational actions to spread the culture of ethics	V85	53
Application of laws/guidelines anti-corruption protocols	V77	48
Ethical certification SA 8000	V78	49
Social balance sheet, social impact indicators and other CSR instruments	V79	50
Specifically, the D.L. 231/2011 on corporate responsibility and 190/2012 for public administrations	V76	47
The lobbying activity would not in itself be negative when regulated and made transparent	V32	19
The regulated and transparent lobbying activity can be positive because, on complex problems, it brings to the attention both of those who decide public policies and of the interests of different stakeholders who can balance each other	V31	9
The diffusion of the ethical sense depends mainly on the culture of the countries	V19	9

The phenomenon of bribery-corruption is mainly linked to the culture of a country and is not strictly economic	V28	17
The diffusion of the ethical sense depends mainly on the individual values of people	V18	8
In Italy the corruption-bribery phenomenon is a widespread practice to obtain advantages in the relationships between companies (in general private subjects) and public administrations (tenders, supplies, concessions, authorizations, etc.)	V24	13
There has been a lot of talk in Italy in recent years but little has been done to combat corruption-bribery	V26	15
The debate on ethics is mainly of image and facade, often used in an instrumental way and does not substantially touch the real behavior of companies / organizations	V8	1
Indicate the degree of coincidence / coherence of the "ethical" concept with the proposed nouns, according to your own conception - Impartiality	V50	35
Indicate the degree of coincidence / coherence of the "ethical" concept with the proposed nouns, according to your own conception - Justice	V49	34
Indicate the degree of coincidence / coherence of the "ethical" concept with the proposed nouns, according to your own conception - Meritocracy	V51	36
Indicate the degree of coincidence / coherence of the "ethical" concept with the proposed nouns, according to your own conception - Correctness	V47	33
Look for new markets to abandon markets that are recognized as ethically compromised even if they are at a high profit	V41	27
Apply safeguards to reconcile work / family actions	V38	24
Choose not to withhold earnings to avoid laying off some employees	V36	22
Support higher costs for environmental prevention and land conservation, even when it is not mandatory by law	V39	25
In all sectors the presence of clear rules favors ethical behaviours	V20	10
The difficulties of adopting ethical behavior depend on the lack of clear and transparent rules	V16	7
The crisis has positively influenced the adoption of ethical behaviours	V23	12
The adoption of ethical behavior was negatively affected by the recent crisis	V14	6
In Italy the corruption-bribery phenomenon is a widespread practice in relations between private individuals/companies (companies' supply chains, credit concessions by banks, etc.)	V25	14
In the public sector, on average, there is a higher ethical sense than in the private sector	V22	11
The ethical sense is stronger in the non-profit sector compared to for-profit companies	V13	5

Source: D'Avanzo, Franch and Borgonovi (2021)

3.3 Simulation and results

The procedure exploits random restart and a set of *parameters* that have to be set. In particular, the maximum number of *parents* that a *node* can have has been set to eight. This parameter is important because the table of *conditional probability* associated with a given node grows exponentially with the number of parents of the node.

Since the *search space* is huge, a number of random restarts makes it possible to compare different solutions and to find a structure of the BN that fits the data better. In our case, the number of restarts of the algorithm has been set to 20.

The *size of the sample*, used in the scoring heuristics and representing the inertia of the parameters when new data are added, has been set to 50 elements.

The initial random number seed used to generate pseudorandom numbers has been set to zero.

The «Link Probability», which is a variable set when a new network is generated at the beginning of each iteration, has been set to 0.1. This parameter affects the connectivity of the network at the beginning.

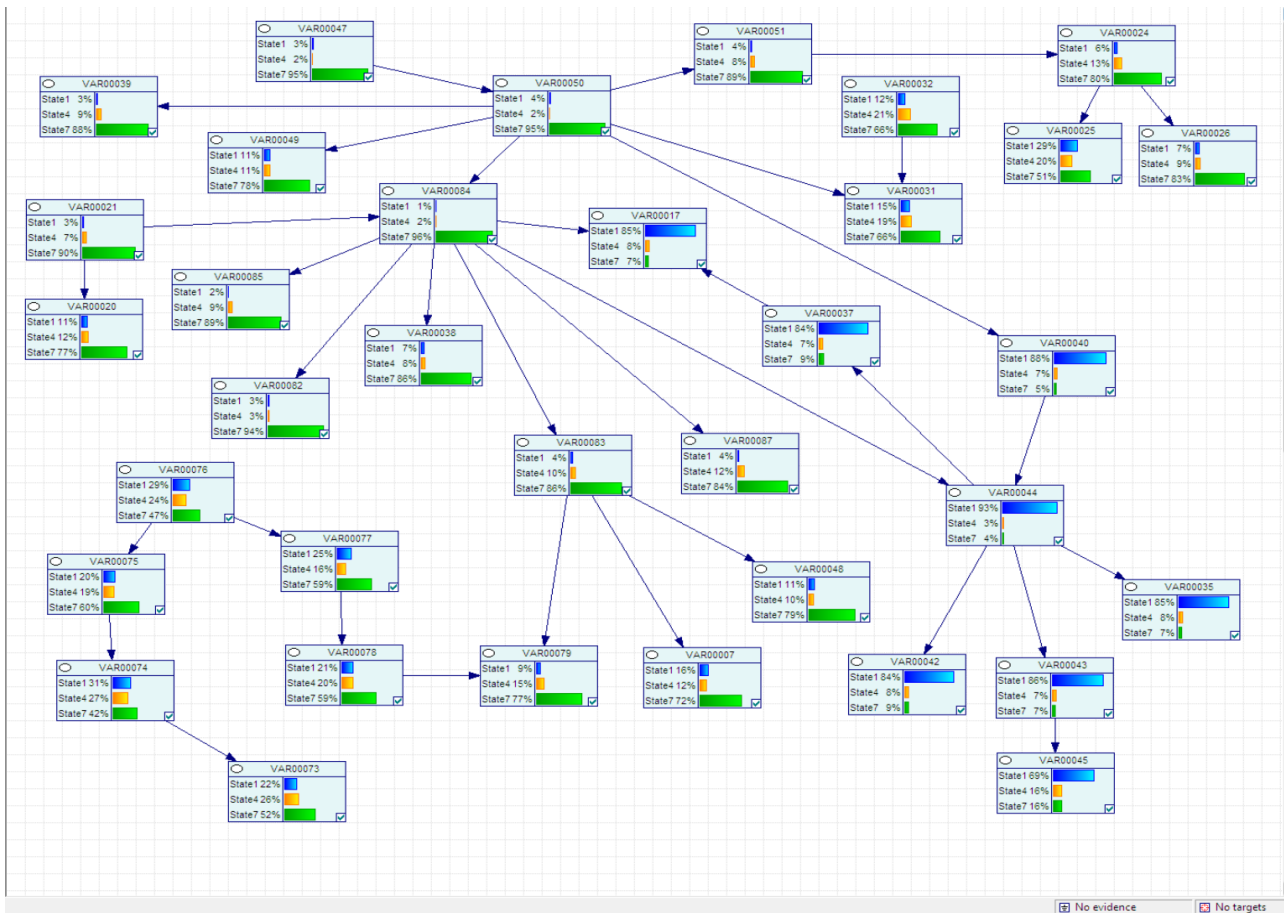
The «Prior Link Probability», which influences the priority of the edges, has been set to 0.001.

In the end, we did not set a maximum time limit to learn the structure of the network.

As a result of the procedure, the tool exploited 149 items of the dataset, i.e. those with non-missing data, and it found a set of seven BNs, each one named with a progressive number, involving different variables of the dataset. In particular, the first network, illustrated in Fig. 1, involves 35 variables associated with 35 specific answers of the respondents; the second network involves other seven answers. Other five networks have been induced, each one involving only two or three variables. Table 1 reports the association between the variable number and the specific answers of the respondents of the poll. All the seven networks are independent of each other.

The other 18 variables generated just 18 isolated, non-connected nodes, showing that no direct influence was found among them and the other variables in the dataset, for this reason they were neglected by the analysis in this phase.

Fig. 1: The Network 1 induced by data. No evidence has been set



Source: our elaboration

According to the Bayesian Network model, each node represents a variable and each state of the node is identified by the labels “1”, “4”, and “7”. In particular, we have associated the label “1” with the scores (1,2, and 3) of the Likert scale given by the interviewees; the label “7” is associated with the scores (5, 6, and 7) of the Likert scale given by the interviewees, while the label “4” is associated with the “neutral” score of 4 provided by the respondents.

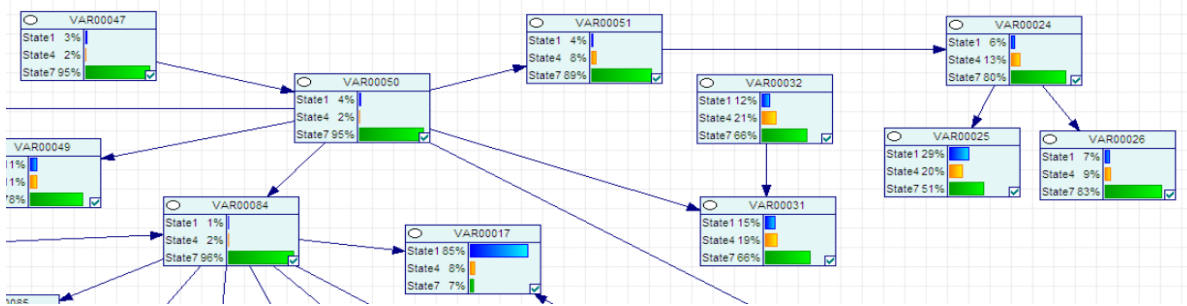
Fig. 1 illustrates the *beliefs* of each variable associated with the probability of each of its states when no evidence is provided. The network looks complex. However, following the paths in the network we can notice that the answers that mainly influence the other variables in terms of *beliefs* of relevance are those involving the concept of «Impartiality» (V50), «the will of keeping secrets about known pollution effects in order to safeguard only the competitiveness of the business» (V44), «the behavior of the direct boss» (V84) and «the presence of an official ethical certification» (V78).

Fig. 2 illustrates a portion of the Network 1 structure. It highlights the following direct influences that has been found by the structure inferencing algorithm implemented in Genie: the «Correctness» (V47) has a direct influence on «Impartiality» (V50); on the other hand, the idea of «Impartiality» directly affects the perception that «the regulated and transparent lobbying activity can be positive» (V31). As if to say that «Correctness» and «Impartiality» are perceived as two important *beliefs* also for «lobbying», as long as it is regulated.

Furthermore, the «impartiality» (V50) directly influence the idea of «meritocracy» (V51), which, in turn, is directly linked to the perception that «In Italy the corruption-bribery phenomenon is a

widespread practice to obtain advantages in the relationships between companies and public administrations» (V24). Another evidence that can be read as the management that has a strong perception of «impartiality» and «meritocracy», perceives equally strongly the fact that in «In Italy the corruption-bribery phenomenon is a widespread practice to obtain advantages in the relationships between companies and public administrations».

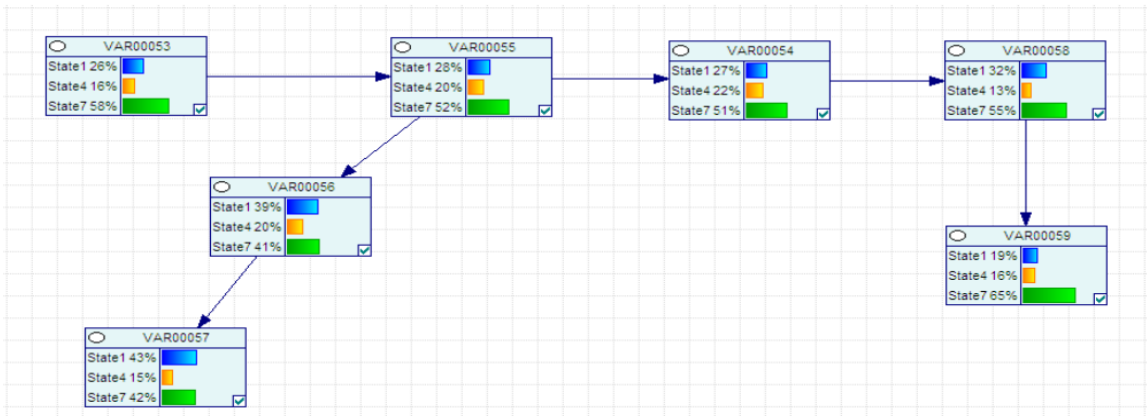
Fig. 2: A portion of Network 1



Source: our elaboration

Another interesting situation is illustrated by Network 2, which is depicted in Fig. 3.

Fig. 3: The Structure of Network 2

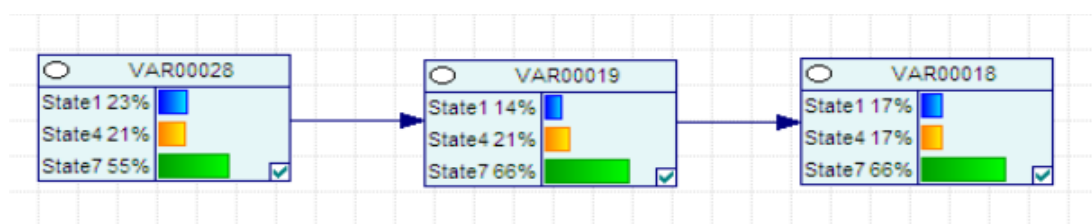


Source: our elaboration

In this network it is possible to observe that the parent node is associated to the idea of «legality» (V53) that directly influences the V55 node associated with the idea of «correctness», which, in turn, influences two paths: the first one is given by the chain «legality» (V54), «impartiality» (V58), and «meritocracy» (V59); the second one is identified by «morality» (V56) and «justice» (V57).

It is worthwhile to point out that all the nodes involved in Network 2 are related to the «moral profile» given by the “Factor 1 - Professional ethics perception” as suggested by D’Avanzo, Franch and Borgonovi in their work (2021).

Fig. 4: The Structure of Network 4



Source: our elaboration

Another influence relationship arising from data is given by Network 4, illustrated in Fig. 4. The outcome is that there is a direct influence path starting from the idea that «the phenomenon of bribery-corruption is mainly linked to the culture of a country and is not strictly economic» (V28), directly linked to the opinion that «the diffusion of the ethical sense depends mainly on the culture of the countries» (V19), which, in turn, has an impact on the individual values of people (V18). All these three variables account for the «moral profile» “*Factor 7 - Management awareness of bad practices*”, that are practice to be avoided when inspired by «ethical behaviors» emerged from the analysis proposed by D’Avanzo, Franch and Borgonovi (2021)

4. Conclusion

Management deals with actions/decisions, among others, such as, for example, «do not punish/sanction the behaviors of collaborators who have violated ethical rules not for their own interests but to bring more profits to the company». Some of them are questionable, as the example before, while others are desirable decisions/actions, such as, for example, «supporting higher costs for environmental prevention and land conservation, even when it is not mandatory by law», or «apply safeguards to reconcile work/family actions».

The initial question was: what are the «conditions» that could favor these types of choices, which, as «common sense» suggests, are to be considered «ethical behaviors»? For instance, management’s «common sense» well knows what does mean when he is called to assume a «respectful» and/or a «kind» behavior. Both conducts useful for fostering actions and decisions such as those just mentioned above.

The existence of a range of *tools* (e.g. board of directors), *levers* (e.g. social example of direct manager) and *rules* (e.g. protocols, certifications), is challenging for the management that aims to select «ethical behaviors», perhaps in the form of «best practices», which are useful for running its business, just as the «common sense» of the manager or entrepreneur sometimes suggests.

This paper introduced a methodology that, starting from the ethical management of «common sense», would pass to the ethical management based on evidence.

A Bayesian network approaches allow a rapid and automatic formulation of hypotheses, obtaining effective data-driven decision support systems, which are also easily explorable, updatable, and, therefore, effectively used by management.

We have employed a dataset provided by D’Avanzo, Franch, Borgonovi (2021), regarding data acquired with a survey run among Italian managers. The dataset has been used as a source for inducing a Bayesian Network through the academic version of the Genie tool.

The experiments show very interesting links, for example, between “Impartiality” and “Correctness”, as well as “Meritocracy” and the corruption-bribery phenomenon and, among the others, the link between “Correctness”, “Morality”, and “Justice”.

This first experimentation, still in its embryonic state, seems to be an adequate methodology to accompany the «common sense» of management in the ethical management of the company. Managerial conducts such as «kind behavior» or «respectful» and so on, begin to take on an empirical basis, as well as plausible, as it was when entrusted only to the «common sense» of the manager.

Future work will regard a deeper understanding of the relationship between other features as well as the embedding of a proper user-centric computational system to support ethical decision in management. Furthermore, a deeper study will be conducted in order to understand the limitations of the approach and the influence of the missing data, as well as using different methodologies to learn the DAG structure to get a more effective reasoning system in the field of ethics in management.

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The impact of stakeholder orientation on innovation: An empirical investigation on firm patenting activity

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Abstract

Framing of the research. *The paper provides novel insights on how firms can boost knowledge by developing a corporatewide orientation towards stakeholders. It investigates the patenting activities of a sample of U.S. firms using a panel dataset.*

Purpose of the paper. *The aim of the paper is to analyze the effect of firm stakeholder orientation, defined as the adoption of policies and management processes to identify, understand, and integrate the interest of stakeholders in firms' decision making, on innovation activity.*

Methodology. *We validate our hypotheses using a panel dataset of 5.608 unique firm-year observation on firms' patenting activity over the period 2002-2012.*

Results. *We find support for our baseline hypothesis on the positive impact of increasing degrees of stakeholder orientation on the quantity of firms' innovation output. Moreover, the degree of stakeholder orientation has a positive impact on innovation radicalness and originality, will decreasing the level of innovation generality.*

Research limitations. *Our work contributes to an emerging debate on the innovation potential of stakeholder orientation. It is based on a direct measure of stakeholder orientation and, based on its methodology, it is not possible to exclude biases related to unobservable managerial preferences. Moreover, we use patents as a proxy for innovation output being aware of its limitation.*

Managerial implications. *Our results suggest the importance of nurturing stakeholder relations to foster knowledge exchange and reciprocal learning, which are crucial for firms' innovativeness. Moreover, our study highlights the importance of stakeholder orientation in the pursuit of radical and original technological trajectories.*

Originality of the paper. *Studies on the innovation impact of stakeholder orientation are still limited and mostly focused on exogenous determinants in limited timeframe. Our study introduces the degree of stakeholder orientation as a key construct to predict innovation that accounts for heterogeneity across firms and stakeholder categories.*

Keywords: *Stakeholder Orientation; Innovation Output; Patenting Activity; Stakeholder Management*

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Introduction

As firms increasingly decide to adopt policies and management processes to identify, understand and integrate the interest of stakeholders in their decision making (Harrison *et al.*, 2010), research has started to investigate such stakeholder orientation as a driver of value creation. Previous studies have largely documented that firms that relies on continuous knowledge exchange with stakeholders in a stakeholder network tend to behave differently from less stakeholder-oriented one, in terms of corporate development activities such as acquisition (Tong *et al.*, 2019) or divestiture (Bettinazzi and Feldman, 2020), thus turning into higher chances for survival (Vurro *et al.*, 2021). Results of these studies tend to suggest that stakeholder orientation is an important trigger for the development of innovative capabilities, while predisposing firms in a better position to coping with uncertainty and interpret and integrate external stimuli (Cheng, 2020).

Heeding the call for a deeper understanding of the organizational implications of stakeholder orientation (Barney and Harrison, 2020), scholars have started to investigate the innovation consequences of developing a proactive stance towards the integration of stakeholder dialogue in a firm's strategic and operational activities (Li *et al.*, 2018; Markovic and Bagherzadeh, 2018). Considering stakeholder orientation as a source of new knowledge and confidence in the viability of long-term investments, previous studies have advanced the idea that close stakeholder relationships can contribute to successful innovation strategies, driving technological investments, employee innovativeness (Flammer and Kacperczyk, 2016; Jiang *et al.*, 2019), and new product development decisions (Aschehoug *et al.*, 2012; Markovic and Bagherzadeh, 2018). Similarly, scholars have recently acknowledge the innovation potential of strategic alliances that span traditional firm-to-firm boundaries and involve unusual stakeholders such as local communities or nonprofit organizations (Cheng, 2020; Niesten and Jolink, 2020). Accordingly, by strengthening the nexus with stakeholders, firms are expected to anticipate changes in the business environment or emerging societal expectations that turn into the discovery of opportunities (Adams *et al.*, 2016; Romito *et al.*, 2021).

Elaborating on how stakeholder orientation can provide appropriate incentives or discourage firms to pursue innovation, empirical studies have examined and supported the casual association between corporate attention to nonfinancial stakeholders and the amount and characteristics of technology investments (Conti and Novelli, 2022; Flammer and Kacperczyk, 2016). Yet, previous research has mostly assumed the development of an orientation towards stakeholders as deriving from an exogenous shock, that is, the U.S. states' enactment of constituency statutes allowing firms to acknowledge the interest of stakeholders when making decisions (Flammer, 2018). Despite valuable in predicting causality and control for endogeneity, such approach has several limitations. First, it does not allow to differentiate between degrees of stakeholder orientation across firms and across stakeholders. Rather, it refers to a general increase of stakeholder orientation as a result of a policy change in the external environment without directly measuring the stakeholder orientation construct across stakeholder categories (Bettinazzi and Zollo, 2017; Greenley and Foxall, 1997). Second, the constituency statutes were enacted by 34 U.S. states mainly during the period 1976-2000, with the only exception of Texas in which the law has been approved in 2006. Thus, investigations are mostly limited to that timeframe and hardly account for the impact of time on the propensity of firms to develop their orientation towards stakeholders as well as on the performance consequences of such behavior (Jain *et al.*, 2017; Shin *et al.*, 2021).

We aim to advance this stream of research by arguing that the degree of stakeholder orientation a firm develops over time matters in predicting its technology investments, in terms of quantity and quality of patents. Accordingly, we elaborate on and test the impact of developing a corporatewide orientation towards stakeholder on the quantity, radicalness, originality, and generality of patents. To better uncover the innovation potential of heterogeneity in stakeholder orientation, we also investigate the impact of firms' orientation towards specific stakeholder categories. More specifically, we focus on those non-financial stakeholders that directly contribute to a firm's value creation capacity, that is, employees, customers, suppliers, and communities. These categories have

been conventionally referred to as primary stakeholders (Clarkson, 1995), given their crucial impact on business continuity and survival (Boaventura *et al.*, 2020; Vurro *et al.*, 2021). We also predicted the innovation impact of a firm's orientation towards the protection of the natural environment, as previous studies have identified environmental responsibility as conducive to green product innovation (Schiederig *et al.*, 2012).

We test our hypotheses using a comprehensive panel dataset of 5.608 unique firm-year observations drawn from 843 U.S. listed firms over the period 2002-2012. We found support for the expected impact of heterogeneity in stakeholder orientation and firms patenting activities. According to our results, higher degrees of stakeholder orientation are associated with higher number of patent applications, especially when firms develop a stronger orientation towards employees, customers, and the natural environment. By developing an orientation towards stakeholder, firms can also improve the quality of their innovation output. Our results supported a positive impact of stakeholder orientation on patent radicalness and originality. In accordance with previous literature, we found a negative significant impact of stakeholder orientation on patent generality as the more firms commit to stakeholders the less their incentive in investing in general technology which improves flexibility and might lead the committed stakeholders to expect opportunism (Hampel *et al.*, 2020).

The remainder of the paper is structured as it follows. First, theory and empirical studies predicting a positive impact of stakeholder orientation on innovation are reviewed and systematized, with the aim of developing hypotheses. These sections are followed by the methodology and empirical analysis. Finally, the findings and contributions are discussed together with the limitations and opportunities for future research.

1. Literature review and hypotheses

Literature has long debated the impact of adopting processes and actions aimed at interacting with stakeholders on a continuative basis on the emergence of capabilities to better manage internal change and organizational innovation (Aragón-Correa and Sharma, 2003; Perrini *et al.*, 2011). In fact, by interacting with stakeholders, firms have better chances to obtain knowledge and resources while cultivating their ability to interpret external stimuli and anticipate change in the external environment (Jones *et al.*, 2018).

By favoring communication across a plurality of voices, stakeholder interaction has emerged as a valuable source of reciprocal learning, as it exposes participants to alternative perspectives (Aschehoug *et al.*, 2012). Knowledge transfer and mutual learning help firms to recombine knowledge and acquire relational resources turning into faster reactions to changes and adaptation to demand for innovation (Li *et al.*, 2018; Yang *et al.*, 2019).

Finally, stakeholder-oriented firms have emerged as more prone to cope with complexity and uncertainty as a consequence of their more frequent engagement in open-ended, informal contracts, which implies higher risks of moral hazards (Gibbons and Henderson, 2012; Romito *et al.*, 2021; Russo *et al.*, 2018). Similarly, previous studies have highlighted how stakeholder orientation fosters firms' tolerance for embracing initiatives that would generate results over longer time horizons (Pinkse and Kolk, 2010).

The growing awareness of the implications of stakeholder orientation on the development of firms' innovative capabilities has fostered theory building on the mechanisms linking stakeholders and innovation. In this regard, Ayuso *et al.* (2006) identified stakeholder dialogue and stakeholder knowledge integration as the capabilities to combine stakeholder insights into a firm's innovative process. Openness to dialogue, reciprocal interaction and proximity to stakeholders have emerged as crucial in driving new product development, thus suggesting the importance of building a corporatewide orientation towards stakeholders to foster innovation. Similarly, the adoption of forms of collaborative governance has been associated to business development and innovation when paired with a stronger openness to stakeholder participation and stakeholder influence on

decision making (Spitzeck and Hansen, 2010). More recently, research as pointed out to the beneficial impact of stakeholder orientation in countering learning inertia as firms age (Adams *et al.*, 2016). Preliminary evidence shows that stakeholder interactions foster resource reallocation and improve adaptability, responsiveness, corporate entrepreneurship and renewal (Ahn and Park, 2018; García-Sánchez *et al.*, 2018). Especially when firms grow older, stakeholder orientation stimulate flexibility and adaptive capabilities, thus countering inertia and improving survival rates (Vurro *et al.*, 2021).

Despite such emerging findings, the direct impact of stakeholder orientation on innovation has been mostly assumed rather than empirically tested. For example, Ayuso *et al.* (2006) contended a positive impact of developing capabilities to manage internal and external stakeholder on the innovation orientation of firms based on a cross-case comparison of large firms. On a partly related side, studies have focused on the innovation potential of promoting an orientation towards employees and stimulate their commitment (Azoulay *et al.*, 2011; Sharma *et al.*, 2021).

More recently, research attention has been addressed to empirically test the causal relation between stakeholder orientation and innovation. Flammer and Kacperczyk (2016) have analyzed how the enactment of constituency statutes in the U.S., which provided directors with a legally enforceable mechanism to consider stakeholders' interest during the decision-making process, influenced innovative output. Based on their findings, they concluded that firms incorporated in states having enacted a constituency statute were incentivized to generate more patents and receive more citations per patents. Stakeholder orientation indeed fosters innovation by encouraging experimentation and tolerance for failure. Based on the same methodology, Conti and Novelli (2022) made a step further and pointed out to the role of stakeholder orientation in predicting technology trajectory. According to their results, they found how stakeholder-oriented firms are more likely to invest in less general technological assets to reduce stakeholder opposition and concerns.

With the exception of such studies and their valuable insights into causality between stakeholder orientation and innovation output, very little is still know about the impact of heterogeneity in stakeholder orientation on innovation (Bettinazzi and Feldman, 2020). As firms develop their attitudes to stakeholder, thy expand that set of value-creating exchanges beyond market transactions (Hillman and Keim, 2001). The more firms engage with stakeholders, expanding their stakeholder orientation, the higher the likelihood of benefiting from interdependencies, knowledge exchanges and learning opportunities, thus increasing the quantity of their innovative output. Therefore, we hypothesize:

Hypothesis 1: The more stakeholder-oriented a firm is, the higher its innovation output

As mentioned before, heterogeneity in stakeholder orientation is not only due to the overall corporate disposition towards stakeholders but also to the extent to which firms develop an orientation towards each stakeholder category. Previous studies have related the innovation impact of stakeholder orientation to exogenous sources such as the enactment of state-level constituency statutes (Flammer and Kacperczyk, 2016). Therefore, the impact of variation at the corporate level and with regards to each stakeholder category remains an open question.

Along with the growing importance of intangibles for firm success, including creation, management and transfer of knowledge, the development of an orientation towards employees has started to be considered a critical source of competitiveness when it turns into improved human resource management practices (Perrini *et al.*, 2011). Employees are directly involved in the innovation process, with their capabilities and orientation being conducive to the development and deployment of innovation. Previous research has pointed out to the impact of work satisfaction in the R&D process, when firms attempt to create new knowledge (Janz and Prasarnphanich, 2003). Employee-oriented firms are those investing on employees' well-being, while providing fair treatment and opportunities for involvement in decision making (Ketata *et al.*, 2015; Liu *et al.*, 2014). Employee-orientation is thus expected to improve worker satisfaction and openness to

knowledge dissemination within the firms, which can be considered vital for innovation. Thus, we hypothesize:

Hypothesis 1a: The more employee-oriented a firm is, the higher its innovation output.

Cooperation with suppliers is as important to foster innovation as employee orientation. Research has long acknowledged the benefits related to long-term buyer-supplier relationships based on knowledge and competence sharing among partners (Vurro *et al.*, 2009). Accordingly, the development of an orientation aimed at integrating suppliers' interests facilitates knowledge transfer, fosters coordination and turns into higher innovation potential (Cheng, 2020). Recent studies have investigated the innovative outcomes of integrating social and environmental consideration in the selection, monitoring, and managing of buyer-supplier relationships (Adams *et al.*, 2016). Based on this evidence, as firms develop their capabilities to select and cooperate with suppliers beyond arms-length relationships we can expect better innovation outputs. Thus, we hypothesize:

Hypothesis 1b: The more supplier-oriented a firm is, the higher its innovation output.

If integrated in firms' decision making, the customers can become advocates for the firms and provide valuable feedbacks to stimulate innovation (Danso *et al.*, 2020; Hillman and Keim, 2001). An orientation towards customers allows firms to better understand their customer needs through open dialogue and transparent interaction, thus improving customer-specific knowledge and stimulating innovation. Hence, we can expect that:

Hypothesis 1c: The more customer-oriented a firm is, the higher its innovation output.

The capabilities to manage the relationships with the local communities, non-governmental actors, and the wider society have been widely acknowledged as strengthening a firm's legitimacy and license to operate (Van Tulder *et al.*, 2016). In face of a growing demand for firm responsibility and engagement in social and environmental issues, partnerships and community-related programs are considered among the mainstays of stakeholder orientation (Bowen *et al.*, 2010). Accordingly, participation in community-development projects or cross-sector collaborations with institutional actors and nonprofit organizations has been considered a driver of innovation by means of fostering a proactive attitude towards the context and helping firms to foresee dynamics of change and risky challenges (Pedersen *et al.*, 2021). Additionally, the development of an orientation towards community actors can support firms in embracing longer-term targets thus extending their tolerance for embracing initiatives that are not expected to generate short-term impacts (Slawinski *et al.*, 2017). Based on this emerging evidence, we hypothesize:

Hypothesis 1d: The more community-oriented a firm is, the higher its innovation output.

The competitive impacts associated to the development of an orientation towards the natural environment are well established in the literature (Porter and Van der Linde, 1995). The adoption of pollution prevention policies and other environmental protection strategies fosters product and process innovations, especially when paired with market demand for greener products (Jay Polonsky and Ottman, 1998; Pilkington, 2004). In fact, the achievement of such results requires adaptation of production processes and renewed product design. On a partly related side, tighten environmental regulation increases production costs, thus providing incentives for efficiency gains and improvement of firms' environmental footprint. Scholars have found a significant positive relationship between pollution abatement expenditures following stricter regulation in U.S. and environmental patents in manufacturing industries (Brunnermeier and Cohen, 2003). Similarly, the

eco-design directive in Europe has triggered the diffusion of energy-efficient products and popularized ecological innovations (Clausen and Fichter, 2019). Thus, we hypothesize:

Hypothesis 1e: The more environmental-oriented a firm is, the higher its innovation output.

In our discussion about the effect of stakeholder orientation on innovativeness we focused our attention on the innovation output. Previous studies, however, have largely emphasized the importance of complementing research with an analysis of the quality of the innovation generated by the firm (Valentini, 2012). In predicting the effect of stakeholder orientation on the quality of innovation output, two potentially conflicting views emerge. On the one hand, research points to a negative effect of stakeholder orientation on the quality of innovation output as a result of the potential resistance to change of certain stakeholder categories. Minoja *et al.* (2010) argued that at higher level of stakeholder orientation, stakeholder cohesion, defined as the alignment among stakeholder categories and with managers, increases. When this happens, cohesion might prevent radicalness in searching for innovative solutions. Similarly, stakeholder could oppose a firm's investment in innovation when such investments offset relation-specific investments, thus threatening the stability of the relationship (Conti and Novelli, 2022; Hoskisson *et al.*, 2018). On the other hand, the stronger involvement of stakeholder oriented firms in frequent interactions and joint problem solving with stakeholders (Vurro *et al.*, 2021) might result in learning and higher exposure to new perspectives and ideas for innovative, breakthrough solutions. It has been posed, in fact, that stakeholder oriented firms develop a stronger ability to leverage stakeholder knowledge and insights in order to generate high quality new products or services (Jiang *et al.*, 2019). It is worth noticing that, when an innovation is generated by leveraging the knowledge of one or more stakeholders, they are typically involved in the process of innovation development. Thus, such stakeholder(s) might actually promote, rather than hinder, the development of a radical innovation as it might strengthen the stability of the relationship with the focal firm. For these reasons we hypothesize a positive relationship between firm stakeholder orientation and the quality of its innovation output.

Hypothesis 2: The more stakeholder-oriented a firm is, the higher the quality of its innovation output, in terms of (2a) radicalness, (2b) originality and (2c) generality of its innovation output.

2. Methodology

2.1 Sample selection

To test our hypotheses, we merged databases on financial data, environmental, social, and governance indicators, and patenting activities of firms over the period 2002-2012. Following Bettinazzi and Zollo (2017) we collected data from Thompson Reuter Asset4 database, one of the most comprehensive databases on ESG (environmental, social and governance) factors for over 7,000 public companies since 2002. Asset4 relies on data collected from multiple public sources to maximize data quality and triangulation (Eccles *et al.*, 2014) and it is considered a valuable source of data for studies on corporate sustainability strategies (Vurro *et al.*, 2021), stakeholder orientation and inter-organizational relationships (Ioannou *et al.*, 2016). After having identified the US firms whose ESG commitments have been assessed by Asset4, we merged the sample with financial data collected from Compustat database. Based on the Bureau van Dijk ID number, we obtained patent data from the Orbis IP database covering all patent publications of firms according to the European Patent Organization (EPO). Only patents registered in the EPO and the United States Patent and Trademark Office (USPTO) were considered. Additionally, duplicated cases due to an amended specification or correction were discarded; and if two firms applied together, the patent was assigned to each firm separately. Later, the dataset was matched with a larger one taken from the

worldwide Patent Statistical Database, PATSTAT, to get the ID number, which is a point of reference. With it, the patent dataset was merged with the OECD Patent Quality Indicators database which contains the quality indicators of EPO and USPTO patents. We obtained 801,209 patent observations. Firm-based and patent-based datasets were thus merged. Grouping by year of application and firm ID, the yearly average of quality indicator and the total sum of patents were consolidated at firm-year level and complemented with financial data. Due to missing data, the final sample resulted in 843 firms and 5,608 firm-year observations.

2.2 Dependent variables

Innovation output: According to previous literature innovative output was proxied with patenting activity (McGahan and Silverman, 2001; Trajtenberg *et al.*, 1997). In particular, the yearly patent count was used as a measure of quantity of innovation output (Flammer and Kacperczyk, 2016). The indicator counts the number of applications filed by each firm in a year. The choice to rely on patent application rather than granted patents in a year is since applications tend to be closer to the time of innovation (Hall and Kerr, 2003).

Quality of innovation output: To track the quality of patent applications we relied on data collected by the OECD based on recent literature. In particular, we used three quality indicators: radicalness and originality based on backward citations and generality of the innovation output based on forward citations (Valentini, 2012). Radicalness refer to the number of cited patents in classes other than the one a citing patent is, that is, the extent to which a patent differs from the predecessors it relies upon. Originality refers to the breadth of the technology fields on which each patent relies and can be considered an indicator of knowledge diversification which is supposed to lead to more original results than concentrated knowledge structures. Different from originality, generality is measured based on the number and distribution of citations received by each patent and spanning across different technology classes. Higher levels of generality are associated to patents cited by subsequent patents that belongs to a wide range of technology fields. If this is the case, the invention can be considered as generalist or relevant for a number of later inventions in more or less related technology classes. According to Squicciarini *et al.* (2013) these variables are normalized to have values between zero and one, dividing the results by the maximum score obtained by any patent in the same year and technology field. This approach makes the indicators comparable between USPTO and EPO patents and over time. It is worth noticing that generality suffer from the usual limitations of indicators relying on forward citation, that is, truncation especially for recent patents that risk to have a reduced number of mentions compared to older one. To reduce the timeliness effect, we used a five-year time window to count forward citations.

2.3 Independent variables

Stakeholder orientation: Following Bettinazzi and Zollo (Bettinazzi and Zollo, 2017) and later studies (Vurro *et al.*, 2021), we operationalized a firm's degree of stakeholder orientation using the equally-weighted average of orientation across the five stakeholder categories on which this study focus (i.e., employees, customers, suppliers, local community and the natural environment). The resulting variable ranges between 0 and 100, with high scores indicating openness, fairness, trust and justice in stakeholder relationships. Consistently with previous operationalizations, we assessed the orientation towards a stakeholder group based on category-specific items. *Employee orientation* is assessed as the average of four Asset4 macro- categories: diversity and opportunity, employment quality, health and safety, and training and development. With those categories, the database measures a firm's management commitment to increase workers' loyalty and productivity by promoting work-life balance, distributing fair employment benefits, focusing on long-term employment growth, and developing employees' skills and competences. *Supplier orientation* does not have a macro-category in Asset4 database. Therefore, based on previous literature, we relied

upon different items that can be associated to a firm treating suppliers as key business partners. Specifically, the orientation is computed as the sum of sixteen dummy (zero, one) items, included in different macro-categories of Asset4, such as the presence of a code of conduct for suppliers, selecting and monitoring suppliers on human rights compliance, extending their workforce policies to the supply chain, or having managerial practices to improve the interaction with suppliers by setting objectives to be achieved on the quality of the relations. The sum of these variables was later divided by the maximum possible value (sixteen) and multiplied by one hundred. *Customer orientation* works with Asset4's Client Loyalty value, which measures the company's effectiveness for generating sustainable growth while maintaining a loyal client base. This macro-category tracks, for example, if the company has set policies to monitor and improve customer satisfaction, promotes transparency when interacting with customers or on the contrary has been under the spotlight due to complaints for its products. *Community orientation* is equivalent to Asset4's Society/Community macro-variable which measures management commitment to maintaining the firm's reputation within its community of reference, by being a good citizen and respecting business ethics, for sustaining the consent to operate. *Environmental orientation* refers to Asset4's Environmental pillar and results from three different macro-categories measuring management commitment and effectiveness towards reducing waste emission (e.g., greenhouse gases or water discharges), developing eco-efficient products and services, and increasing efficiency in the use of natural resources. This variable indicates the extent of environmental management practices to minimize the firm's operation ecological footprint and attentiveness to eco-efficient opportunities.

2.4 Controls

A number of controls were included in the analysis to account for factors that affect innovation activities. First, we controlled for the level of *R&D intensity*, which is considered conducive to the development of innovation processes and drive innovation outcomes (Hu and Jefferson, 2009). Research has reported a positive impact of R&D intensity on firms outcomes and innovative ability, specifically due to the positive relationships between R&D spending and the number of patents (Trajtenberg, 1990). R&D intensity was measured as the ratio between of R&D expenses and total revenues As firms age and mature they can be trapped in path-dependent trajectories and learning traps (Ahuja and Morris Lampert, 2001). To account for potential heterogeneity based on experience, we included *firm age* as a control for the analysis, measured as the natural logarithm of the difference between the observation year and the foundation year. We also controlled for *firm size* to account for the impact of firm dimension on patenting activity. Previous research has submitted that large corporations are likely to patent their innovation as they more likely rely on slack resources (McGahan and Silverman, 2001). Firm size is measure as the natural logarithm of total employees (Benassi *et al.*, 2022). In addition we controlled for the *debt-to-equity*, the log-transformation of *intangibles book value* which measures assets such as acquired patents, trademarks, and brands, and for firm performance using *return on equity* (ROE) Finally, to account for temporal dynamics within sectors we included a *year * sector fixed effect* the regression models aimed at testing the first set of hypotheses submitted, while in the models aimed at testing the second hypotheses we included *firm and year fixed effects*.

2.5 Model specification

To estimate the effect of firm stakeholder orientation on the quantity of innovation output we used a Poisson regression model, due to the patent count non-negative integer nature (Hu and Jefferson, 2009). To test our second set of hypotheses aimed at investigating the effect of stakeholder orientation on the quality indicator of innovation output we used fixed effect regression models. Consistently with innovation management literature, the dependent variables, patent counts and patent quality indicators, are lagged by 1 year. Flammer and Kacperczyk (2016) found that an increase of stakeholder orientation turns into higher innovative output after 12 months. Similarly,

Brunnermeier and Cohen (2003) that innovation outputs follow R&D expenditures with a 1 year lag.

Table 1 reports the summary statistics and the pairwise correlations. There is considerable variation across firms regarding their patent activity. On average, firms submit 95 applications per year, but patent applications change dramatically across time and across industries. On average, the firms in the sample employ 36.59 thousand employees, and R&D expenses are around 4% of total revenues. In terms of stakeholder orientation, firms have a higher customer and community orientation than towards the employees, the environment and the suppliers. Additionally, the correlation matrix does not show a high correlation among variables. Not surprisingly, there is a high correlation between the aggregated indicators (i.e., stakeholder orientation and quality indicators) with their respective components. Additionally, some types of orientation have a moderate correlation with other ones, such as employee and environmental orientation, ranging from 0.27 to 0.72. Therefore, and following the various hypotheses, the aggregated stakeholder orientation measure will be analyzed independently as well as the impact of each orientation on the different innovation outputs.

Tab. 1: Summary statistics

	N	Mean	Std. Dev.	Min	Max
Patents	5608	95.01	384.43	0.00	1693.00
Radicalness	3386	0.42	0.15	0.00	1.00
Originality	3386	0.77	0.10	0.00	0.98
Generality	3386	0.45	0.18	0.00	0.92
Stakeholder orientation	5608	42.74	20.78	5.31	95.09
Employee orientation	5608	47.79	22.23	6.49	97.62
Supplier orientation	5608	17.75	23.15	0.00	100.00
Customer orientation	5608	52.66	26.27	1.39	98.20
Community orientation	5608	51.70	30.24	2.68	97.36
Environmental orientation	5608	43.82	31.73	8.32	97.29
Size	5608	9.40	1.53	3.09	14.60
Intangibles (ln)	5608	8.63	2.65	0.00	14.12
R&D intensity	5608	0.04	0.13	0.00	5.40
ROE	5608	14.53	13.63	-15.18	44.74
Debt-to-equity	5608	0.89	0.99	0.00	3.81
Age (ln)	5608	3.15	1.00	0.00	5.31

Source: Our elaboration

Tab. 2: Pairwise correlations

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Patents	-															
2. Radicalness	-0.05	-														
3. Originality	-0.04	0.50	-													
4. Generality	0.06	0.31	0.35	-												
5. Stakeholder orientation	0.33	0.01	0.02	0.02	-											
6. Empl. orientation	0.30	0.00	0.03	0.01	0.85	-										
7. Supplier orientation	0.28	0.01	0.02	0.02	0.69	0.54	-									
8. Customer orientation	0.22	-0.01	0.00	0.01	0.66	0.43	0.27	-								
9. Community orientation	0.16	0.01	0.01	-0.02	0.81	0.65	0.37	0.46	-							
10. Environ. orientation	0.34	0.03	0.02	0.04	0.86	0.72	0.59	0.39	0.59	-						
11. Size	0.29	-0.02	-0.01	0.00	0.54	0.46	0.41	0.35	0.42	0.46	-					
12. Intangibles (ln)	0.26	-0.02	0.04	0.03	0.24	0.23	0.23	0.10	0.16	0.23	0.37	-				
13. R&D expenses	0.14	-0.06	0.02	0.07	-0.03	-0.01	-0.01	-0.02	-0.06	0.00	-0.13	-0.02	-			
14. ROE	0.01	-0.01	0.00	-0.01	0.03	0.03	0.03	0.05	0.02	0.01	0.02	-0.01	-0.04	-		
15. Debt-to-equity	-0.08	0.01	0.00	-0.05	0.03	0.03	-0.03	-0.01	0.07	0.03	0.05	0.10	-0.12	0.07	-	
16. Age (ln)	0.11	-0.02	0.00	0.03	0.22	0.21	0.14	0.13	0.17	0.19	0.23	0.04	-0.04	-0.01	0.05	-

Source: Our elaboration

3. Results

Table 3 reports the regression models used to test hypothesis 1 on the impact of stakeholder orientation and stakeholder-specific orientation on the quantity of innovation output. All the results are reported with robust standard errors to control for heteroskedasticity (Torres-Reyna, 2007).

Tab. 3: Results of the main analyses on the quantity of innovation output

	Baseline	Hp1	Hp1a	Hp1b	Hp1c	Hp1c	Hp1d
Stakeholder orientation		0.81** (0.39)					
Employee orientation			0.55** (0.27)				
Supplier orientation				0.91** (0.41)			
Customer orientation					0.19 (0.15)		
Community orientation						-0.02 (0.13)	
Environment orientation							0.46** (0.23)
Size	52.99*** (12.36)	48.46*** (11.61)	49.91*** (11.89)	49.73*** (11.85)	52.19*** (12.11)	52.96*** (12.38)	49.23*** (11.92)
Intangibles (ln)	4.01* (2.30)	3.88* (2.26)	3.81* (2.25)	4.15* (2.28)	3.99* (2.29)	4.02* (2.30)	3.96* (2.27)
R&D intensity	46.50 (48.84)	47.87 (48.75)	46.23 (48.44)	45.51 (48.59)	48.63 (49.57)	46.53 (48.86)	46.20 (48.29)
ROE	0.64* (0.35)	0.59* (0.34)	0.61* (0.35)	0.65* (0.34)	0.61* (0.34)	0.64* (0.34)	0.62* (0.35)
Debt-to-equity	-0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Age (ln)	-3.07 (7.11)	-4.53 (7.05)	-3.87 (7.13)	-2.07 (6.96)	-3.42 (7.08)	-2.80 (7.05)	-3.77 (6.99)
Constant	-53.55*** (12.12)	-45.51*** (10.42)	-46.90*** (10.70)	-46.59*** (10.65)	-47.15*** (10.62)	-48.06*** (10.90)	-47.25*** (10.71)
Sector fixed effects included							
Year effects included							
Sector * Year effects included							
Robust standard errors in parentheses							
*** p<0.01, ** p<0.05, * p<0.1							

Source: Own elaboration

In the baseline model we reported the regression including only control variables. According to Hypothesis 1, the overall stakeholder orientation is associated to a higher number of patent applications. Results, confirm our hypotheses, the coefficient estimates associate to stakeholder orientation is positive and statistically significant ($\beta = 0.81$; $p < 0.05$). Hypothesis 1a considered the influence of employee orientation, which was one of the three orientations supported ($\beta = 0.55$; $p < 0.05$). In Hypothesis 1b, we tested the impact of supplier orientation on the innovative activity. The coefficient estimates associated to supplier orientation is positive and significant ($\beta = 1.20$; $p < 0.001$), providing support for our prediction. Hypothesis 1c indicated an increase of patents applied in a year with a higher customer orientation, and the outcome was positive but the results are not statistically different from zero ($\beta = 0.19$; $p > 0.1$). Similarly, the results related to the regression aimed at analyzing the relationship between community orientation and the volume of innovation generated did not provide support for hypothesis H1c ($\beta = -0.02$; $p > 0.1$). Finally, hypothesis 1e studied the environmental orientation impact on innovation output, obtaining a positive and significant coefficient that supported the premises ($\beta = 0.46$; $p < 0.05$).

The results of the fixed effect models, aiming to analyze the impact on the quality of innovation output, are detailed in table 4. Results were estimated with robust standard errors.

Tab. 4: Results of the main analyses on the quantity of innovation output

	Hp2a	Hp2b	Hp2c
Stakeholder orientation	0.07***	0.04***	-0.05*
	(0.02)	(0.01)	(0.03)
Size	-0.97	-0.50	1.60
	(0.90)	(0.97)	(1.27)
Intangibles	-0.01	-0.06	-0.44
	(0.33)	(0.30)	(0.34)
R&D expenses	1.19	0.22	-0.77
	(1.78)	(0.79)	(1.33)
ROE	0.01	-0.01	-0.04*
	(0.02)	(0.02)	(0.02)
Current ratio	0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)
Age (ln)	0.53	-0.10	-0.95
	(1.15)	(1.02)	(1.33)
Constant	46.54***	81.21***	40.02***
	(7.86)	(7.50)	(10.65)
Firm fixed effects included			
Year effects included			
Robust standard errors in parentheses			
*** p<0.01, ** p<0.05, * p<0.1			

Source: Own elaboration

According to the hypothesis 2, we predicted the impact of stakeholder orientation on radicalness, originality and generality of the innovation output. In terms of radicalness, the model supports a positive, significant impact of stakeholder orientation ($\beta = 0.07$; $p < 0.01$). Additionally, the direction of the relationship between originality and stakeholder orientation goes as predicted in Hypothesis 2 ($\beta = 0.04$; $p < 0.01$). Different from what hypothesized, the generality variable showed a negative significant relationship with the independent variable at a 10% significance level ($\beta = -0.05$; $p < 0.1$).

We used patent applications as a proxy for innovation. This approach is widespread because patents are a relevant component of R&D activities (Klevorick *et al.*, 1995). Nevertheless, due to relevant variations across firms in term of patenting, scholars have suggested to complement patent counts with other indicators of innovation output (Hoenig and Henkel, 2015). To check if a firm's patenting activity can potentially lead to subsequent innovations, we relied on forward citations (i.e., the number of times each patent is cited in subsequent patents) as an alternative measure for the amount of innovative output (Trajtenberg, 1990). As a robustness test, we used forward citations from US patents given their high level of comparability, as a subset of total forward citations. In fact, previous research suggests that the USPTO and the EPO's patent examination practices differ substantially (Alcacer and Gittelman, 2006). Results were consistent with the hypothesized relationship between stakeholder orientation and quantity of innovation output measured with patent counts. Stakeholder orientation maintained a positive, significant relationship with innovation, as well as employee, environmental and supplier orientation remained positively related to the firm's innovative activity.

4. Discussion and conclusion

Our study aimed at theorizing and testing the relationship between heterogeneity in stakeholder orientation and innovation, in terms of quality and quantity of innovation output. According to our

review of the literature and previous empirical findings we submitted that stakeholder-oriented firms have better chances to get access to diversified streams of knowledge, anticipate changes in the wider society, learn from stakeholders and counter inertial behavior. Based on our results we found the existence of a positive innovation return on investments in the development of a relational approaches to stakeholders. Firms with higher degrees of stakeholder orientation also applied for more patents as compared with firms with lower levels of stakeholder orientation. We thus confirmed and extended previous findings (Flammer and Kacperczyk, 2016) by showing that heterogeneity in stakeholder orientation across firms and stakeholders matters in predicting quality and quantity of innovation outputs. We relied on more recent data and direct measures of stakeholder orientation to test our hypotheses and contributed to theory on the role of stakeholder relationships as a source of intangible assets to build competitiveness (Perrini *et al.*, 2011).

Among the different stakeholder categories, we showed that employee orientation plays a major role in driving technology investments. The development of human capital by investing in quality relationships with employees is crucial to obtain and disseminate knowledge (Luk *et al.*, 2005). Being defined as the management commitment to increase loyalty and productivity by promoting work-life balance, long-term employment, competence development and favorable internal climate, employee orientation had the most significant impact on the quantity of innovation output (Janz and Prasarnphanich, 2003). Similarly, results confirm the notion that development of an orientation aimed at integrating suppliers' interests facilitates knowledge transfer and fosters coordination among partners, resulting in increased innovative outputs for the focal firm. Additionally, innovation resulted to be driven by an orientation towards the natural environment through the implementation of environmental management practices. The more firms act proactively towards environmental management the greater the possibilities to generate social consensus and accumulate trust and reputation, while opening new markets in response to the growing interest in green public and private purchasing and the need to avoid costly litigations and fines.

Our results also supported emerging theory on the need to move beyond the amount of innovation output to deeply understand the impact of stakeholder orientation. Not all innovations are the same and stakeholders could be attracted by or support specific types of innovation rather than other (Conti and Novelli, 2022). We found that stakeholder relationships can be a source for more radical and original innovations. The more firms orient their decision making towards the integration of stakeholder interests the higher the chances to avoid competence traps and learning inertia. Similar to the findings according to which firms exposed to novel technologies increase the radicalness of the output (Ahuja and Morris Lampert, 2001), a higher stakeholder orientation can uncover new knowledge streams and stimuli that are absorbed into the innovation process. Our study supports the importance for manager to think outside-in, that is, understanding stakeholder perspectives to discover new opportunities. Firms with higher degrees of stakeholder orientations were also those able to generate technologies relying on distant technological fields and diversified knowledge trajectories. Therefore, we argued that being more open to a heterogeneous set of perceptions is conducive to higher innovation potential. Contrary to what hypothesized, a negative relationship was found between stakeholder orientation and generality of the innovation output. While higher levels of stakeholder orientation help firms to include new and diversified perspective into the innovation process, these turns into innovations that have limited applications. Indeed, it seems that stakeholders favor relationship-specific investments. Yet, forward citations increase with a higher stakeholder orientation although in narrower technological fields.

Our findings have important implications for practice, suggesting the importance to develop appropriate strategies for communicating with stakeholders and integrating their needs to remain innovative and renew firms' competitive advantage. It is by listening to stakeholders and understanding their needs that firms can come up with new ways of satisfying them (Harrison *et al.*, 2010). Stakeholder orientation is an important source of legitimacy and reputation, but can also stimulate the quantity and quality of technological trajectories (Jiang *et al.*, 2019). Although some stakeholders have a stronger impact of innovation than other, our study confirms the importance of

developing a corporate-level attitude towards stakeholders, a relational attitude towards the entire set of interests to which firms are espoused.

In order to gain these benefits, our findings points out to the importance of creating organizational structures and processes designed to support the flow of relevant information between firms and stakeholders, at the same time integrating this knowledge into corporate development processes (Markovic and Bagherzadeh, 2018). Multiple communication channels provide an opportunity to get access to diverse expertise and improve the firm's stakeholder dialogue capabilities (Ayuso *et al.*, 2006). Having these mechanisms in place, firms can develop collaborative approaches to research and development, as well as increase stakeholder awareness of their role in the innovation process. Involving external and internal stakeholders with different perspectives and diverse knowledge bases has the potential to increase a firm's capabilities to absorb new sources of innovation but also foster creativity, even when the output of the innovation activity has a narrower application.

By involving stakeholders, firms can bring in new ideas and overcome restraints. Yet, this is not an easy task as firms need to transform their internal processes to accomplish this task being aware that stakeholder demands can be unbalanced or misaligned. Aligning internal and external groups to innovate is challenging, can lead to inertia if too complex to be managed, or internal conflict. Thus, our results open new opportunities for research in the direction of investigating the innovation impact of balanced versus unbalanced stakeholder orientations (Hawn and Ioannou, 2016). Additionally, we focused on patenting activity as a measure of innovation performance being aware of the limits and the existence of alternative indicators. Future studies could further contribute to understanding how stakeholder orientation unlock innovation potential by investigating its impact at different stages of the innovation process and with reference to different innovation outputs. Finally, we theorized about the existence of a positive relationship between the degree of stakeholder orientation and innovation. Yet, preliminary evidence shows that stakeholders can affect the quality of innovation or represents sources of inertia when their requests are too complex of the organizational structure of the firm is not appropriately equipped. Future studies could dig deeper on this point and uncover the managerial, organizational, or institutional contingencies behind the downside of stakeholder orientation.

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Substance and symbol in ESG-linked executive compensation: evidence from Italian listed companies

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Abstract

Framing of the research. A very recent development in corporate governance studies is about how to integrate environmental, social and governance (ESG) indicators in executive compensation plans. Particularly, the debate is no longer about whether the use of ESG indicators in executive compensation makes sense, but how to do it in the most effective way.

Purpose of the paper. Based on the Neo-Institutional Theory (NIT) and on the substantive vs. merely symbolic inclusion of ESG criteria in executive compensation plans, we describe the spread and frequency (of use) of ESG indicators in CEOs' compensation plans designed by Italian listed companies, verifying, at the same time, the quantitative diversification of such indicators and the progress made by selected companies in recent years. In addition, our aim is to provide configurations that enable firms to give a higher weight of ESG indicators in their compensation plans.

Methodology. Our sample covers all Italian listed companies in FTSE Mib during the last 5 years (2017-2021). To analyze data and define the specific configurations mentioned above, we employed the Fuzzy-set qualitative comparative analysis (Fs/QCA).

Results. In an overall context that shows a relevant progress in the adoption of ESG indicators as part of the compensation plan metrics, three configurations emerged, which achieve the highest ESG weights, and which correspond, according to our interpretation, to different levels of substantiality in ESG implementation.

Research limitations. Firstly, we did not consider other conditions that could have helped to identify cases of symbolic adoption. Secondly, we have not delved into the type of ESG indicators that firms adopt.

Managerial implications. Sustainability-oriented investors might look for cues in the bundle of characteristics of the remuneration policy to infer whether it corresponds to a more or less substantial implementation of the ESG activities.

Originality of the paper. To the best of our knowledge, our database is the first longitudinal database of ESG indicators on CEO's compensation.

Keywords: ESG weight; ESG indicators; neo-institutionalism; symbolic adoption; substantial adoption; QCA analysis

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1. Introduction

The financial crises, the climate change, the CoViD-19 pandemic and, more recently, the emerging political crisis in Eastern European countries, have generated an extremely complex context, characterized by high instability, which is threatening the achievement of most of the goals set by the United Nations 2030 Agenda.

In this scenario, companies have an extremely important and active role with reference to all ESG (Environmental, Social and Governance) pillars. More in details, firms have the responsibility to design and implement effective corporate governance mechanisms, as well as in engaging those practices aimed at the reduction of the environmental impact, in terms of use of natural resources and harmful emissions, and the safeguarding of social well-being, including those best practices of internal CSR (Corporate Social Responsibility), such as the one addressing workforce issues, and external CSR, such as product responsibility and human rights protection (Kim *et al.*, 2010; Farooq *et al.*, 2017).

From a theoretical point of view, by recognizing the importance of ESG items, most scholars have had, indeed, a substantial shift from a “Friedmanian” vision (Friedman, 1970), based on the maximization of short-term profit for the shareholder, to a “Freemanian” vision (Freeman, 1984), aimed at an enlarged and longer-term creation and distribution of value. Since according to the conflict resolution hypothesis (Calton and Payne, 2003; Baron, 2009), and more recently reaffirmed by Stern (2020), what’s good for people and sustainable for the planet is also good for business and sustainable for long-term shareholder returns, there would be a convergence, in the long run, between the pursuit ESG objectives and the shareholder’s value. Indeed, we are recently noticing a profound shift according to which organizations are moving away from the idea of “doing good but not well” to embrace the idea of “doing good and well” (Krishnamoorthy, 2021, p. 2; Ya Ni *et al.*, 2018). The entire theoretical background according to which a higher short term ESG engagement will result in long-term firms’ overperformance, is based on the capability of companies to acquire this renewed role in the social and economic systems, especially in the post pandemic era, that leads them to reach a (new) legitimacy (Matthews, 1993). As noted in organizational literature (Ashforth and Gibbs, 1990), firms may obtain this so-called “citizenship” (Melo and Garrido-Morgado, 2012) on a large-scale, also through “coercive, mimetic and normative isomorphism” (DiMaggio and Powell 1983), that will result in a compliance to values, norms and expectations of a broader part of community members (Perrow, 1970).

According to the described theoretical background, also practitioners are adapting their investing strategies and approaches. Indeed, ESG has become increasingly popular and investment strategies driven by this sustainable perspective have gained popularity worldwide (Díaz, *et al.*, 2021; Zumente and Bistrova, 2021; Cornell and Damodaran, 2020). These circumstances are confirmed also by statements published by several associations of primary company leaders and international organizations. The Business Roundtable, for example, a group of prominent CEOs of major U.S. companies, announced that “while each of our individual companies serves its own corporate purpose, we share a fundamental commitment to all of our stakeholders” (2019). Therefore, they declare that the purpose of the corporation no longer gives shareholders special consideration, but rather that corporations should serve the interests of all their stakeholders (Harrison *et al.*, 2020). Or again, the universal purpose of the “Davos Manifesto 2020” by the World Economic Forum, which states that “the purpose of a company is to engage all its stakeholders in shared and sustained value creation”, clarifies the mentioned shift in companies’ objective also in the international public-private cooperation.

In this perspective, the alignment between the interests of shareholders and managers, rather reducing its importance as a research theme, has gained a renewed attention and prominence, particularly in terms of designing new incentives schemes aiming at fostering firms’ responsible behavior which will result in the aforementioned legitimacy and in a “win-win” situation.

Therefore, a very recent development in corporate governance studies is about how to integrate environmental, social and governance indicators in executive compensation plans (Flammer *et al.*,

2019), which, according to Baraibar-Diez *et al.*, will represent the “the response to demands of society in terms of sustainable behavior” (2019, p. 1457). Therefore, the debate is no longer about whether the use of ESG indicators in executive compensation plans makes sense, but how to do it in the most effective way, overcoming the problem stated by the so-called “overinvestment hypothesis” (Barnea and Rubin, 2010), according to which CSR expenditures are seen as an expropriation of shareholders to raise private benefits in terms of reputation.

On this point we have several confirmations that the inclusion of ESG indicators in executive compensation plans is a topical theme also for practitioners. The High Committee for Corporate Governance (HCGE), for instance, in its 2020 report, highlighted the necessity to include at least one environmental indicator in the determination of the executive’s variable compensation.

Differently from previous research on this topic, which mostly had the aim at demonstrating whether implementing a sustainable-based compensation policy has a positive influence on companies’ ESG and economic engagement (Baraibar-Diez *et al.*, 2019) or on long-term orientation and firm’s value (Flammer *et al.*, 2019), and based on the described new context, the purpose of this paper is three-fold. First, we will provide, following other authors (Aguilera *et al.*, 2006; Cucari, 2019b), a response to the calls for alternative theories in corporate governance studies, adopting a multi-dimensional and all-encompassing theory, as suggested by Haque and Ntim (2020), based on the Neo-Institutional Theory (NIT) and on the substantive vs. merely symbolic inclusion of ESG criteria in executive compensation plans (Adu *et al.*, 2022). Second, our study will describe the spread and frequency (of use) of ESG indicators in the CEO’s compensation plans designed by Italian listed companies, verifying, at the same time, the quantitative diversification of such indicators and the progress made by selected companies in recent years. Finally, we will provide three specific configurations of key governance and social performance variables that enable firms to give a higher weight of ESG indicators in their executive compensation plans.

To accomplish these objectives, gathering data from companies’ compensation reports, we build a novel database that compiles information on the composition of compensation plans with reference to ESG indicators. Our sample covers all Italian listed companies in FTSE Mib during the last 5 years (2017-2021) and, to the best of our knowledge, this database is the first longitudinal database of ESG indicators on CEO’s compensation. To analyze data and define the specific configurations mentioned above, which is the main contribution of this paper, we employed the fuzzy-set qualitative comparative analysis (fs/QCA), which is broadly recognized as an appropriate method in social science to define different combination indicating a specific outcome (Pappas and Woodside, 2021; Misangyi *et al.*, 2017; Cucari, 2019b).

Our study is structured as follows: Section 2 illustrates the theoretical background; Section 3 describes fuzzy-set qualitative comparative analysis methodology and Section 4 reports descriptive statistics and fs/QCA results. Lastly, Section 5 is dedicated to discussion and concluding remarks.

2. Theoretical Background

2.1 Corporate Governance and Social Responsibility in the Neo-Institutional Perspective

According to the Cadbury Report (1992), Corporate Governance (CG) refers to the system by which firms are controlled and managed (MacMillan *et al.*, 2004). According to the European Commission (2011), firms can be responsible if they are able to go beyond the compulsory law requirements when integrating social and environmental concerns into their strategies and operations. These two mentioned definitions, apparently, would deny a direct relationship between CG and Corporate Social Responsibility (CSR), leading to the so-called “separation thesis” (Harris and Freeman, 2008). However the broader approach to CSR, indirectly, includes CG mechanisms, while the ESG (Environmental, Social and Governance) acronymous even explicitly includes CG as one of the pillars of firms’ socially responsible business models and behavior (Gillan *et al.* 2021),

reaffirming that corporate governance has in any case seen as a topical theme in social responsibility.

On this point, scholars have had a long-lasting debate regarding if social and environmental concerns should or not be a managerial objective. The well-known Friedmanian position, according to which the only social responsibility of business is to increase its profits (Friedman, 1970), has been, indeed, opposed by the stakeholder approach to the firm (Freeman, 1984; Freeman and Velamuri, 2006), according to which companies should be managed in the interest of a wider range of parties, including their macro-environment (Clarkson, 1995).

This latter vision, which is consistent with the communitarian position (Lashgari, 2004) has, by time, gained a higher consensus, that became even more evident in the last two years because of the covid pandemic and of the effects on the community it has had. According to this wider perspective, CG and CSR have several points of contact (Aguilera *et al.*, 2006) and together contribute to sustainability and best business practices, laying the foundation for a new way of sustainable competitive advantage (Ho, 2005) and long-term wealth creation (Beltratti, 2005). In this way, managers can fulfill their moral, ethical and social duties, while also targeting corporate goals for their shareholders (Jo and Harjoto, 2012).

Therefore, unlike the agency model (Jensen and Meckling, 1976), the synergistic relationship between CSR and CG, rather than being illusory (Bebchuk *et al.*, 2022; Bebchuk and Tallarita, 2021) drives to a “win-win” situation for shareholders and other stakeholders (Edmans, 2021).

The recognition of a synergistic relationship between CG and CSR is further reinforced according to the theoretical perspective that places both along the so-called corporate responsibility continuum (Bhimani and Soonawalla, 2005; Jamali, 2008), as CG, social and environmental concerns can all be seen as elements that contribute, in an integrated way, to the sustainable growth of firms (Van den Berghe and Louche, 2005).

In this viewpoint, the needed new measures of value creation should include ESG goals as a complement to standard financial metrics (Schwab, 2019). Moreover, ESG goals, are not only a complement to financial information, but also a driver of companies' overperformance, since many scholars found a positive relationship between ESG and financial performance, that means that short term ESG investments lead to long term higher value creation (Mishra, 2020; Henisz *et al.*, 2019; Friede *et al.*, 2015), resolving the debate on different forms of capitalism (Stiglitz, 2019) and, in particular, on responsible capitalism (Stulz, 2022).

Since companies are open systems deeply interconnected with individuals and communities to whom they are somehow accountable (Russo e Perrini, 2010), besides more intuitive beneficial effects in terms of efficiency (Brammer and Millington, 2005), that firms can obtain through a higher ESG engagement, scholars have highlighted the relevance that responsible behavior has in order to respond to stakeholders' pressures, thus acquire legitimacy and creating competitive advantage (Halkos and Piazons, 2016; Lee *et al.*, 2018). Indeed, Sen *et al.* (2006) defines CSR as the set of activities put in place by firms to fulfill their obligations to society, thus creating and enhancing their societal relationships (Sun *et al.*, 2019). Therefore, since ESG concerns are constantly raising their importance in the worldwide community, thus improving the stakeholder pressure on firms, the relation between companies and stakeholders can be enhanced by additional investments of firms in ESG. This strategic choice may result in a higher firms' reputation (De Castro *et al.*, 2006), that is the set of expectations, perceptions and opinions that stakeholders have on values and behaviors of a given organization (Fombrun *et al.*, 2000). By demonstrating that they respond to the environmental, social and governance pressures, firms may raise their reputation and obtain the so-called citizenship (Matten and Crane, 2005) and legitimacy (Carroll, 1994). The aforementioned reasons by which companies may consider it worth to raise their ESG engagement is consistent with the Neo-Institutional Theory (NIT) which is recognized to be a dominant theoretical framework in organizational studies (Alvesson and Spicer, 2019, p. 204). Indeed, the NIT suggests that a firm's response to institutional pressures is often driven by two reasons: efficiency (substantive/economic) and legitimization (symbolic/impression management) (Meyer and Rowan, 1977). Of course, both reasons that drive response of firms to stakeholders' pressures

are pushed, on a large scale, by the well-known three mechanisms of institutional isomorphism: coercive isomorphism, that originates from political influence, mimetic isomorphism, that stems from risks and responses to uncertainty, and normative isomorphism, mainly related to education and professionalization (Di Maggio and Powell, 1983). Indubitably, all these three forms and, at the same time, causes of isomorphism are currently strongly in place with reference to ESG issues. From a coercive point of view, the incentives for social and environmental responsibility have increased significantly over years (consider that about 500 of the 800 billion euros of Multiannual Financial Framework 2021-2027 and NextGenerationEU are allocated to CSR objectives), as well as the sanctions. Similarly, from a competitive point of view, globalization and the more rapid diffusion of information, witnessed in the last 10 years due to technological progress, have exacerbated reputational risks for companies, leading them, in a mimetic way, to pay more attention and neutralize their gap in terms of ESG engagement. Lastly, as Ghoshal warned in 2005, academic and managerial training has increasingly drawn from scientific research with reference to the aforementioned shift from a shareholders' view to a stakeholders' view, that is consistent with a greater ESG engagement, in order to prevent bad theories to negatively influence good managerial practices (Ghoshal, 2005).

In order to fulfill stakeholder expectations and to obtain reputation and legitimacy, companies have to accurately disclose information on their responsible behavior (DasGupta, 2021). Indeed, scholars have highlighted that one of the main reasons why CSR activities fail to create the expected added value is that firms don't effectively communicate their socially responsible activities (Kim, 2017). Obviously, corporate social disclosure differently impacts on different companies. Firms that, because of their core activity, may more heavily and negatively impact on the community (is the case of chemicals, food or pharmaceutical companies, for instance) are more likely to give a higher attention to this topic and diffuse more information about their social and environmental engagement (Gao *et al.*, 2005; Boutin-Dufresne and Savaria, 2004). Likewise, larger companies, who typically have greater impact on community and greater notoriety, usually suffer greater stakeholders' pressures. to which they will have to respond with analogous level of non-financial disclosure (Carlisle and Faulkner, 2004; Graafland *et al.*, 2004). Additionally, country specific characteristics may influence the required level of social disclosure, given that different forms of capitalism and governance that characterize companies in different contexts may differently impact on the expected level of corporate social responsibility disclosure (van Der Laan Smith *et al.*, 2005; Aguilera *et al.*, 2006). Regardless the higher or lower need to communicate organizations' social performance, it is clear that social disclosure, like any other business communication, responds to the need to reduce information asymmetry towards stakeholders, including financial ones (Gangi *et al.* 2019). Indeed, both debt and equity (institutional investors) holders, through this greater information disclosure, may be able to better evaluate companies' risk, thus limiting the well-known problems of adverse selection (Verrecchia, 2001).

The above mentioned considerations describe a rather clear theoretical and practical background, but there is still one last element missing. Since, especially in terms of improving economic efficiency, the costs associated with a greater ESG engagement are more likely to turn into financial performance improvements only in the medium to long term, and since managers are more typically evaluated on the basis of short-term performances, some incentive mechanism is needed to align the interest of executives with this new conceptualization of enlarged value creation, that may be fostered by institutional forces that compel firms to sustainability-based compensation (Adu *et al.*, 2022) and result also in the described enhancement of the shareholder value.

2.2 ESG-linked compensation plans

During the COVID-19 crisis, ESG based performances and compensation schemes have gained more importance (Eklund and Stern, 2021) since the pandemic has demonstrated that societies and businesses should prioritize sustainable economic systems and social objectives (Van Barneveld *et al.*, 2020). In previous studies, such as in the one of Baraibar-Diez *et al.*, (2019), scholars have

mainly investigated whether having a sustainable compensation policy has a positive influence on ESG and economic scores. Following the “pay for performance” assumption, several other authors have argued the importance of ESG-based compensation policies to motivate executives to pursue sustainable objectives beyond financial performance (Haque, 2017). Moreover, even the study of Flammer *et al.*, (2019, p. 1099) showed that the adoption of CSR contracting - as the integration of CSR criteria in executive compensation - leads to: i) an increase in long-term orientation); ii) an increase in firm value; iii) an increase in social and environmental initiatives; iv) a reduction in emissions and v) an increase in green patent, but didn't provide any evidence about the link between compensation plans design and corporate social performances.

Nevertheless, as reported by Maas (2018), most of the existing studies focus on the effect of executive compensation on corporate social performance and only a few studies analyze whether this effect changes when corporate social performance targets are used. Furthermore, according to Stern (2020), most ESG-linked bonus plans are poorly designed, which may be the reason they achieve such mixed results. Therefore, the debate shifts on the substantive vs. merely symbolic inclusion of ESG criteria in executive compensation (Adu *et al.*, 2022), since organizations, as already stated, frequently try to pursue legitimacy through both symbolic and substantive practices (Ashforth and Gibbs, 1990). In this scenario, only a few authors have focused on substantive vs. merely symbolic inclusion of ESG indicators in executive compensation plans (Adu *et al.*, 2022), although some discussion on if CEOs' compensation may be driven by symbolic and substantive considerations have been developed in the less recent past (Zajac and Westphal, 1995).

In this perspective, it is absolutely relevant to understand both the progress that companies are making towards a greater inclusion of ESG goals in executives compensation plans and which can be the driver of this new form of alignment between shareholders and managers objectives. In the next sections of the paper, we will contribute to existing literature filling this gap, by both describing the recent progress in terms of ESG-related compensation plans by Italian firms and investigating how some variables, such as the “say on pay” (SOP), the compensation committee independence and the compensation plan structure, may determine a higher weight of ESG goals in the CEO's compensation plan.

The compensation committee is an important element of the corporate governance structure, since it may heavily contribute to reducing agency problems by improving the alignment of executive remuneration with shareholders' objectives (Murphy, 1985). Therefore, several studies state that to obtain this alignment and push executives to raise companies' CSR engagement, the compensation committee should tie managers' remunerations to CSR objectives (Al-Shaer & Zaman, 2019). The relevance of this choice has been verified by Hong *et al.* (2016) who provide evidence of a positive relationship between CSR-linked CEO's remunerations and companies' CSR performances. In this context we decided to include, as an explanatory variable of the CSR weight in the compensation structure, the independence of the remuneration committee, since this characteristic of board members is likely to promote a higher CSR engagement (Jo and Harjoto 2011; Jo and Harjoto 2012).

Another CG tool that can somehow reduce the aforementioned misalignment between shareholders and managers is SOP. Through this mechanism, shareholders express their opinion on executives' compensations (Conyon and Sadler, 2010; Esposito De Falco *et al.*, 2016), showing an increased activism towards orienting managerial behavior (Cucari, 2019a). However, even if not so much attention has been paid to this element in previous CSR research (Lozano-Reina and Sánchez-Marín, 2020), some authors have found that the nature and level of CEO's remunerations are positively linked to CSR performances (Cullinan *et al.*, 2017).

Finally, we included in our empirical analysis two more elements: the number of ESG indicators used to define short-term incentives and the total number of performance indicators used to define short-term incentives. We included these two measures because, on one hand the number of ESG indicators in the compensation structure can serve as a proxy of a broader and diversified vision of CSR engagement, which is consistent with the legitimacy theory and with the need for an enhanced disclosure of firms' sustainable behavior. On the other hand, we decided to take in account the

overall number of indicators included in the compensation structure because it can serve as a proxy of a less limited discretion for managerial behavior, which is consistent with higher agency problems and, therefore, with a higher necessity to include CSR objectives as a part of CEO's compensation in order to more effectively align his interests to shareholders' ones.

When investigating the effect of the selected variables on the relative weight assigned to ESG performance indicators on the overall compensation plan, our contribution will provide different configurations of the mentioned drivers that can lead to shape a rather symbolic or substantive inclusion of ESG scores in compensation plans. Indeed, our theoretical perspective, relying on the NIT, takes into consideration that organizations are highly concerned about social and symbolic pressures arising from their institutional environment (Suddaby et al, 2013) and may adopt this kind of practices just for legitimacy effects, while providing only an appearance of economic rationality.

3. Methodology

3.1 Sample

The dataset consists of all Italian firms listed on the FTSE Mib during the period from 2017 to 2021. This time frame was chosen to allow an investigation of the impact of ESG indicators during the recent Covid-19 pandemics. ESG compensation in the Italian context has received scant attention, and to the best of our knowledge, no other studies have addressed the variations in ESG indicators in executive plans. Given the normative and political pressures they normally bear, listed companies are particularly interested to be studied within a Neo-Institutional framework, whose aim is to make sense of the institutionalization of organizational practices under the effects of contextual influences. To the same token, listed companies are more likely to incur in a merely symbolic and formal application of new practices, such as ESG implementation, just to comply with the dominant institutional context. Appendix 1 provides the final list of companies (26) we have included in the sample according to the availability of data.

3.2 Qualitative Comparative Analysis

Recently, different authors have suggested a more pluralistic range of theory building and methods to study corporate governance (Tihanyi et al, 2014; Boyd et al, 2017; Filatotchev and Wright, 2017; Cucari, 2019b). One of these is certainly the introduction of qualitative comparative analysis (QCA) in corporate governance studies (Cucari, 2019b; Garcia Castro *et al.*, 2013).

QCA has led to a new wave of “neo-configurational” studies that explicitly embrace causal complexity (Misangyi *et al.*, 2017; Greckhamer *et al.*, 2018). For a deeper review concerning different approaches and tools in QCA design, see Thomann and Maggetti, 2020. Briefly, QCA aids in the identification of causal structures (Ragin, 1987; Fiss et al 2013) and it is an instrumentation of generic analytical approaches for which qualitative methodologists advocate (Kan *et al.*, 2016). Specifically, Filatotchev and Wright (2017, p.459) prescribed a “qualitative research... based on using rich research and governance-related documents at the firm's level” and other recent contributions suggest that literature requires a much richer empirical base.

In this sense, QCA has been adopted in corporate governance research to empirically help to tackle the complexity implied by the bundle perspective on corporate governance (Khlif *et al.*, 2019; Cucari, 2018). Specifically, we adopted the fuzzy-set QCA (fs/QCA) that allows researchers to define the value of conditions not only in a dichotomous way, but also in gradual variations. The use of fs/QCA requires the selection of a calibration method to transform the original values into fuzzy set values for both the causal and outcome conditions (Ragin, 2009), as discussed in the next section.

3.3 Data and Operationalization of outcome and causal conditions

Since we adopted the Fs/QCA, we need to express variables into sets and subsets according to their degree of membership in a specific condition (calibration process). Our analytical model comprises one outcome, which measures the relative weight assigned to ESG performance indicators in short-term incentive plans and 4 causal conditions in line with the literature above (Table1).

Tab. 1: Outcome and conditions

Outcome/Conditions	Data Source	Description
ESG weight (outcome)	<i>Report on remuneration policy and payments</i>	Relative weight (%) assigned to ESG performance indicators used to define short-term incentives
ESG Indicators (condition)	<i>Report on remuneration policy and payments</i>	Number of ESG indicators used to define short-term incentives
Total indicators (condition)	<i>Report on remuneration policy and payments</i>	Total number of performance goals used to define short-term incentives.
“For” Votes (condition)	<i>Elaboration of the meeting minutes and of the summary report of the votes</i>	Percentage of favorable votes over the total of the votes expressed by investors for the first section of the remuneration report (remuneration policy).
Degree of independence of the Remuneration Committee (condition)	<i>Report on corporate governance and ownership structure</i>	Percentage of independent directors (according to the criteria of the Corporate Governance Code) over the total of directors composing the Remuneration Committee.

Source: our elaboration

The calibration process could be based on theoretical criteria when available. Unfortunately, in this case, we cannot use any theoretical criteria and consequently, based on other studies, we followed the practice of relying on sample statistics such as percentile scores (Greckhamer, 2016; Paolone *et al.*, 2021). In this study, the values of the 95th, 50th and 5th percentiles correspond to full membership, the crossover point and full non-membership, respectively: full membership (fuzzy score = 0.95); the crossover point (fuzzy score = 0.5); and the threshold for full non-membership (fuzzy score = 0.05).

Table 2 shows the calibration process and indicates the transformation of both the outcome and the conditions into fuzzy terms.

Tab. 2: Calibration process

Outcome/Conditions	Calibration values		
	Full non-membership	Crossover point	Full membership
ESG weight	0.05	0.13	0.24
ESG Indicators	0.63	1	2
Total indicators	3.7	6.25	15.7
“For” vote	0.75	0.92	0.97
Rem Committee Independence	0.67	0.83	1

Source: our elaboration

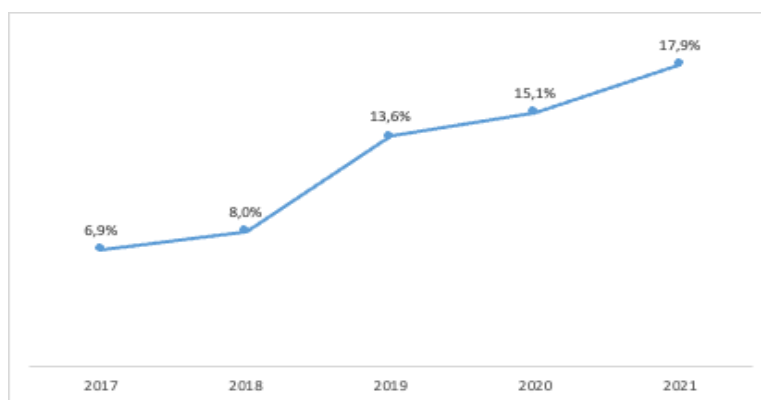
We consider the value average both for the outcome and for the causal conditions over a period of 5 years. Finally, we set our consistency threshold at a minimum of 0.80 (Ragin, 2008).

4. Results

4.1 Descriptive statistics

Table 3, 4, 5, 6 shows descriptive statistics for all variables used in the analysis.

Tab 3. Average ESG weight over time



Source: our elaboration

The average ESG weight, for firms in our sample, has been growing quickly in recent years. This trend seems to have started even before the Covid-19 pandemic, so that it is hard to tell whether the virus-related crisis has had any impact on the employment of ESG indicators as part of executive remuneration. The average number of ESG indicators and of total indicators across the 5 years, as well as the relative percentage of ESG indicators over the total are shown in Table 4. It is worth noticing that the ESG weight does not equal the percentage of ESG indicators, and that the latter has been generally higher and has been growing slower than the former across the years.

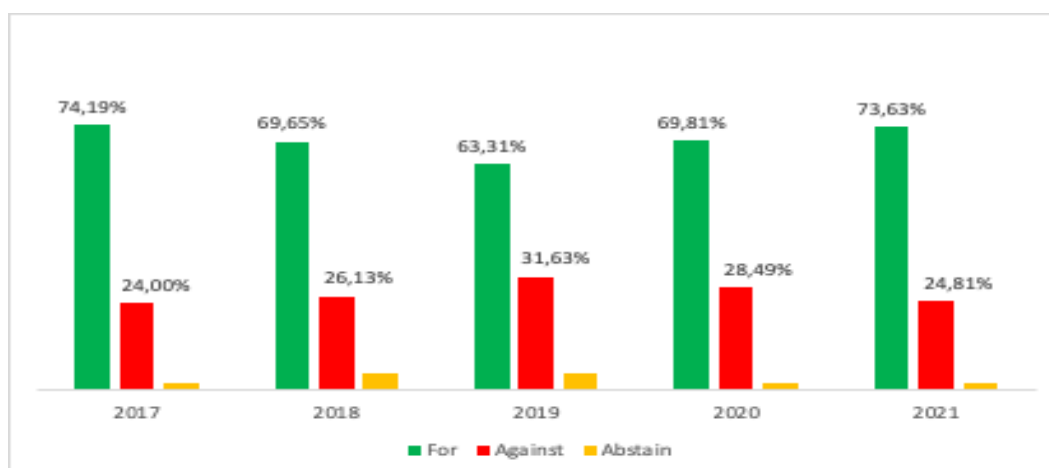
Tab 4. Average ESG Indicators and total number of indicators over time

	2017	2018	2019	2020	2021
<i>Number of ESG indicators</i>	0.65	0.70	1.15	1.42	1.76
<i>Total number of indicators</i>	6.65	6.16	6.62	7.88	7.97
<i>Percentage of ESG indicators over total number of indicators</i>	18,54%	19,67%	22,34%	25,14%	25,51%

Source: our elaboration

The percentage of “for” votes over total votes is relatively high (always greater than 60%) in all the years considered (Table 5), with a relevant minimum in 2019 (63.31%). However, it should be considered that these votes include the ones from block holders and majority shareholders, who tend to approve executive decisions and to increase the percentage of “for” votes. Therefore, even a small fraction of voting dissent is indicative of shareholders’ satisfaction, and especially of minority shareholders.

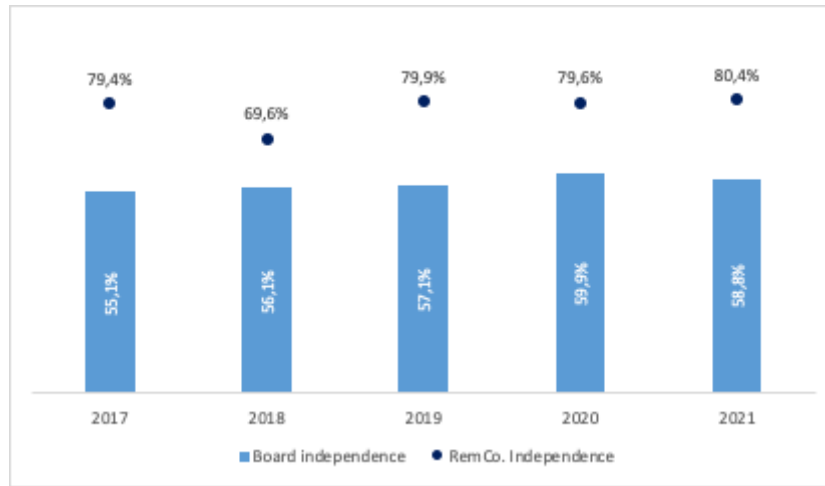
Tab 5. Percentage of “for” votes over total votes



Source: our elaboration

Table 6 shows the average percentage of independence of both the board and the remuneration committee of the firms in our sample. It immediately stands out that there is an abrupt drop in board independence in 2018, even if there are no dramatic changes in remuneration committee independence in this year as compared to the other four years.

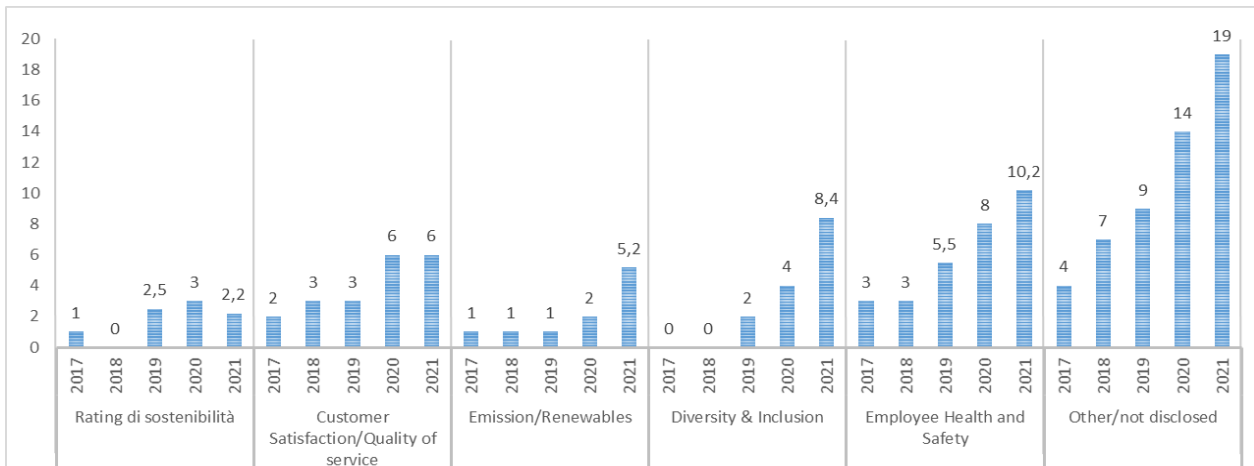
Tab 6. Percentage of “for” votes over total votes



Source: our elaboration

Finally, table 7 shows the evolution of the number of ESG indicators over the 5 years, divided by category. It emerges that, even if all categories have been growing over time, the most part of indicators are in the category “other/not disclosed”.

Tab 7. The number of ESG indicators divided by category



Source: our elaboration

4.2 fs/QCA results

The results of fs/QCA are shown in Table 8. Following the notation introduced by Ragin and Fiss (2008), we’ve reported consistency and coverage values for each configuration as well as for the overall solution for each outcome. The coverage value indicates how much of the outcome is explained by a given configuration and therefore reflects empirical importance (Ragin 2008). The consistency indicates how closely a perfect subset relation is approximated. In our study, we obtain an overall coverage of 0.51 and an overall consistency of 0.95, that are suitable scores for the analysis.

Coverage indicates empirical relevance, so greater coverage implies a greater empirical relevance of the solution (Ragin, 2009), which means that a greater number of empirical cases are covered.

Tab. 8: fs/QCA results

<i>Conditions</i>	Configurations		
	1	2	3
ESG indicators	●		●
Total indicators	○	○	
'For' votes	○	○	○
Remuneration Committee Independence		●	●
<i>Note:</i> Black circles (“●”) indicate the “presence” of a condition, circles with a cross-out (“○”) indicate its “negation”, and blank spaces in the solutions indicate the “don’t care”.			
Raw coverage	0.38	0.37	0.35
Consistency	0.96	0.05	0.97
Solution Coverage	0.51		
Solution Consistency	0.95		

Source: our elaboration

The findings reveal three “equifinal” configurations that lead to higher ESG weights:

- Solution #1: a high number of ESG indicators, with a low number of Total Indicator, associated with a low percentage of “Vote For” and ‘don’t care situation’ for the level of independence of the remuneration committee. We define this configuration as a *symbolic ESG inclusion*.
- Solution #2: a low number of ESG indicators, with a low number of Total Indicator, associated with a low percentage of “Vote For” and a high level of independence of the remuneration committee. We define this configuration as a *semi-substantive ESG inclusion*.
- Solution #3: a high number of ESG indicators, with a ‘don’t care situation’ of Total Indicator, associated with a low percentage of “Vote For” and a high level of independence of the remuneration committee. We define this configuration as a *substantive ESG inclusion*.

5. Discussions and conclusion

As suggested by some authors (Furnari *et al.*, 2021), we adopt “configurational thinking and theorizing” that is well-suited for explaining causally complex phenomena. According to our results, we find that some variables/conditions are conducive to higher ESG weights in compensation plans. Although all three configurations are associated with a higher ESG weight, nonetheless they correspond to different “bundles of values” that allow us to interpret the outcome ESG weight as more or less ‘substantial’ or ‘symbolic’. In other words, even if the outcome is the same (i.e., higher ESG weight) it can be interpreted differently (e.g., a symbolic ESG implementation), depending on the background conditions (i.e., configurations) from which the output arose. In the perspective of Neo-Institutionalism, in some configurations, the formal application of ESG standards, as proved by a high ESG weight, is decoupled from the actual practices carried on by organizations (Boxenbaum and Jonsson, 2017).

Specifically, based on our theoretical framework, the configuration that can be associated with the highest degree of substantiality is Solution #3. In this case, we consider that the more ESG indicators are present in a remuneration plan, the greater is the awareness of the company decision-makers of their importance in keeping track of ESG performance. In addition, a truly independent remuneration committee ensures that ESG implementation is not just a matter of appearance but that it is truly embedded into the organizational culture (Abdelmotaal and Abdel-Kader, 2016). The total number of indicators used in a compensation plan is irrelevant.

The other two configurations, instead, present lower levels of substantiality in ESG-linked compensation plans. Both these configurations include a lower number of total indicators, which

might be an indication of insufficient attention towards fine tuning the system of incentives or even towards transparency about the internal processes of the firm. More specifically, Solution #2 appears to be in the middle in the substantial-symbolic continuum. The high ESG weight is achieved in this case when having a low number of total indicators in the remuneration plan. Therefore, even if the remuneration committee is highly independent, it might be that the remuneration plan is not sensitive enough in grabbing all the nuances in performance goals (both financial and non-financial ones) that can be linked to incentives for executives. As a result, the ESG weight might result from more contingent and less thoughtful evaluation.

Finally, Solution #1 is the one that, among the three, seems to correspond to the least substantial, and so the most symbolic, ESG implementation. In fact, in this configuration are included those organizations that generally obtains low percentage of 'for' votes, while having a remuneration plan that includes fewer total indicators and several ESG indicators. At the same time then, in this case it is irrelevant whether the remuneration committee is more or less independent. Furthermore, the low number of total indicators, coupled with the relatively high number of ESG indicators, might indicate that the ESG weight is artificially inflated by using too many ESG indicators that have little relations to the firm operations.

Several theoretical and practical implications can be drawn. Firstly, an important result is that one of the variables presenting the same value in all three configurations is the low percentage of 'for' vote percentage. This comes with little surprise, since higher voting dissent is often intended almost as a synonym of shareholder activism (Stathopoulos and Voulgaris, 2016) and so it can be interpreted as a sign of the attention of investors towards the corporate strategy issues, including sustainability concerns (Grewal *et al.*, 2016). However, it must be considered that the 'for' vote regards the remuneration plan as a whole, so that investors have no way for approving or rejecting a single component (e.g., financial indicators, ESG indicators) of the remuneration plan. Therefore, lower percentages of 'for' votes are to be intended as general dissent on the remuneration plan, but not specifically on ESG weights. This result is in line with the growing number of companies that are linking executive pay to sustainability metrics. Therefore, it emerges that "say on sustainability", likewise the "say on pay", could rule the votes at the upcoming shareholder meetings. Consequently, a specific configuration could help in this vote. Sustainability-oriented investors might look for cues in the bundle of characteristics of the remuneration policy to infer whether it corresponds to a more or less substantial implementation of the ESG engagement.

Secondly, another important result is represented by the percentage of independent directors within remuneration committees, which has the responsibility of designing the remuneration plan and defining the remuneration policy (Kuo and Yu, 2014). This governance tool should be free of burdensome ties with the other decisional tiers of the organization, so that it can best design incentive systems that truly align the interests of owners, managers and other stakeholders. The presence of not independent directors can undermine the functionality of the remuneration committee, which ends up being dominated by the interests of executives and top managers and being unable to defend the interests of all other stakeholders, including society. Independent directors safeguard the interest of all stakeholders and ensure that the implementation of ESG goals is embedded within the organizational culture and not decoupled from the actual organizational practices (Park and Zhang, 2020).

Thirdly, the number and the type of ESG indicators adopted can be an indication for investors of how much symbolic or substantial is the adoption of the ESG logics within the firm, as emerged by descriptive analysis. Too few and vague, general, or poorly measurable indicators may indicate a purely formal compliance to the sustainability, which allows the firm to define themselves social and environmentally friendly, without having to transform internal processes.

Some limitations of the present research need to be addressed through additional investigation and future research. In the first place, we look at only a subset of the possible cues of substantial or symbolic ESG adoption. For instance, we did not consider other conditions - such as absolute number of independent directors, or CEO duality - that could have helped to identify cases of symbolic adoption. Second, since institutional pressures are context-dependent, our research may

suffer from the specificities of the industries that the firms in our sample belong to. Therefore, further investigation is needed to verify the extent of symbolic adoption in different industries, as well as the profile of symbolic adopters in these domains. Finally, we have not delved a lot into the type of ESG indicators that firms adopt, especially in the fs/QCA results. With regards to this, future research may try to identify the profile of symbolic adopters of specific (environmental, social, governance) indicators.

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Appendix 1. List of companies included in the sample

1. A2A
2. Assicurazioni Generali
3. Atlantia
4. Banca Generali
5. Bper Banca
6. Buzzi Unicem
7. Enel
8. Eni
9. Finecobank
10. Hera
11. Intesa Sanpaolo
12. Inwit
13. Italgas
14. Leonardo
15. Mediobanca
16. Moncler
17. Nexi
18. Pirelli & C.
19. Poste Italiane
20. Prysmian
21. Recordati
22. Saipem
23. Snam
24. Telecom Italia
25. Terna
26. Unipol Gruppo

From myopic to focused engagement: An explorative perspective on Italian pension funds

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Abstract

Framing of the research. *This paper focuses on shareholder engagement as the core SRI strategy among institutional investors.*

Purpose of the paper. *Since engagement is the preferred tool for European institutional investors, our aim was to investigate what determines (the lack of) engagement by pension funds, deepening the main critical issues and discussing possible factors that would improve ESG engagement for other pension funds.*

Methodology. *The study is based on a structured survey administered to a sample of pension funds. Principal component analysis was used to compute factor indexes concerning the perceived benefits and hindering motivations of shareholder engagement, the impact of which on engagement propensity was then tested through OLS regression.*

Results. *Based on our results, we defined a conceptual framework and affirmed that a virtuous path seems to emerge along which the approaches to engagement are shifting from negative factors that hinder engagement to positive aspects that create benefits. This means a shift from “myopic” to “focused engagement”, and this scenario provides a new relevant role for the pension funds in influencing the strategies and behaviours of investee companies in the long term.*

Research limitations. *Since our study focuses on contractual pension funds, future studies could enlarge the scope of analysis to include other types of institutional investors.*

Managerial implications. *This research aims to enable pension funds to account for the difficulties that they face in engagement processes and encourage a change in their behaviour through the implementation of possible adequate solutions.*

Originality of the paper. *Notably, to the best of our knowledge, no previous studies analyse the experience of pension funds in relation to this specific topic. Therefore, this study could be a real novelty in the Italian context.*

Keywords: *Engagement; ESG; Shareholder Engagement; Institutional Investors; Pension Fund*

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1. Introduction

Pension funds have become significant owners of corporations (Hamilton and Eriksson, 2011; Clark and Hebb, 2004, 2005; Skerrett, 2018), and they are among the institutional investors that are most concerned about corporate sustainability and responsible investment (Alda, 2019; Pucheta-Martínez and López-Zamora, 2019). According to Sievänen *et al.* (2013), pension funds' responsible investment is a means to advance corporate social responsibility (CSR), and engagement is regarded as an efficient way to promote CSR (Clark and Hebb, 2005). However, according to Calza *et al.* (2016), the orientation towards proactive environmental, social and governance (ESG) strategies varies among institutional investors. For example, Sievänen *et al.* (2013) find that especially the legal origin of the country, ownership of the pension fund and fund size-related variables are associated with pension funds' responsible investment.

According to the UN Principles for Responsible Investment, a large number of institutions have endorsed these investing principles, thereby declaring that CSR is an essential part of their due diligence process and matters for their investment decisions. Consequently, socially responsible investment is widely understood as the integration of ESG factors into investment processes and decision making. Socially responsible investing (SRI) can be implemented by strategies such as exclusion, integration of ESG criteria, engagement or impact investing. Following other studies (Wagemans *et al.*, 2018), this paper focuses on engagement as the core SRI strategy among institutional investors who want to discuss ESG concerns without publicizing them (Solomon *et al.*, 2004; Vandekerckhove *et al.*, 2007). While most of the research on SRI focuses on the relationship between SRI and financial returns (Capelle-Blancard and Monjon, 2012; Derwall *et al.*, 2011; Renneboog *et al.*, 2008) or on certain SRI strategies, particularly shareholder voting (Monks *et al.*, 2004; Sparkes and Cowton, 2004) and screening and exclusion (Aslaksen and Synnestvedt, 2003; Haigh and Hazelton, 2004), only a few studies analyse engagement and its application (Barko *et al.*, 2021; Bauer *et al.*, 2013; Dimson *et al.*, 2015; Ferraro and Beunza, 2018).

Thus, there is little knowledge on shareholder engagement's causes, processes and consequences. In addition, the existing studies cover data and viewpoints of some institutional investors and asset managers, particularly when studying the effectiveness of engagement, but not from the perspective of pension funds (Alma, 2019; López-Ruiz and Grande-Gascón, 2021). Indeed, most of the previous literature considers institutional investors as a homogeneous group, while the behaviour, investment objectives, time horizon and clientele may differ widely among institutional investors, with different categories existing (Hoskisson *et al.*, 2002). In this framework, very few studies analyse the role of pension funds in engagement practices (Alda, 2019; Hamilton and Eriksson, 2011; Sievänen *et al.*, 2017; Wagemans *et al.*, 2018), although the literature mentions that pension funds are important institutional activist investors (Del Guercio and Hawkins, 1999; Jan de Graaf and Haigh, 2011). To fill this gap, the research question that guides our paper is as follows:

RQ: *What are the benefits and the hindering motivations of shareholder engagement in ESG?*

To answer this research question, we have chosen the Italian market as the focus of the study for various reasons. First, the literature on institutional investors in Italy is scant. Notably, to the best of our knowledge, no studies analyse the experience of pension funds in relation to this specific topic. Therefore, this study could be a real novelty in the Italian context. Second, the Italian pension funds (IPFs) collectively could have the potential to be one of the most influential Italian institutional investors. According to the latest data, the total assets under management reached 197.9 billion euros (6.7 per cent more than in 2019), representing 12 per cent of the Italian GDP and 4.1 per cent of households' financial assets (Covip, 2020). Third, given the economic weight of the assets managed and their political and social importance (due to their fiduciary duty towards their policyholders), IPFs can influence and participate actively in an investee company's decisions, and the literature shows the importance of the activism of this type of institutional investors (Clark and Hebb, 2004; Gillan and Starks, 2000). Finally, the Italian pension fund industry is relatively new,

supplementary pension schemes being regulated by the Italian legislation from 2005. IPFs have only recently approached SRIs, and only a few of them have undertaken engagement activities. Thus, studying their approach to active ownership is useful to gain a better understanding of the development of such practices and possible measures to support them.

Therefore, the paper investigates the main issues that prevent IPFs from being active owners and which possible benefits and solutions IPFs could adopt to play their fiduciary role. In this way, shareholder engagement is a way to support companies in promoting sustainability-based behaviour, and the concept of engagement myopia is provided to underline that the path towards shared sustainability behaviour of pension funds is facing a turning point. Indeed, strategies inspired by ESG logic have highlighted that top-down approaches leading to definite guidelines for promoting sustainability-based decisions and behaviour are no longer effective. A new approach is required in which the focus is on bottom-up involvement, participation and accountability.

The remainder of this paper is organized as follows. In section 2, we present the theoretical background for our paper. In section 3, we describe our empirical methods, while in section 4 we show our empirical results. Section 5 discusses the paper and provides concluding remarks.

2. Theoretical background

2.1 *The role and importance of pension funds: a focus on ESG engagement issues*

The influence of today's massive pension funds is being felt in every capital market in the world; consequently, some authors argue that the fifth stage of capitalism is dominated by pension funds (Clark, 2000; Clark and Hebb, 2004; Monks, 2001). According to Clark and Hebb (2004, p.164), they are beginning to use their influence to increase transparency and accountability and to raise social and environmental standards of corporate behaviour.

In addition, an active role of pension funds could have an effect on the growth of the economy (Bripi and Giorgiantonio, 2010). Albeit sometimes reporting contrasting results (see, for example, Davis, 2004; Hu, 2006), the literature states that pension funds can contribute to the development of financial markets through various channels: i) professional asset allocation, which promotes international portfolio diversification; ii) the longer-term horizon of pension funds (compared with other institutional investors), which reduces the term premium; and iii) the professional management of pension savings, which reduces the risk premium (Walker and Leffort, 2002).

The positive impact of pension funds on financial markets and economic growth also depends on their internal governance structure (Bripi and Giorgiantonio, 2010) and their fiduciary duty. Therefore, in recent years, there have been several new laws in Europe aimed at improving governance and consequently the possibility of being active and aware investors. Indeed, investors' activism has been promoted by some recent legislation (the Shareholder Rights Directive II,¹ hereinafter "SRD II", and the IORP II Directive²), and these laws have created new challenges for pension funds, such as paying more attention to disclosure, good governance and ESG engagement, seeking changes in the investable universe to meet the ESG standards, new investment methodologies and the integration of ESG criteria into investment strategies. Consequently, long-term ESG standards are appropriate concerns for pension funds to ensure long-term returns to members and therefore fulfil rather than detract from their fiduciary duty. Specifically, SRD II requires institutional investors, including pension funds, to develop and disclose their approach to shareholder engagement publicly or explain why they have chosen not to do so. Thus, pension funds should develop and publicly disclose an engagement policy describing how they integrate shareholder engagement into their investment strategy as well as which different engagement

¹ Directive (EU) 2017/828 of the European Parliament and of the Council of 17 May 2017 amending Directive 2007/36/EC as regards the encouragement of long-term shareholder engagement

² Directive (EU) 2016/2341 of the European Parliament and of the Council of 14 December 2016 on the activities and supervision of institutions for occupational retirement provision

activities they choose to carry out and in what manner. Shareholder engagement by pension funds could take various forms, in escalation, that is, through letters/calls, voting at annual general meetings, engaging in informal negotiations with the management and so on. In any case, there is limited knowledge about how pension funds choose between shareholder engagement and other methods of changing corporate ESG behaviour relative to their portfolio firms (Hamilton and Eriksson, 2011) and about ESG engagement (Wagemans *et al.*, 2017). Indeed, while the development of ESG criteria, based on rankings and assessments, pushes corporations toward the adoption of ESG management processes and the implementation of (new) sustainability strategies (Engle *et al.*, 2019), there is little research on why and how institutional investors (and pension funds) adopt policies that are favourable to ESG issues.

ESG factors are a major driver of direct shareholder engagement because shareholders are concerned about negative ESG exposures, which imply substantial legal, reputational, operational and financial risks (Hoepner *et al.*, 2018). For example, according to Bauer *et al.* (2014), institutional investors frequently use engagement tactics to influence and change the firms in which they invest. According to Wagemans *et al.* (2018), pension funds use engagement especially in cases in which environmental management or sustainability generally adds shareholder value. This is because, generally speaking, institutional investors couple their interest in short-term returns with an interest in long-term ones as the prosperity of the investee company and the ESG engagement fit into this approach (Gond *et al.*, 2018; Wagemans *et al.*, 2018). In addition, Barko *et al.* (2021) find that firms with a good ESG track record prior to engagement are more likely to comply with the activists' requests. Firms that did not care much about ESG issues continue to do so as they seem reluctant to adopt investors' suggestions.

Therefore, ESG engagement is a great opportunity to create both financial and non-financial value for the investee companies, and more pension funds now state that they consider ESG factors in their selection process. According to Lachance and Stroehle (2021, p. 17), engagement can enhance "investment decisions, communicate concerns, and foster relationships and constructive conversations with companies about their ESG strategies". They have a strong preference for identifying and addressing ESG-related downside risks (Sautner and Starks, 2021). According to Alda (2021), the SRI integration phenomenon is especially expanded among pension funds due to their pro-social behaviour, long-term investment nature, management of large retirement savings or high political profile.

2.2 An investor's perspective on shareholder engagement

The new European laws encourage institutional investors to "be active owners and incorporate ESG issues into ownership policies and practices", which indicates the need for responsibility at the levels of both strategy and practice. Regarding strategy, some authors identify specific behaviour of pensions funds. For example, Tilba and McNulty (2013) find that a very small number of well-resourced and internally managed pension funds exhibit engaged ownership behaviour. In their recent work, Johnston *et al.* (2021) find three forms of engagement behaviour (termed agency, trusteeship and ownership) and investigate whether the current regime promotes or discourages them. However, commitment to general principles is usually much easier to achieve at the strategic level than in daily operations (Epstein and Roy, 2001), and this is particularly relevant to pension funds (Scholtens, 2006; Sievänen *et al.*, 2017). Consequently, from the perspective of pension funds, engagement activities with investee companies might be associated with both benefits and potential negativities that hinder their adoption.

One of the perceived benefits of shareholder engagement might be the possibility for investors to have positive effects on financial performance in the long term (Elsenhuber and Skenderasi, 2020). Among the perceived negatives might be inexperience and the high cost of engagement activities. Therefore, many factors could determine the effectiveness of engagement in stimulating ESG performance among investees. For example, Wagemans *et al.* (2018) find that engagement can be more effective when pension funds focus on specific themes, target companies that are open to

engagement and seek collaboration with societal and policy actors. According to Allen *et al.* (2012) and Gifford (2012) and in line with shareholder salience, legitimacy, power and urgency are the primary factors. However, beyond these, it is possible identify other factors (Tab. 1).

Tab. 1: List of factors that determine the effectiveness of engagement

Factor(s)	Author(s)
The openness and stance of the investee towards engagement	Wagemans <i>et al.</i> (2018)
The positions and interests of internal stakeholders in relation to CSR issues	
Urgency in relation to the internal processes and deadlines within an investee organization	
The type of contact and the selection of companies for engagement	
The form in which engagement occurs	
The connection between financial materiality and ESG performance	
The (cultural) proximity	Bauer <i>et al.</i> (2017)
The duration and intensity of engagement	Cucari <i>et al.</i> (2019); Ferraro and Beunza (2014)
The receptivity of the engaged companies	
The openness of companies	
The ownership of companies	
Personal interactions	Wolff <i>et al.</i> (2017)
Contact person	
Engagement theme	
Communication type	
Voting right	Hamilton and Eriksson (2011)
Reputation and financial risks	

Source: our elaboration

Various theoretical speculations can be developed at this stage about the engagement of pension funds. First, fiduciary duty requires pension fund decision makers to act prudently and thereby instructs them to avoid uncertainties (Hoepner *et al.*, 2011). Hence, a lack of guidance usually leads to a status quo bias in pension fund decision making.

The second issue to consider is the interpretation of the recent directives by pension funds and, depending on how the main objective of *encouragement of long-term shareholder engagement* is understood, whether legal or ethical compliance is to be preferred. In this case, an important factor is the existence of dependencies, in terms of either power or legitimacy (Hamilton and Eriksson, 2011). Power dependencies arise from the strength of the link between the fund and the investee company, while legitimacy dependencies concern the influence deriving from the credibility of the fund.

A third interesting point worthy of exploration is the impact of engagement in the operations of pension funds. For pension funds, it seems that being able to list a wide range of engagement is more important than its actual outcome (Wagemans *et al.*, 2018). Hence, a fuller investigation of pension fund engagement is needed to assess the extent to which this oversight is being exercised.

Finally, the fourth issue to consider is the value and nature of engagement. For instance, a collective engagement could save time and reduce costs in that the collective organization coordinates the actions of its members and acts like a unique large investor.

3. Methodology

3.1 Research design and sampling

The primary data were acquired from direct contact with the directors or chairperson of pension funds associated with Assofondipensione. Surveying key figures within organizations and companies is a well-established method to gain information about shared beliefs and potential decisions as well as organizational practices (Chatterjee *et al.*, 1992). Assofondipensione is a non-profit association, established in September 2003 on the initiative of the Italian employers'

federation Confindustria and the largest Italian trade unions, namely CGL, CISL and UIL, with the aim of representing the interests of 33 contractual pension funds.

All contractual pension funds were asked about the benefits and the hindering motivations of shareholder engagement during a workshop organized by Assofondipensione. A structured survey was also conducted regarding the knowledge of SRD II, the activities of pension funds with regard to engagement and the role of external actors (i.e., asset managers). It was answered by 22 pension funds, which represent about the 68% of all contractual pension funds.

Relevant independent and dependent measures were collected through this questionnaire. After reducing the dimensionality of the independent variables through principal component analysis, we conducted an OLS regression to test the impact of the perceived benefits and two types of hindering motivations on engagement propensity.

3.2 Variable operationalization

We employed a structured questionnaire with closed questions, preserving homogeneity in the data collection and allowing the quantitative treatment of the variables. Propensity for engagement, the dependent variable, was measured on a single 6-point Likert scale from null propensity to maximum propensity. Although it seems likely that numerous factors might influence the “propensity to engagement”, it should be noted at this point that, because of the limited research on this topic, we used a perception variable. Given that the propensity for engagement is intrinsically subjective since it belongs to a subject (e.g., a manager or a business owner), we deemed it appropriate to adopt the survey instrument to collect information about all the independent variables of our study (Annunziata *et al.*, 2018). Consequently, the degree of propensity is limited to the sensitivity of the survey questions and the subjective evaluations of the interviewed persons.

The questions about perceived benefits and hindering motivations of shareholder engagement (i.e., the independent variables) were designed considering the relevant literature presented previously. They consist of two sets of items measuring, respectively, the perceived benefits and the hindering factors of shareholder engagement on a six-point Likert scale ranging from 0 to 5. The potential benefits that respondents were asked to evaluate were:

- Improving the fund’s risk management and investment strategy (riskmng)
- Allowing the fund to communicate its mission and approach to investments (communication)
- Increasing issuers’ transparency in managing both financial and non-financial risks (proactive)
- Increasing the funds’ transparency and enhancing the dialogue with the funds’ subscribers (transparency)

As for the factors hindering engagement, the respondents had to rate the following items:

- High costs (cost)
- Small share (small share)
- Potential reputational repercussions (reputational risk)
- Lack of internal resources (internal resources)
- Complexity of the process (complexity)
- Inconsistency with the fund’s goals (inconsistency)
- Inexperience (inexperience)
- Unfavourable culture of the context (environmental cultural)

As shown in the next section, the number of independent variables was reduced through principal component analysis, which resulted in three final factors, one concerning the perceived benefits of engagement and the other two concerning two types of hindering motivations of engagement.

3.3 Principal component analysis

The collection of survey data was intended to serve the purpose of analysing the motivations driving shareholders’ propensity to engage with the management. To test concurrently their impact

on engagement propensity, the items concerning perceived benefits and hindering motivations of shareholder engagement were first synthesized into fewer dimensions through principal component analysis (PCA; Jackson, 1991), conducted with IBM SPSS Statistics 23.

In fact, with a large set of variables, it is often the case that there are many pair-wise correlations between the variables. PCA can then be employed to reduce a large number of variables into a smaller number of factors while at the same time minimizing the information loss (Jolliffe and Cadima, 2016). The resulting factors are linear combinations of the input variables and are orthogonal among each other. Given its properties, PCA is useful from both a statistical and a theoretical point of view. With regard to the former point, PCA avoids multi-collinearity issues when several potentially correlated independent variables are entered into a regression model together. However, it also enables the researchers to inspect the underlying semantic structure of a set of indicators and to check for the existence of latent constructs condensing the observable variables and reflecting meaningful theoretical concepts.

Therefore, as the first step, we ran PCA on all the items measuring the benefits and hindering motivations to verify the underlying factor structure (Tab. 2). The initial eigenvalues and the scree plot were used to determine the approximate number of principal components (i.e., factors) that could be extracted. This first analysis revealed that four eigenvalues were greater than 1, corresponding to as many factors. However, given its low associated eigenvalue (1.068) and the odd pattern of factor loadings across the input variables, the fourth component was dropped from the analysis.

Tab. 2: PCA - Components extracted

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.727	39.394	39.394	3.008	25.068	25.068
2	2.529	21.078	60.472	2.864	23.869	48.936
3	1.615	13.457	73.930	2.860	23.835	72.771
4	1.068	8.901	82.830	1.207	10.059	82.830
5	.685	5.709	88.540			
6	.381	3.177	91.717			
7	.354	2.951	94.668			
8	.206	1.715	96.383			
9	.171	1.422	97.805			
10	.152	1.263	99.068			
11	.081	.678	99.746			
12	.030	.254	100.000			

Source: our elaboration

In addition, to ease the interpretation of the final factors, we adopted the varimax rotation method to the extracted principal components. This method consists of rotating the axes corresponding to the components, with no loss of total variance over the four extracted components (Jolliffe and Cadima, 2016). As shown in Table 3, the initial set of indicators could be represented in three dimensions. The items concerning the perceived benefits associated with shareholder engagement had high factor loadings on the first component. Instead, motivations hindering shareholder engagement revealed two underlying dimensions, one related to resource availability and the other to reputational risk. Considered together, these three factors explain 72.7% of the total variance (Tab. 2).

Tab. 3: Rotated component matrix

	Component			
	1	2	3	4
<i>benefit_riskmng</i>	.909	-.132	.091	-.245
<i>benefit_comm</i>	.756	-.164	-.243	.404
<i>benefit_proactive</i>	.940	-.021	-.094	-.119
<i>benefit_transparency</i>	.725	-.141	-.293	.430
<i>negativefactor_cost</i>	-.039	.035	.862	.118
<i>negativefactor_small share</i>	-.030	.266	.355	.802
<i>negativefactor_reputationalrisk</i>	-.213	.795	-.118	.238
<i>negativefactor_internalresources</i>	-.259	.275	.793	-.120
<i>negativefactor_complexity</i>	-.114	.204	.896	.227
<i>negativefactor_inconsistency</i>	-.138	.901	.198	.054
<i>negativefactor_inexperience</i>	.198	.689	.522	-.028
<i>negativefactor_environmentalculture</i>	-.117	.832	.267	-.006

Source: our elaboration

Once the factor structure had been assessed, we could then compute the factor indexes by running the PCA separately on each of the groups of indicators and retaining the factor scores of the underlying latent dimensions in new variables. Three final indexes resulted from this procedure: the first - *benefit* - included the items concerning the benefit of shareholder engagement, the second - *reputational* - was related to the alignment with the fund's image (reputational risk, inconsistency and environmental cultural), while the third - *cost* - concerned the resource burdens of shareholder engagement (costs, internal resources and complexity). Two of the input variables (small share and inexperience) were dismissed from further analyses given their low factor loadings on any of the first three components extracted.

4. Results and Discussion

The three latent factors obtained by PCA were then employed as independent variables in a regression model examining their impact on engagement propensity. The results are shown in Table 4.

Tab. 4: Regression coefficients

	B	Std Error	Beta	t	Sig.
(Constant)	3.500	.158		22.148	.000
Benefit	.848	.173	.770	4.909	.000
Reputational	-.167	.178	-.151	-.937	.361
Cost	.219	.178	.198	1.231	.234

Source: our elaboration

The results of the OLS regression analysis, with engagement propensity as the dependent variable, suggest that only the engagement-related benefits have a significant effect, affecting engagement propensity positively. Instead, the hindering factors' effects are not statistically significant. Therefore, it seems that, even if pension funds' managers are aware of the motivations that might prevent them from actively engaging investee companies, they do not seem to be actively affected by these factors in their propensity actually to start engagement actions. The value of the coefficient of determination ($R^2 = .61$) indicates good fitting of the observed values to the model, so, overall, the independent variables explain around 60% of the variation in the response variable.

These results support further exploration of the potential complex causal links between positive and negative aspects and engagement. For example, they may provide support for initiatives to reverse historical trends regarding these topics and adjust the internal structure of pension funds. In

terms of research development, this study suggests potential benefits from integrating a conceptual framework and areas of research interest such as engagement, active ownership and voting. Therefore, based on these results, we can affirm that a virtuous path seems to emerge in which the approaches to engagement are shifting from negative aspects that hinder the engagement to positive aspects that create benefits.

Specifically, it is possible to state, according to the directors involved in the workshop, that the change in the approaches to engagement has been characterized by two main variables:

- i) Education aimed at improving internal expertise;
- ii) Involvement of the entire structure of the organization, aiming for the effective participation of all levels of decision makers (board, finance committee and director).

Combining these two variables, we propose a conceptual framework to define four different approaches to engagement. This is summarized in Figure 1:

- Engagement myopia (no interest - no strategies). In such a configuration, the topic of engagement is completely underestimated so that there is no interest in promoting strategies for the definition of sustainability-based approaches and strategies.
- Coercive engagement. In this configuration, pension funds are forced by regulatory requirements to define sustainability in ESG guidelines and practices of engagement. However, the scarce involvement of actors, who are more concerned about complying with regulations, may not lead to an awareness of the benefits of engagement at all company levels;
- Collaborative engagement. Such a configuration emerges as a result of an intensive level of involvement between internal and external actors. Thanks to the adoption and spread of ESG practices, all pension funds have increased their attention to the ESG domain. However, a lack of internal expertise could lead to “blind reliance” on initiatives by other actors that have greater knowledge and awareness of engagement activities;
- Focused engagement. In this configuration, attention to engagement is real and depends more on participation and expectations, specifically defined internally. This scenario provides a new relevant role for the pension funds in influencing the strategies and behaviours of investee companies in the long term. Only in this latter scenario is it possible to image a real departure from engagement myopia.

Fig. 1: Conceptual framework of pension funds’ shareholder engagement

Internal expertise	<i>High</i>	<i>Coercive engagement</i>	<i>Focused engagement</i>
	<i>Low</i>	<i>Myopic engagement (No interests - no strategies)</i>	<i>Collaborative engagement</i>
		<i>Low</i>	<i>High</i>
Level of involvement of internal and external actors			

Source: our elaboration

With regard to the conceptual framework and statistical results, we are confident in affirming that we are witnessing a transition of pension funds’ organizational culture from a myopic approach to more focused engagement. Indeed, it seems that only positive motivations are effectively driving up shareholders’ engagement, while concerns and negative motivations are not able to restrain pension funds’ propensity. This might reflect the fact that the involvement in and attention to ESG issues of pension funds’ decision makers has implicitly increased over time, leading them to abandon the “myopic engagement” configuration.

Furthermore, this leads to positive expectations about pension funds' future approach to engagement since, under the impetus of perceived benefits, they might be induced to define ESG-based procedures and guidelines, taking the final step towards "aware engagement". After all, "engagement is the neutral term, which can vary in intensity" (Winter, 2011, p. 12). Indeed, it is only this latter configuration that couples the interest in and procedural rules of implementation of shareholder engagement. Thus, we can distinguish three stages of engagement. The first one is *formal*, in which the engagement activity is seen as mere compliance - the legal approach - with a standard and takes the form of formal and non-substantial adherence to the SRD II directive. The second one is *accidental*, occurring when pension funds implement engagement activities aimed at responding to contingent situations of temporary difficulty. The last stage is *focused engagement*, characterized by a high intensity of engagement, in which the pension funds fully understand the contribution that stewardship can provide to the investment made and consequently the activity is structural or not limited in time and/or to a specific situation.

Therefore, reflecting on the four scenarios reported in Figure 1, various propositions can be developed. First, we suggest that IPFs have to shift from "myopic engagement" to "focused engagement". We define myopic engagement, referring to marketing myopia (Levitt, 1960), as the view of engagement as an end in itself: the idea that engagement is enough to be a responsible investor. In other words, similar to the new concept of marketing myopia (Smith *et al.*, 2010), the pensions funds have an overly narrow definition of engagement and its benefits, and this leads to their failure to recognize the changed societal context that necessitates the addressing of multiple aims. We advocate a more sophisticated understanding of engagement that takes into consideration a wider set of stakeholders who are concerned about a company's social and environmental impacts. Attention to all stakeholders beyond the members of pension funds could lead to the development of a materiality analysis. Different guidelines (i.e. the AccountAbility1000 Accountability Principle Standard and Global Reporting Initiative) require materiality analysis to determine the relevance and significance of an issue to an organization and its stakeholders (Formisano *et al.*, 2018; Torelli *et al.*, 2020). To the best of our knowledge, a materiality analysis that aims to determine material and relevant issues systematically in accordance with stakeholder needs has not been undertaken for Italian pensions funds, except for the Espero pension fund. We believe it is necessary to be aware of what the ESG risks are, quantify them and take the most efficient actions to reduce them through engagement, always with a view to balancing the risks and benefits. This leads to "focused engagement".

Second, collaboration could be the best strategy for pension funds as, through the establishment of associations, it is possible to share skills and resources. As shown by Doidge *et al.* (2019), through collective action, members can better serve their common interests to improve firms' governance compared with the outcome arising from individual, unorganized actions. However, it is necessary to avoid using collective engagement as a shortcut to demonstrate compliance with the new rules without internal awareness. The positive effects of this type of engagement are realized only if the fund actively participates and follows the initiative in all its phases. Pension funds need to adopt the "4 Cs" of collective engagement:

- commonality of purpose: a clear and shared understanding of the issues to be engaged (and the rationale behind the work) can avoid disagreements between group members in the later stages of the process;
- coordination: matching the group's resources to the reach of the initiative sets the stage for success; a third-party coordinator can facilitate the group's work;
- clarity: sharing and clarity of the "ground rules" - for example what information can be made public - helps to build trust and avoid communication problems;
- competence: the involvement of investor representatives with a similar level of competence, knowledge, seniority and expertise with respect to the issues.

Third, drafting an ESG engagement policy according to a "coercive approach" is not enough to benefit from the engagement (Cucari *et al.*, 2020). This activity should be accompanied by an accurate and continuous training activity and a high level of involvement of the actors (internal and

external), allowing the development of internal skills capable of effectively supporting the monitoring of risks related to sustainability and conscious and active participation in engagement initiatives. Only by developing a “culture of engagement” or “culture of active ownership” can the pension funds benefit from the positive effects of engagement. This is to say that engagement is a function of a fund’s internal culture. If culture arises from shared learning to solve the problems of external adaptation and internal integration, its qualities of dynamism and continuous evolution emerge clearly. Thus, the conception of culture as something static and stable is overcome by a much more fluid and progressive vision. The actual external context also requires pension funds, as well as companies, to be antifragile.

5. Conclusions

In this paper, we tried to complement the literature on shareholder engagement by investigating the determinants of pension funds’ engagement. Since engagement is the preferred tool for European institutional investors, our aim was to investigate what determines (the lack of) engagement by pension funds, deepening the main critical issues and identifying possible factors that would improve ESG engagement for other pension funds. To this extent, we relied on the experience of contractual pension funds, members of Assofondipensione.

This paper aimed to make three important contributions. First, despite a large amount of research into several problematic aspects of the governance structure of Italian pension funds (Bripi and Giorgiantonio, 2010), there is little knowledge on the causes, processes and consequences of engagement. Based on our statistical results and conceptual framework, we propose a solution to pension funds’ engagement myopia. The current literature shows a lack of activism by Italian pension funds, and this research aimed to prompt pension funds to account for the difficulties that they face and to promote a change in their behaviour through the implementation of possible adequate solutions.

Second, pension funds need to apply engagement in collective forms to develop internal experiences and skills that allow them to reach the fourth level of engagement, focused engagement. In addition, Italian contractual pension funds usually share the same ESG principles and forms of engagement (“soft engagement” through constructive private dialogue and, in some cases, voting at annual general meetings). IPFs may therefore develop cooperative engagement strategies, sharing the same guidelines and external advisors, and speak with investee companies as unique large investors instead of multiple small shareholders. In this way, they may substantially enhance their influence and awareness, significantly reducing the individual costs at the same time. In this regard, this research aimed to provide an incentive for Italian PFs in taking this substantially unexplored route and become a pillar of Italian corporate activism.

Third, similarly to other studies (Johnston *et al.*, 2021), in which three broad patterns of behaviour of institutional investors are proposed, our paper contributes to the understanding of the approach (or behaviour) of pension funds (Tilba and McNulty, 2013). Indeed, our conceptual framework extends beyond a dyadic focus on engagement, as “yes or no”, respectively, to attend to a broader examination of the approaches to engagement and the positive or negative aspects involved in the processes. In this way, we highlight investors’ view of engagement as part of their fiduciary duty, and consequently it could add value to the investment strategy.

The present study includes some limitations. Firstly, the sample size can be expanded in future research to enhance the precision of the estimates and corroborate our results. Secondly, despite the novelty of the use of the perception variable for the propensity for engagement, additional research examining other situational factors that may be related to these perceptions seems warranted. Indeed, due to the complex nature of the concept of engagement, to reveal the other factors that influence the propensity, qualitative studies should be encouraged. Thirdly, since our study focuses on pension funds, future studies could enlarge the scope of analysis to include other types of institutional investors or the perspective of companies (Ciappei *et al.*, 2022). These other actors

might in fact behave differently with regard to engagement and be motivated by different types of factors.

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Universities and the generation of impact: the role of university foundations in knowledge transfer

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Abstract

Framing of the research. *The paper explores the role of the University Foundations (UFs) in the knowledge transfer activities of the Italian universities, as one of the possible organizational solutions for academic-industrial collaborations.*

Purpose of the paper. *The work examines the UFs under an organisational and strategic perspective through the analysis of those organizations that have been designed to generate impact within a third mission framework.*

Methodology. *We conducted a multiple-case study as exploratory research approach, interviewing the employees of three different Italian UFs. Furthermore, we ran a thematic analysis on the transcripts to inductively code our data and to identify significant relationships between emerging themes and existing literature.*

Results. *The paper sheds light on the role that the Italian UFs play in bridging the gap between university and industry with a specific focus on their activities, employees, strategies, and relationships. Acting as an intermediation structure for knowledge transfer activities, they represent a simplified entry point to the universities' assets by scouting opportunities and catalysing the innovation processes.*

Research limitations. *The research explores the UFs under a small sample of cases. However, this work represents just a preliminary effort toward the exploration of the phenomenon. These limits can provide avenues for future research.*

Practical implications. *The paper contributes to the literature on knowledge transfer and intermediary organization by analysing the specific case of the UFs.*

Originality of the paper. *The work address for the first time the UFs not only under the legislative lens of investigation but also under the strategic and the managerial ones. There are no prior studies focused on understanding this organizational phenomenon under these perspectives.*

Keywords: *University Foundations; knowledge transfer; knowledge transfer organizations, University-industry collaborations*

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1. Introduction

In the last decade, scholars have been paying increasing attention to the role of universities and their impact on society, not only through education and research but also in terms of their so-called third mission (Guimon, 2016; Vesperi and Gagnidze, 2019; Compagnucci and Spigarelli, 2020; Petruzzelli and Murgia, 2020). Universities all over the world have intensified their relationships with the external environment. In particular, they have become more innovative and entrepreneurially-oriented in the exploitation of academic assets and technologies through knowledge transfer (KT) activities (Perkmann *et al.*, 2013; Pfothenhauer *et al.*, 2016; Davey, 2017; De Moortel and Crispeels, 2018), which do represent an important component of the third mission. This increasing commitment has been characterised by a set of changes in the internal organization of the universities and in their interactions with their external environment (Audretsch *et al.*, 2014; Granieri and Basso, 2019, Perkmann *et al.*, 2021).

It is well known that to facilitate these interactions, universities have equipped themselves with internal and external intermediary organizational structures. The most widespread solutions are internal knowledge and technology transfer offices (KTOs/TTOs) designed to support researchers in all the knowledge transfer activities (e.g., IP protection, research commercialization, university-firm collaboration, and promotion of entrepreneurship) (Gubitta *et al.*, 2016; Clayton *et al.*, 2018; Giuri *et al.*, 2019). Furthermore, several universities have also set up external intermediaries as limited companies, incubators, science parks, or foundations to support in whole or in part the academic third mission's activities (Muscio, 2010; Conti *et al.*, 2012, Perkmann *et al.*, 2013; Bonomi, 2014; Battaglia *et al.*, 2017).

With regard to Italy, researchers have emphasized that Italian universities have experienced a catching-up phase in the knowledge transfer frame (Algieri *et al.*, 2011; Conti *et al.*, 2012; Cesaroni and Piccaluga, 2016; Grimaldi *et al.*, 2021). They have been growing fast in terms of third mission activity, and yet they still require investments related to times and resources if compared with more consolidated organizations in Europe or in the rest of the world (Di Bernardino and Corsi, 2018; Micozzi *et al.*, 2021).

In this scenario, an interesting Italian peculiarity is the one of the University Foundations (UFs). Established in 2001 by the Italian legislator, these organizations can perform a vast set of supporting activities on behalf of their related institutions that establish and formally drive them (Bellezza and Florian, 2005; Serravalle, 2012; Fabbri, 2016; Sicchiero, 2020). According to the limit of action defined by the universities, UFs can work closely with their KTOs becoming their "operative arm" (Radano, 2005; Serravalle, 2012).

Given the general lack of investigation of this phenomenon, our study addresses the following research question: *after 20 years from their establishment, which is the role of the University Foundations in the academic knowledge transfer activities?* We conducted a multiple-case study as exploratory research approach, considering three different Italian UFs.

This study contributes to the literature on knowledge transfer and intermediary organizations in three main aspects. First, we contribute to the analysis of the UFs, considering not only the legislative framework but also the strategic and the managerial ones (Ferrara and Rea, 2011; Fabbri, 2016). To our knowledge, no prior studies have examined this organizational phenomenon under these perspectives. Second, we provide a specific contribution to the literature related to knowledge and technology transfer in Italy (Villani *et al.*, 2017, Vesperi and Gagnidze, 2019; Grimaldi *et al.*, 2021). Third, our research sheds light on the role that Italian UFs play in bridging the gap between university and industry with a specific focus on their employees, activities, strategies, and relationships, which represents a finding that can be useful for other national contexts.

The remainder of this work is organized as follows. First, we illustrate the conceptual background in Section 2. Section 3 describes the methodology. Section 4 presents the main findings. Finally, we discuss the implications of our results and we draw our conclusions in section 5.

2. Background literature and theoretical framework

2.1 Bridging the gap

Within this research context, scholars have paid growing attention to the role of intermediary organizations in the knowledge transfer process (Bonomi, 2014; Villani *et al.*, 2017; Clayton *et al.*, 2018; Alexandre *et al.*, 2021). These organizational structures act as intermediaries in the knowledge transfer process to shorten the distance between universities and industries, dealing with markets that are often highly knowledge-intensive and increasingly competitive (Audretsch *et al.*, 2012; Petruzzelli and Murgia, 2020).

These types of organizations can be formed internally to universities but also externally, according to the different third missions' roles and objectives of each institution and countries' characteristics related to legislation, policies, etc. (Battaglia *et al.*, 2017; Maresova *et al.*, 2019). Even if it highly depends on the different local contexts, in the majority of the cases only internal university's offices are responsible for knowledge and technology transfer activities (Conti *et al.*, 2012; Lafuente and Berbegal-Mirabent, 2019), mainly through KTOs or TTOs, which have been widely explored in prior studies (Gubitta *et al.*, 2016; Clayton *et al.*, 2018; Giuri *et al.*, 2019).

However, in some countries, such as Canada, UK, and Israel, these internal and external organizational levels coexist, cooperating in the third mission's activities, with distinctive and integrated roles and capabilities. Universities decentralize some activities to these bridging structures or develop them to support the activities carried out by the internal offices (Brescia *et al.*, 2016).

Examples of these organizations can be the university incubators, designed to develop university innovations by facilitating knowledge flows with the market (McAdam *et al.*, 2006; Kolympiris and Klein, 2017), the collaborative research centres, set to enhance translational research through partnerships (Schröder *et al.*, 2014; Gibson *et al.*, 2019), the scientific and technological parks, organized to foster links with enterprises on a local basis (Giarretta, 2014; Minguillo and Thelwall, 2015), and the Proof-of-Concept Centres, organized to increase the technology readiness to market of the universities' patents (Gulbranson and Audretsch, 2008; Bradley *et al.*, 2013).

Another example may be the knowledge transfer companies which are for-profit private ventures, as limited companies wholly owned by the universities, that represent an instrument to easily engage with the private sector in a profit-oriented way (Villani *et al.*, 2017; Hoackaday, 2020). The first case of these organizations is the technology transfer companies, established in Israel in the 60s and designed to support the TTOs in their operational activities (Meseri and Maital, 2001).

Usually, the boards of these organizations are composed of representatives both of the university and the industry, to facilitate the intermediation process and to strategically align the third mission objectives of the universities with the external environment. These organizations, mainly composed of employees with training in engineering and management, are usually more involved in the provision of knowledge transfer-related services for the exploitation of knowledge-based opportunities (Landry *et al.*, 2013; Brescia *et al.*, 2016; Kolesnikov *et al.*, 2019).

Scholars identify those sorts of organizations as suitable actors to span the gaps between universities and their external context. They can improve the efficiency of the knowledge transfer activities, reducing the cost related to time, negotiation, and coordination among parties (Battistella *et al.*, 2016; D'Este *et al.*, 2016; Grimaldi *et al.*, 2017). However, given the high research focus on internal organizational structures for knowledge transfer, these external organizations still represent a relatively recent and understudied phenomenon (Brescia *et al.*, 2016; Battaglia *et al.*, 2017; Villani *et al.*, 2017; Alexandre *et al.*, 2021). Within this framework, we contribute to this research field by analysing a specific case of external organization for the university-to-industry technology transfer: university foundations in Italy.

2.2 *The Italian University Foundations*

UFs in Italy represent a relatively recent organizational supporting form in the field of KT and impact (Conti *et al.*, 2012; Macrì, 2016). Still, low scientific attention has been paid to discuss their nature and the main opportunities and threats related to them, both from a managerial and a legal point of view (Ferrara and Rea, 2011; Fabbri, 2016).

The UFs' establishment was driven by the universities' need for new effective instruments through which addressing competition and funding issues in the academic world (Macrì, 2016; Manfredi, 2017). The legislator set up these new organizational forms to enhance the simplification of the public structures by decreasing the bureaucracy levels (Marchetta, 2001; Hinna, 2005; Serravalle, 2012)

The regulatory action that introduces in the Italian legislative system the legal entity of the UFs is the Decree of the President of the Republic (d.P.R.) 24th of May 2001, n.254. This legislation allows the University to constitute foundations, singularly or in associated form, to acquire goods and services at the best market conditions, and to perform instrumental and support activities to the teaching and the research. At the last annual conference of the Italian UFs, it emerged that about 29 organizations of this sort have been set up in Italy and 23 still operate (Magnani, 2019).

This particular organization, controlled by the universities but at the same time with good levels of autonomy, can work in collateral and support activities. With the transfer of several tasks to these external organizations, the offices of the universities can be more focused on their main institutional "core" activities while the Foundations can address more boundary issues (Mainardi, 2008; Boffo and Moscati, 2015). At the same time, the coexistence, at an organizational level, of the private structure of the foundation and the public nature of the interest pursued can help these structures to act as intermediators between the public and the private dimension (Serravalle, 2012; Sicchiero, 2020).

This organizational structure can assist the reference institution which directly participates in the organization, in this case, the universities. It means that the UFs are typically controlled by the university in terms of strategic objectives and on the way through which they operate in the market (Hinna, 2005). The universities, with respect to the foundations, play an address and feedback function on the effective coherence of the activities performed. In addition, they also define the guidelines for the foundation, approving the annual and triennial activity plans (Bellezza and Florian, 2005).

2.3 *The UFs' Distinctive Characteristics*

Starting from the aspects underlined in the previous sections, it can be considered how the regulation has conceived the UFs as instrumental entities (Bellezza and Florian, 2005). According to Serravalle (2012), the four main distinctive characteristics of these organizations can be framed as follows: (i) the participation, according to which the founding members can directly and actively participate in the foundations' operation; (ii) the founders' plurality, which indicates that in the constitutive process of a foundation there are shared objective among several participants that contribute to the provision of the basic means for the foundations' activities; (iii) the dynamic and progressive formation of the foundation's capital, related to the fact that other participants could enter the organizations, providing to the institution new resources for the achievement of common objectives; (iv) the operativity, which is mainly related to an active presence in the economic, political, and social context in which these organizations operate.

2.4 *The UFs' Governance Systems*

Universities play a key role in the governance and strategic path of UFs, acting as related institutions. The UFs have to operate in the exclusive interest of the universities, working as their "operative arm" (Radano, 2005). Even if also external subjects can play a role in the foundation's

management, the DPR 254/2001 prescribes that the university has to directly nominate the governance bodies to effectively control the foundation and its moves.

Four main roles are called upon to perform a governance function within the Universities Foundation, these are: (i) the President; (ii) the Board of Directors, which is the body that manages and controls the foundation's activities and it can consist of a maximum of eleven components, including the president, and its absolute majority has to be appointed by the related institution; (iii) the Board of Auditors; (iv) the Scientific Committee.

In the definition of the relationship between the UFs and the related institutions, Ferrara and Rea (2011) emphasize the role played by the university in the legislative framework defined by the DPR 254/2001. The interactions among the two entities are regulated through the foundation's charters which specify the main tasks, the operative structures of the organization, and the duration of the foundation's bodies. It means that Universities define the guidelines for the foundations' activities which are readjusted years after years to better address issues and to more effectively perform activities. The relationships among these two entities are regulated by the charter that determines how they will take place, in terms of collaborations, consultancies, assistance, support services, and the activities related to the promotion of the university's assets (Serravalle, 2012).

2.5 The UFs' Activities

The Italian Legislator designed these organizations to directly address the needs of university potential or actual stakeholders. DPR 254/2001 states the various activities that the foundations can perform in favour and on behalf of their related institutions. Universities have the power to design their foundations to best fit their institutional, educational, and research needs, exercising address and monitoring functions. For this reason, an optimal UFs model does not exist and each situation requires a different set of goals and a specific institutional design to perform efficiently. However, a proper division of labour, tasks, and responsibility should be clearly stated to contain or, if possible, avoid any kind of conflict and inefficiency (Demarie, 2005).

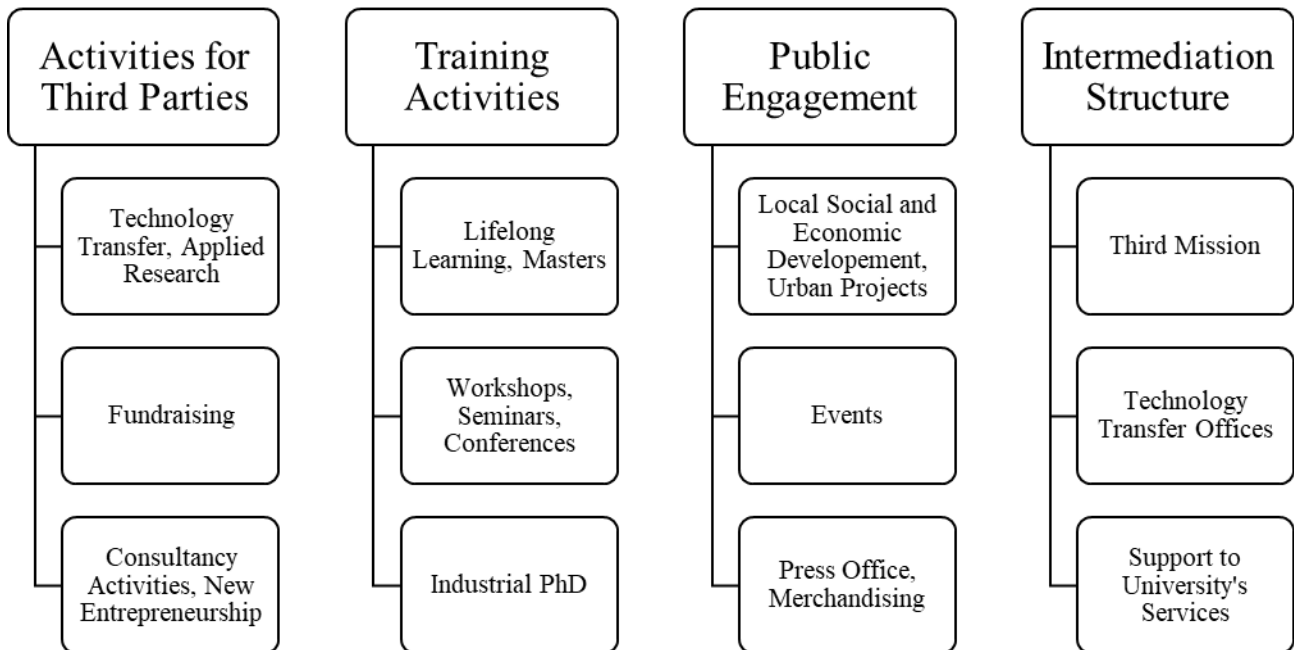
In Art. 2, Paragraph 1 (DPR 254/2001), the Legislator makes a list of all the possible activities that can be carried out by the UFs, in favour and on behalf of the universities. In fact, according to the foundations' charters, these organizations can mainly address two issues. First, the acquisition of goods and services at the best market conditions. This "in-house providing" framework permits a public entity to outsource its services to external juridic subjects that are under the same administration (Ferrara and Rea, 2011). Second, the performance of instrumental and supporting activities for their related institution. Within this frame, universities can differently configure their foundations, according to their specific needs (Demarie, 2005).

The legislator considers several UFs' activities that may be divided into four macro-areas, according to the structure proposed by Magnani (2019) schematized in

Fig. 1. First, the activities for third parties, which cover a vast set of actions, such as technology transfer, applied research, fundraising, and every form of consultancy. Second, the training activities, as the organization of workshops, seminars, and conferences, the university supports the industrial PhD management and the lifelong learning dimension. Third, the public engagement, with the social and local development, in several cases also in terms of urban-related projects, organization of public events, press offices, and merchandising services. Fourth, the intermediation

structure both with external stakeholders in a third mission scenario, and internal stakeholders as the TTOs, the International Research Offices, or the Public Engagement Offices.

Fig. 1: University Foundations, main activities



Source: Own elaboration on Mangnani (2019).

Considering the theoretical analysis proposed in the previous paragraphs, it emerged that the role of UFs in the universities' knowledge transfer activity received scarce attention from academia in Italy and abroad (Ferrara and Rea, 2011; Fabbri, 2016). In particular, we observed a general lack of analysis of this organizational phenomenon under the lens of investigation of the business sciences, especially from an organisational and a strategic perspective. According to the review we carried on in the previous paragraphs, UFs have been mainly examined only within the Italian academic debate and mainly from a legislative point of view.

In order to deeply understand and analyse the phenomenon of the Italian UFs and their role in the knowledge and technology transfer activities of their related institutions, we set an investigative framework to answer the research question: *after 20 years from their establishment, which is the role of the University Foundations in the academic knowledge transfer activities?*

3. Methodology

3.1 Research setting

According to the research framework proposed by Saunders *et al.* (2016), to gain further understanding of a scarcely investigated phenomenon, this work will consider an exploratory research approach. The choice of this proposal is mainly related to the flexible and adaptable nature of this research framework. Since, as emerged in the previous paragraphs, UFs still represent a

relatively recent phenomenon that has not been fully explored and on which a scarce amount of scientific material has been produced, we considered the multiple-case study as research approach. In fact, it enables an investigation of the phenomenon through interviews from the different cases and a comparison among them (Yin, 2009).

By asking the same questions to different organizations, this approach will be useful to code and compare information under multiple perspectives (Adams *et al.*, 2014). Starting from the context-related information previously converged, we designed the process in order to highlight common aspects and differences among the various cases. The multiple-case study should allow a wider exploration of the research questions through suggestions more grounded in several empirical pieces of evidence (Gustafsson, 2017).

According to the research approach proposed by Yazan (2015), the process of data collection and analysis will take place under a multiple embedded design rather than a multiple holistic one. In fact, it will not be considered the phenomenon of the UFs as a whole but only under those aspects related to the knowledge transfer activities. From this point of view, even if the cases will be described and the different activities will be presented, the spectrum of analysis related to the investigation of other activities will be excluded *a priori*.

3.2. Cases selection

The analysis will be mainly based on a qualitative approach and it will consider three cases. We selected those cases for the purpose of setting a generalized framework of research, finding recurrent and comparable aspects. The selected cases should lead to point out possible logics and relations capable of enabling connections and keys of interpretation through which read the phenomenon (Eisenhardt and Graebner, 2007; Yin, 2013). From the list of the 24 Italian UFs available from the Italian Ministry of Education, University, and Research (MIUR, 2020), we considered three foundations for our analysis because of four aspects that allowed a comparison: the knowledge transfer commitment, their geographical proximity, the participation of similar institutions, and their different levels of experience.

In terms of their commitment to knowledge transfer, universities designed these foundations to specifically support the activities carried on by the TTOs and to valorise the research assets of their related institutions (Battaglia *et al.*, 2017). In terms of their geographical proximity, the three foundations connect the academic dimension with a similar stakeholders' system, at least from a local point of view (Steinmo and Rasmussen, 2016). They collaborate with very similar companies and participate in comparable consortia. In addition, they are participated by quite similar related institutions in terms of institutional control, number of departments, patents filed, academics employed, and students enrolled (Villani *et al.*, 2017). To better explore the phenomenon, we considered three universities that belong to three different classes of the public CENSIS ranking (2020): which are the mega, the big, and the technical universities. In conclusion, they have different levels of experience. The foundations considered have been established in different historical moments, this difference in time can help to better answer the research questions from an evolving perspective. The key features of the universities that host the foundations are summarized in *Tab. 1*.

Tab. 1: Characteristics of the Universities

Institutional characteristics (year 2020)	Polytechnic University of Milan	University of Padova	Ca' Foscari University of Venice
Institutional Control	Public	Public	Public
CENSIS Class	Technical	Mega	Big
# of Students	>46.000	>57.000	>21.000
# of Academics	1.430	2.268	1.039
# of Departments	12	32	8
# of Patent filed	76	57	17

University Foundations	The Foundation Polytechnic of Milan	UniSMART - Padova University Foundations	University Foundation Ca' Foscari
University Foundations' Websites	https://www.fondazionepolitecnico.it/en/about-us/	https://www.unismart.it/	https://www.unive.it/pag/15272/

Source: Own elaboration from Universities' Social Report and Knowledge-Share.eu database (2021).

Under this research setting, we considered three UFs. Firstly, The Foundation Polytechnic of Milan (FPM) which is the UF of the Polytechnic University of Milan since 2003. It is actively involved in the enhancement of the university innovation path since the university designed its foundation for the transfer of knowledge developed within the polytechnic in the fields of engineering, architecture, and industrial design to external stakeholders from the public and the private sector. It is the first Italian UF (Foundation Polytechnic of Milano, 2020a; Foundation Polytechnic of Milano, 2021). Secondly, UniSMART - Padova University Foundation (FUS) which is the UF of the University of Padova deputed to the technology transfer activities and post-graduate education. The organization has been established in 2016 as UniSMART Padova Enterprise, a commercial for-profit limited company. At the time, this organizational framework represented a unicum in the Italian scenario (Carosio *et al.*, 2018; Carosio *et al.*, 2019; UniSMART, 2021a; UniSMART, 2021b). Thirdly, the University Foundation Ca' Foscari (FCF) which is the instrumental entity of the Ca' Foscari University of Venice established in 2010 and mainly deputed to support the university in the pursuit of its third mission's activities (University Foundation Ca' Foscari, 2020;). An overview of the three UFs based on the framework of analysis for knowledge transfer organizations developed by Cesaroni and Piccaluga (2016) and Campbell *et al.* (2020) is schematized in *Tab. 2*.

Tab. 2: Foundations' Overview

Variable	Description	UniSMART - Padova University Foundation (FUS)	University Foundation Ca' Foscari (FPM)	The Foundation Polytechnic of Milan (FCF)
Experience	N. of years since the foundation started its activities.	1	10	18
HR	N. of employees and collaborators in the knowledge transfer area.	9	25	30
Earnings from knowledge transfer activities	Total earning from licenses, research contracts, consultancy, and other services TT-related. (TT-related earnings/production Value.	2.432.499 (61%)	2.077.554 (29%)	4.512.609 (43%)
Contracts	N. of knowledge transfer projects for third parties, involving the university departments.	67	47	150
Funded Projects	N. of active EU or International funded projects.	15	1	63

Source: Own elaboration from Foundations' Social Reports and Balance sheets. All data are referred to 2020. Please, notice that usually the earnings from research contracts and consultancy activities are not considered within the earnings from the technology transfer of the Italian TTOs.

3.3 Data collection

In the multiple-case study, the data collection for the research purpose of this work will consist of two sources: primary sources collected via interviews and secondary sources assembled through desk research. The approach to data collection will be mainly qualitative and the information could

not be addressed without reference to the context. Considering the particular nature of the case studies, the data collection process will not take into account only the most traditional knowledge and technology transfer indicators, but also other elements linked to the transfer channels and to the environment in which those kinds of activities are put in place (Campbell *et al.*, 2020).

As previously mentioned, the primary data collection took place through specific interviews on a sample of three foundation employees that carry on knowledge transfer activities within the three different organizations. According to the methodology developed by Gioia *et al.* (2013), the primary data collection is based on semi-structured interviews which are set on a one-to-one basis. This flexible framework provides primary sources not only on the specific case analysed but also on the background and on the context in which the foundations operate (Saunders *et al.*, 2016). We contacted respondents via e-mail and, due to the pandemic situation, interviews took place online on the Microsoft Teams platform. Employees may be schematized as follows: Manuela, Chief Operating Officer at Foundation Polytechnic of Milan (FPM); Stefano, Technology Transfer Manager at UniSMART - Padova University Foundation (FUS); Tommaso, Director at University Foundation Ca' Foscari (FCF).

3.4 Data analysis

On the basis of the grounded theory approach of Strauss and Corbin (1998) and more recent approaches developed in qualitative management research (Gioia *et al.*, 2013), we inductively coded our information to identify significant relationships between data, emerging themes, and existing literature. We considered an open coding approach to construct generic categories based on in-vivo codes from respondents' phrases (Strauss and Corbin, 1998). We coded data according to the research question to identify the actual role of the UFs in the knowledge transfer activities performed in the bridging process between the universities and the external environment.

Following standard practice, we conducted data analysis in several stages by reading several times the data collected. Using MS Excel spreadsheets, we proceeded manually starting with first-order codes and then to more abstract themes that represent an overarching dimension used to develop a general framework through thematic analysis (Saldaña, 2015). Finally, when no additional first-order codes emerged from the data, we grouped them in more general themes that represent the second-order codes. At this stage, our objective was to reduce the number of code units and identify general categories which may assume relevance for the analysis. *Tab. 3* presents the structure of our data, including first- and second-order codes, as much as the dimensions in which we aggregated the themes for presenting the results.

Tab. 3: The thematic analysis grid

Codes (first-order codes)	Themes (second-order codes)	Dimensions
Preliminary support; Knowledge transfer support; Ingoing support; Outgoing support.	Supporting activities	Knowledge Transfer Activities
Path definition; Own way research; Trade-off.	Role definition	
Reaction to external stimulus; Reaction to the market needs.	Reactive Strategy	Strategy
Consulting approach; Top-down approach; Solutions offering; Proactive activities.	Proactive Approach	
Value distinction; Value uniqueness.	Unique value proposition	
University centrality; University autonomy; University self-sufficiency.	University Independence	Relationship with the university
Synergy with Universities Offices; Collaborative Behaviour.	Synergy with Universities	
Compliance with university's objectives; Instrumental bodies.	Instrumentality	
Market aggressiveness; Flexible approach; Market needs accomplishment.	Industry Engagement	Competitive advantage
Inter-sectoral interactions; Public-private interactions.	Public-private Interaction	

Source: Own elaboration from interviews.

4. Findings

Based on our inductive coding, we distinguish between 10 themes. Aggregated into four dimensions, the findings are presented in the next subsections.

4.1 Knowledge Transfer Activities

This sub-section considers the codes that resulted from the thematic analysis which we associated with the themes “Supporting Activities” and “Role Definition”. It is not always easy to specifically define a unique set of activities performed by the UFs. In fact, as instrumental organizations, they have been designed in order to respond to the precise needs of their related institutions. This aspect clearly reflects the adaptability and agility in terms of activities and operations that, according to the respondents, it is not that easy to reach within the universities related to our case studies, since they are large and aged multinational organizations. Given the great dimensions of the universities, there is a vast range of supporting activities that can be located under the knowledge transfer frame. They have been schematized in *Tab. 4*.

Tab. 4: Foundations’ Knowledge Transfer Activities

Knowledge Transfer Activities	The Foundation Polytechnic of Milan (FCF)	UniSMART - Padova University Foundation (FUS)	University Foundation Ca’ Foscari (FPM)
Project Management – Industrial Projects	X	X	X
Project Management – Collaborative Projects	X	X	X
Research Contracts	X	X	X
Innovation Consulting	X	X	X
IP Management and Valorisation		X	
New Entrepreneurship – Start-ups’ support	X		
New Entrepreneurship - Spin-offs’ support		X	

Source: Own elaboration from *Foundations’ Social Reports*.

By considering a general overview of this specific aspect of the UFs’ phenomenon, it emerges a common ground underlined by all the respondents. In terms of technology and knowledge transfer, these intermediary organizations act as a simplified entry point for the industry to the innovation developed within the university’s departments.

We are a facilitated interface towards the assets, the technology, and the knowledge of the university, with respect to the industrial sector. A company with technology-related issues is not always able to identify the correct person for a support internal to the university and that’s where we come in. (Manuela - FPM)

The first kind of activity widely diffused among the UFs is project management (Van Horne and Dutot, 2017; Garengo, 2019). Units within the organizations have been designed to cope with a vast range of programs, as the industrial projects, mainly financed under the schemes similar to the Recovery Fund or other national and regional funding, the European Projects, largely financed through the former Horizon2020 schemes now Horizon Europe, the Interreg Italy-Switzerland program, or other international tenders and collaborative projects.

The second typology of activity is the research contracts. It is about the management of highly innovative contracts commissioned by private and public organizations to the laboratories or the research groups of one or more university departments. For the external stakeholders, it represents a facilitated way to commercially benefit from the unique value proposition and capabilities of the

universities' research centres. The transferring process happens through practical answers to needs that would not be addressed by the external organizations in such an easy and cost-efficient way (Berbegal-Mirabent *et al.*, 2015).

The third activity is innovation consulting which consists of targeted support to private and public organizations to find innovative solutions to complex problems through the valorisation of the knowledge and technology of the universities' departments. The consultancy activities may support through the innovation of customized innovation strategy, the development of products and services, or the analysis and scouting of emerging markets and technologies in a constantly developing perspective.

Fourth, the Intellectual Property management. This activity can comprehend various sets of actions related to the patents' valorisation. Foundations may collaborate in the process of IP registration, licensing, and brokerage, supporting the university in the negotiation of their licensed technologies and in the protection of IP-related rights through legal assistance. While the previous activities were carried on by all the foundations considered within the multiple cases analysis, in this specific example, foundations can cooperate with the TTOs or the ILOs both through general support or through a delegated responsibility by the universities to directly manage a specific part of the process or the whole of the patents' life cycle (Landry *et al.*, 2013; Brescia *et al.*, 2016).

The fifth and final typology of activity is related to the new entrepreneurship support and it mainly takes place on a double track. The former way is the processes of academic start-ups' creation, management, and valorisation. The latter track is the spin-offs generation, promotion, and support (Bonomi, 2014). These activities have been designed to assist students and researchers in turning business ideas into action within the framework of a university-led innovation (Minola *et al.*, 2016).

4.2 Strategy

This sub-section investigates the codes that emerged from the thematic analysis which have been associated with the themes "Reactive Strategy", "Proactive Approach", and "Unique Value Proposition". A first aspect that has been underlined in all the interviews is that, from a strategic point of view, the initial approach for a foundation is to understand what is its "place in the world", defining what to do and how to grow. It is not such an easy issue if we consider that these organizations have been designed to operate in between the problems of both the public and the private sectors, as private foundations under the public law legislation. It means that the value generated cannot be taken for granted but it depends on the project managers' ability to generate margins over knowledge transfer operations.

Respondents generally agree to point out that foundations' strategy is often a quick response to the system in which the foundation provides knowledge transfer services. An interesting definition has been the one of FPM's COO which refers to strategy as the "function of the study of what the plate gives" (Manuela - FPM). In fact, one of the ways through which foundations bring value to their related institutions is the university's involvement through industrial and collaborative financing schemes. From the perspective of the intermediary organizations, the process of engaging universities' departments, professors, and researchers mostly occurs in a top-down way. It is a response of what are the needs of the market in terms of innovation transfer and collaboration opportunities.

Our distinctive characteristic is that we open the university to the market. We started to intercept firms and institutions with needs and unexpressed questions, offering solutions and answers. So, after an internal screening, we brought to the market the knowledge and the technology of the university. (Tommaso - FCF)

If we consider the knowledge transfer operations carried on by the UFs, another issue that emerges from the respondents' overview is the identification of a fundamental strategic aspect in

the valorisation of the uniqueness of their value offering. These intermediary organizations represent a meeting point between a complex organization, like the university, and a vast range of local, European, and international stakeholders. From an ingoing perspective, external players may find a facilitated way to enter into contact with the innovative assets of the university.

For the reasons mentioned above, in terms of trade-offs, it is essential that the foundation's role is clear and stated. As related institutions, universities have to design their foundations defining what they can and what they cannot do. The legislator provides a vast set of activities that UFs can pursue but this aspect does not mean that they have to cover all of them. From a strategic point of view, only a clear and stated role distinction can enable efficient support to the universities' activities.

As emerged in the interview with FUS PM, the foundations must not become a duplicate of the universities. Even if the objectives are shared, these intermediary organizations have to pursue different strategies and operative approaches. If their top-down strategical proposal and their "market-aggressive" entrepreneurial mindset are not valorised, UFs would not represent anymore a value-added to all the activities already performed by the universities and their departments.

[Foundations] do not have to replicate university's models, modus operandi, approaches, and mindsets, but they have to find their own way. Until the foundations maintain their independence, they can represent a competitive advantage for the universities. (Stefano - FUS)

4.3 Relationship with the university

This sub-section investigates the themes "University Independence", "Synergy with Universities", and "Instrumentality". The interviews carried on within the foundation's employees have generally confirmed what emerged from the literature review. UFs, as intermediary organizations, play only a supporting role in the knowledge and technology transfer activities for their related institutions and, in particular, with the TTOs or the other offices that address similar aspects. All the interviews underlined the fact that the university would be capable of carrying on these activities also without the assistance of an organization of this sort. This diffuse awareness among the cases selected can help to better understand the role of the UFs.

In the investigation of this relationship, the words "synergy" clearly comes out in all the interviews collected. This aspect assumes critical relevance to reach a successful outcome in the third mission's activities. A synergic approach permits avoiding competition and aligning the interests between the parties involved. In the development of a knowledge transfer process, the synergy among the different actors represents a fundamental aspect for the emergence of a successful collaboration. It does not lock the innovation system into a vicious circle, pursuing a more vast and comprehensive diffusion of innovative solutions (Leydesdorff and Ivanova, 2016; Cesaroni and Piccaluga, 2016).

Another important element that emerged is that, for the foundations' employees, the constant dialogue and the collaborations set with the TTOs and the other universities' offices represent a litmus test. In fact, it permits to understand whether the supporting activities are actually aligned or not with the universities' strategic objectives in the third mission frame.

From this point of view, according to the FPM's COO also a spatial proximity dimension may be helpful, in particular in the early stage of a UF of this sort. For example, the TTO of the Milan Polytechnic was beside the foundation's offices. That closeness, also in terms of physical relations, enhanced a constant confrontation and strengthened more collaborative dynamics. This perspective can lead intermediary organizations to work more efficiently as mediators in the knowledge and technology transfer process.

[TTOs] know that we collaborate in facilitating and supporting their job. There is no competition with them because we have been designed to do different things. They are our principal

instrument through which we can understand if we are aligned with the university or not. (Manuela - FPM)

A relevant aspect observed in the interview with FUS but that refers to a widespread behaviour among the cases considered is the different approach to the project development (Stefano - FUS). In fact, in the relationships with the university's offices aimed at a project development, both under a research contract on a European project scenario, the universities follow a more bottom-up path while the foundations a more top-down one. Because of its nature as a private organization designed with a structure able to deal both with university and industry, the foundation can be more facilitated in the engagement of companies and researchers in projects already in progress.

4.4 Competitive advantage

At this final stage of the findings, it will be considered the codes associated with the themes "Industry Engagement" and "Public-private Interaction". Respondents mostly agree in recognizing that UFs do not radically change the big picture of their related intuitions' activities. However, they can become key organizational players when the university needs extra gear in times of difficulty or in moments in which the offices are saturated with work. They can represent a competitive advantage to better position universities in all the situations that require quick flexibility and adaptability. These characteristics cannot always be easily matched by large public organizations of this sort (Petruzzelli and Murgia, 2020).

The foundation is a competitive advantage for the university. However, it does not directly affect the overall picture. The University would carry on the same activities but probably this process would require more time and it would come late or it would have more complications because a public organization of this sort cannot always move with agility. (Stefano – FUS)

Another relevant aspect, in terms of competitive advantage, is the different organizational behaviour more related to a consulting approach. It can represent an efficient and effective attitude in particular in situations that require adaptable responses to specific market needs to involve industrial collaborations or to scout opportunities (Villani *et al.*, 2017). From this point of view, as previously mentioned, respondents generally agree upon the identification of a different kind of tension that can be perceived within this typology of intermediary organizations concerning their internal university offices. This constant research of a profitable outcome for their related institutions, led these organizations to behave in a more proactive and accelerated way.

Even in this case, it is fundamental to underline that the foundation's strategic objectives do not differ from the ones of the university. So, the value represented by the foundation is not always something that can be simply added to the overall university's value. Mentioning a comment of the FUS' respondent, "it is another way, not another business".

5. Conclusions and implications

5.1 Conclusions

The multiple cases' analysis on the UFs and the embedded approach on their knowledge transfer activities have set an exploratory framework on UFs after 20 years from their establishment. Considering the insights which emerged from the data analysis and findings, we can derive few conclusions.

It is still not easy to define a single and simple answer to the research question. One of the main reasons is that there is not a unique way to organize the UFs. As emerged in (Bellezza and Florian, 2005; Serravalle, 2012; Sicchiero, 2020), the related institutions define their role

accordingly to the precise needs and strategic objectives of the athenaeums. Therefore, considering the specific focus of the knowledge transfer activities and looking at the multiple cases considered, the next paragraphs will try to piece together all the observations and the suggestions made so far to address the phenomenon and made some remarks.

The worldwide academic system is always more crowded and competitive not only in terms of education and research activities but also from the third mission side (Vesperi et Gagnidze, 2019; Petruzzelli et Murgia, 2020; Compagnucci et Spigarelli, 2020). Universities have tried to readapt their organizational behaviours to better cope with the academic market needs, acting under a more entrepreneurial perspective (Cesaroni et Piccaluga, 2016; Davey, 2017). However, especially for the Italian case, it is not always easy for such huge and dated organizations to collaborate with the external environment by pursuing socio-economic profitability through the transfer of their knowledge and technology (Algieri *et al.*, 2011; Micozzi *et al.*, 2021).

As intermediary organizations, UFs can represent an external operative instrument in the hands of the athenaeums to pursue all the strategic objectives that require a higher level of flexibility and market-adaptability, as the ones related to the knowledge transfer activities (Ferrara et Rea, 2011; Serravalle, 2012; Macrì, 2016). For this reason, according to the pieces of evidence collected in the previous paragraphs, the role of the UFs can be determined as follows.

As emerged in sub-section 4.1., UFs, as intermediary organizations, have the role to comprehend which are the opportunities that may arise from each of them and, if any, which is the value-added that these variegated actors can bring to the academic system, or vice-versa, generating innovative solutions for the entire society. Foundations' employees agreed in considering their foundation as a platform and a simplified entry point for the industry to the innovation developed inside the university. They act as a translator of the needs of the external environment into operative targeted activities, scouting opportunities within the innovation process.

Acting as a bridge between the university and the external environment, UFs represent catalysts to innovation. As emerged in Brescia *et al.* (2016) and in Battaglia *et al.* (2017), those organizations do not pursue objectives different from the ones of their related institutions, with respect to the more traditional internal offices' approach, they just act in a different way. From this point of view, a relevant aspect to underline in the conclusive side is the different *modus operandi* of the foundations' employees when compared with the people in the universities' TTOs (Landry *et al.*, 2013; Villani *et al.*, 2017; Kolesniknov *et al.*, 2019).

It is important to keep in mind that foundations' project managers are employees of private organizations and that their salaries may change accordingly to their results and accomplishments in the knowledge transfer activities. This helps to better contextualise that "tension" that leads foundations' employees to constantly seek for new and innovative routes to generate value, as described by FPM COO's (Manuela - FPM). The project managers' proactive role may be a useful approach capable to generate innovative paths not only within their foundations, but also in the academic mindset of researchers, departments, and universities' offices.

Again, we need to keep in mind that UFs do not represent the only possible structure through which the athenaeums may address activities related to knowledge and technology. On the basis of the analysis carried on so far, these organizations may represent a possible solution among many others, according to the specific needs of each university and its strategic direction.

5.2 Research limits and future researches

This study has several limitations. Indeed, the research method proposed is considered as a limited one with respect to other research frames, especially from the generalization point of view (Yin, 2013). This is mainly because the investigation is carried on under a small sample of respondents and that the research approach is still set on an explanatory basis. As discussed before, this is the level of analysis required by the early-stage of the research framework related to UFs and knowledge transfer activities. However, even if the content of this dissertation can have low generalizability in absolute terms because of its case-specific context, this aspect does not

compromise or undermine the explanatory purpose of this multiple-case study (Saunders *et al.*, 2016). Since we just analysed a sample of 3 UFs, this represents just a preliminary approach to the research of this phenomenon that may be enriched with more cases.

In addition, our work is related to a qualitative research approach. For this reason, another possible path to take could be the analysis of this phenomenon from a more quantitative perspective. Through specific data collections, it could be measured the impact of the UFs on the knowledge transfer activities of their related institutions. For example, it could be made a comparison among the outcomes of similar activities carried on by the internal university offices and the foundations' units. This approach could help to shed light on which organizational structure operates more effectively and could lead researchers to provide useful insights to all those offices that carry on knowledge and technology transfer activities, choosing the proper organizational structure and the right role distinction to better enhance these processes (Battaglia *et al.*, 2017; Micozzi *et al.*, 2021).

Those kinds of organizations may be investigated under a more general focus within the framework of intermediary organization for knowledge transfer activities. Researchers can analyse when it can be more efficient and effective to for the universities to go for the support an intermediary organization rather than a completely external one (Villani *et al.*, 2017; Alexandre *et al.*, 2021). Since it is a still recent phenomenon for scientific research, there are still many observations that can be made. From this point of view, it can be specifically addressed which are the advantages and the disadvantages of the different organisational structures and in which context they would better fit.

In general, this analysis could be carried on also under a more international perspective, considering similar cases in different national contexts. In particular, interesting examples can be found in the US, the UK, Israel, and Canada that, together with Italy, can count cases of this organization's typology (Brescia *et al.*, 2016; Hoackaday, 2020). Another interesting investigation could be carried on to assess which are the factors that better enhance an efficient and effective transfer of knowledge and technology when facilitated by intermediary organizations. By considering successful cases of knowledge transfer, the phenomenon could be in-depth analysed, providing practical and operative paths. This frame could lead to develop new strategies and to reshape processes by maximising the results of the transfer.

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Redefining knowledge co-creation in Covid era: the role of artificial intelligence in smart education

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Abstract

Framing of the research. *In contemporary digital era, organizations are forced to align with a mounting technological evolution that poses the need to reframe education through the implementation of a technological ecosystem that redefines the knowledge sharing practices and the relationship between providers and users. Through the application of a series of digital projects, smart cities are leading actors in the fight to pandemic and in the digital redefinition of education service. Service ecosystems view can foster the reinterpretation of contemporary cities as interrelated sets of technologies, multi-levelled relationships between public and private organizations and citizens, connected through technology-mediated interactions.*

Purpose of the paper. *The study aims at analysing how the imposed technological evolution in contemporary smart cities enhanced knowledge co-creation by using AI-based tools. The objective is to understand how cities' strategies and practices should be reframed to exploit the opportunities offered by AI-enhanced solution for the enhancement of knowledge co-creation (KCC) processes. To address this goal, the paper rereads smart cities as service ecosystems.*

Methodology. *To address the research objective, qualitative empirical research is performed through a case-study analysis that explores the smart projects developed in selected Italian smart cities over the last years to address the limitations (social distancing, smart working, distance learning, learning, etc.) posed by pandemic.*

Results/ Originality/ Implications: *The findings obtained permit to introduce a conceptual framework that can identify the enablers of knowledge co-creation in contemporary smart education by using AI-based tools. Hence, the framework can show management and urban policy-makers how to successfully implement AI-based solutions in education services to comply with the technological evolution posed by pandemic and to support the emergence of new knowledge and innovation. The analysis of the different smart projects implemented in Italian smart cities to redefine education can provide research with a useful theoretical foundation to derive, conceptualize and measure the construct of knowledge co-creation in future quantitative studies.*

Keywords: *smart education; knowledge co-creation (KCC); knowledge management processes (KMP); artificial intelligence; human-computer interaction; smart cities.*

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1. Introduction

The global health emergency requires companies to adapt to the economic, cultural and technological changes that redefined the ways of working, living, interacting, studying for workers, citizens and consumers over the last two years. This disrupting phenomenon emphasized further the need to redefine digitally the strategies for value creation by showing that contemporary private companies, public institutions and organizations should remodel and orientation, the practices for resources exchange and knowledge sharing (Appio *et al.*, 2020) to address the pandemic.

Covid-19 revolutionized the world of education (Choi *et al.*, 2020), by demonstrating that the resolution of a crisis and the implementation of changes can take place only through collaboration between education providers/institutions and community. The stakeholders engaged in the provision of education service, at public and private level, can combine skills and resources to address social, economic and cultural needs, with the aim of ensuring the continuity of learning, especially for the most disadvantaged students.

In VUCA (acronym for volatility, uncertainty, complexity and ambiguity, Bennis and Nanus, 1987) times, economic, social and cultural changes occur more rapidly than in the past, the information is limited, and the predictions become increasingly complex (Mack *et al.*, 2015; Worley and Jules, 2020). With the advent of pandemic, the uncertainty of the context and the potential emergence of unpredictable disrupting events increased. In this scenario, smart cities played a key role in the fight against Covid-19 to support communities in the use of technologies. In Italy, the public administration introduced a task force to identify how AI-based technology can offer innovative solutions to encourage the “obligated” digitalization of learning era during Covid-19.

Over the last ten years, different Italian smart cities became digital innovation hub for the provision of smart education thanks to the strategic collaboration between private and public universities, research centers, regions and municipalities, start-ups (Arcese *et al.*, 2019; Ferraris *et al.*, 2020). The creation of a synergistic system of actors established a virtuous circle of value and knowledge creation and co-creation that also attract talents and young researchers and entrepreneurs, stimulate economic growth (Ugolini and Vigolo, 2009; Betz *et al.*, 2016) and increase the innovation opportunities (Florida *et al.*, 2017). Citizens’ engagement and the willingness of policy-makers to satisfy multiple needs in the city (from companies to public institutions to customers, talents and workers) can be considered as key levers for the creation of value (Christofi *et al.*, 2021; Ugolini *et al.*, 2021).

To redefine the service and provide courses and exams online rapidly, over the last two years the Italian system of smart education has been dramatically redefined through the creation of a complex technological ecosystem based on Artificial Intelligence (AI), Big Data and Internet of Things (IoT).

In this changed scenario, AI can increase value and knowledge sharing, by simplifying information and communication flows, strengthening users and providers interactions (Huang and Rust, 2018). Despite the increasing diffusion of studies that analyzes the relationship between knowledge sharing, digital technologies and AI (Leone *et al.*, 2021), in contemporary research and in the period of global crisis, there is the need to analyze how knowledge co-creation is actively redefined through digital technologies based on AI (Kartemo and Helkkula, 2018).

Knowledge co-creation (KCC, Prahalad and Ramaswamy, 2003; Von Hippel, 2005) can be intended as the active engagement of users in the complex process of generation, sharing, combination and creation of the knowledge (Hakanen, 2014; Su *et al.*, 2016) deriving from the integration of unique resources by different actors. Contemporary smart cities can be considered as a set of multi-leveled relationships between actors and technology. Hence, the rereading of contemporary cities as service ecosystems can help analyze the transformative role of AI in smart education and in knowledge exchange (Lytras *et al.*, 2021) by observing how Covid-19 reframed the interactions among actors and between actors and technologies (Kashef *et al.*, 2021).

Thus, through the reinterpretation of smart cities as service ecosystems that adopt a complex set of AI-based solutions for smart education in the Covid era, the study seeks to address the following research questions:

RQ1: How can AI-based tools for smart education reframe knowledge co-creation practices in urban ecosystems to address the limitations posed by Covid-19?

RQ2: How can the new knowledge co-creation practices developed in smart cities encourage the emergence of innovation?

The research questions are assessed through qualitative empirical research that employs content analysis as an inquiry to examine the key projects of smart education realized in four Italian smart cities (Milan, Turin, Bologna, Trento) through AI-based solutions after the advent of Covid-19. The design of methodology and data analysis are based on the adoption of an ecosystems perspective that analyzes the impact of AI on knowledge co-creation and the potential the emergence of new knowledge that can affect the development of innovation.

The paper is structured as follows. In the theoretical background, an overview on the impact of AI-based tools on knowledge co-creation. Then, smart cities are reinterpreted as service ecosystems to set the theoretical foundation of the empirical analysis for an investigation of knowledge co-creation in smart education. In paragraph 3, the methodology and techniques adopted for the empirical research are discussed. Next, the findings are presented and a conceptual framework is introduced. In the last sections, conclusion and implications are debated.

2. Theoretical background

2.1 Knowledge co-creation and artificial intelligence

Knowledge co-creation (KCC, Prahalad and Ramaswamy, 2003; Von Hippel 2005) is defined as the process of collaboration between users and providers during service exchange. It can be conceptualized as the result of the engagement of actors in the analysis, sharing, combination and creation of knowledge (Su *et al.*, 2016) deriving from the combination of unique resources during value co-creation processes. Therefore, knowledge co-creation can be intended as an enabling element of value co-creation and of new co-created solutions (Hakanen, 2014).

Traditional knowledge management processes (KMP, Singh and Gupta, 2014) are defined as the integration of the activities of: 1) *knowledge generation*: the base of knowledge created in an organization that can be applied to create value (Cantù *et al.*, 2009); 2) *knowledge sharing*: combination of knowledge and expertise within and outside an organization (Gupta *et al.*, 2006); 3) *knowledge creation*: generation of new theoretical and operational knowledge (Nonaka *et al.*, 2006); 4) *knowledge retention*: creation of new routine in the form of codified knowledge (Alavi and Leidner, 2001). In service literature, KCC is introduced to reframe the phase of knowledge sharing and to emphasize the participation of users in the co-creation of value and, hence, new knowledge.

The combination of stakeholder's skills can generate a high degree of variety to encourage the creation of new knowledge, new insights for organizational change, the improvement of services or the creation of new products (Arikan, 2009). Thus, different types of actors, in various exchange contexts, can provide various resources and stimulate the emergence of innovation.

AI is based on the simulation of human intelligence for the automatized selection of actions and decisions to attain given objectives (Dobrev, 2012; Syam and Sharma, 2018). AI-based tools can have a huge impact on decision-making and management (Black and Van Esch, 2020) and can help companies fulfill the needs of multiple actors (users, managers, policymakers) by increasing their knowledge (Paschen *et al.*, 2019), fostering value co-creation and supporting the co-development of innovative solutions (Huang and Rust, 2018).

The relevance of AI in service provision can be highlighted by the focus on customer (Vargo *et al.*, 2008; Leone *et al.*, 2021): these tools can increase the experience of users and strengthen internal and external knowledge sharing (Paschen *et al.*, 2019). Moreover, companies can benefit from the possibility to gather and analyse data on consumer behavior, by gaining feedback to improve services and enhancing the competencies of each stakeholder.

Therefore, AI can bring multiple benefits in service delivery. For this reason, the use of AI-based tools can simplify the delivery of education service through sophisticated technologies that can address effectively and punctually the needs of students and can provide them with personalized learning experiences (Sabherwal and Becerra-Fernandez, 2013; Lytras *et al.*, 2018).

After the advent of pandemic, the traditional modalities for education provision have been dramatically redefined. To meet the requirements established by government and align with social distancing, schools and universities should deliver online courses and exams. Distance learning shows that teachers and students should not only new technologies but also possess digital skills to be implemented in their daily activities. AI can automatize lessons, evaluation processes, tutoring and students' interactions through intelligent systems that can be used to submit exams, register presence in real time, manage the organizations of lessons, assess the skills of students and the quality of teaching. Moreover, intelligent assistants based on AI can interact with the students individually, by offering contents and helping the improvement of skills, knowledge and decrease the digital divide gap.

The most common AI-based solutions that can support smart education not only enhance and automatize the delivery of courses but also for evaluation and can customize the materials prepared by teachers. Moreover, tutoring can be enhanced through the collection of feedback and suggestions and of data on school dropout. Therefore, AI can reshape education service as a whole, by all-encompassing all the phases of provision (from pre-delivery to post-delivery), supporting each stakeholder (from teachers and students to staff and management) and improving learning processes both at individual/relational (by providing new skills and redefining interactions) and social level (by creating new routines for education).

2.2 Smart education in smart cities as service ecosystems

The need to comply with the restrictions posed by the pandemic reframed the traditional ways of providing services by introducing smart working, distance learning and augmenting the digitalization of public services. To readapt their organizational models quickly, smart cities should comply with the new technological evolution. In Italy, also the less smart cities transformed their activities digitally to survive the crisis and attain resilience (Ernst & Young's Smart Cities Index 2020). In this way, even the less smart cities overcame any psychological, economic and cultural resistance to the use of new technologies for daily life activities.

Considering the multi-layered and interactive nature of education service, grounded on the combination of knowledge, skills and capabilities, service ecosystems view (Vargo and Lusch, 2010, 2016; Akaka *et al.*, 2013) can permit to reframe education service as a complex process of resource integration between actors who can co-create value and knowledge through a complex set of technology-mediated interactions.

Service ecosystems are embedded systems of actors that in contemporary context can exchange resources more easily through technology by co-creating knowledge that can foster the co-development of innovation (Grieco and Cerruti, 2018). Consequently, KCC can include the generation, capture, transfer, combination and creation of knowledge (Su *et al.*, 2016) arisen from the integration of unique resources by different stakeholders engaged in value co-creation. By sharing capabilities, abilities, skills, actors can obtain a high degree of variety to encourage the emergence of new knowledge, insights for organizational change and for the improvement of services or the creation of new products (Arikan, 2009), thus enabling the co-creation of value (Acharya *et al.*, 2018). Therefore, the acquisition, application and assimilation of knowledge actively can favor the emergence of value and new co-created solutions (Hakanen, 2014).

If knowledge co-creation can be considered as a driver of value co-creation, it can be reframed as a complex process deriving from the synergistic integration of transformations at micro- individual, meso- relational and macro- institutional levels (Vargo *et al.*, 2015), the three contexts in which value co-creation can be generated.

Extant research on service ecosystem investigates the role of digital technologies in enabling value co-creation (Leitafa *et al.*, 2016) by providing a systems understanding of how resource integration can help manage and overcome disruption by generating new practices for knowledge co-creation that influence ecosystems' well-being during a global emergency (Brodie *et al.*, 2021).

Service ecosystems view can be applied to education sector since cooperative learning can be associated with knowledge co-creation and can comply with the win-win logic of mutuality that encourages ecosystems actors to co-create knowledge and value for the different co-creators engaged (Díaz-Méndez *et al.* 2019). Rereading smart cities as service ecosystems can shed light on the most effective strategies that can be employed to address emergency through technology-mediated interactions, value and knowledge co-creation for the development of innovative and resilient practices (Troisi *et al.*, 2017; Visvizi and Lytras, 2019).

The three contexts in which ecosystems (Vargo *et al.*, 2010; 2015; Akaka *et al.*, 2019) exchange value and knowledge- that can be applied to education service in smart cities- are: 1) micro-level: individuals' intentions, attitudes and value perception; 2) meso-level: interactive dimension of resources exchange between students, teachers, organizations, institutions, etc.; 3) macro-level: collective dimension in which rules and institutions that guide the actions of community are defined.

The adoption of service ecosystems view to detect how artificial intelligence can reshape value co-creation in smart cities seeks to address some gaps emerging from extant research (Tsaih and Hu, 2018). Previous studies emphasize the need to have a more comprehensive understanding of the role of technology in value co-creation (Kaartemo and Helkkula, 2018) and of the impact on the relationships between actors (Leone *et al.*, 2021). Hence, the analysis of the new modalities of interactions and of the new practices for value co-creation arising from micro (individual), meso (relational) and macro (institutional) levels of smart city ecosystems can be intended as a first step to fill this gap. Despite the numerous contributions that examine the role of artificial intelligence in value co-creation, extant studies tend to underestimate the impact of users' attitude, perception (Ugolini *et al.*, 2014) and resistance to the use of technology (Solakis *et al.*, 2022). For this reason, through a re-elaboration of literature on service ecosystems, some of the key dimensions used to analyze the micro-level are: actors' motivations, attitude and willingness to employ new technologies (see Table 1).

Moreover, despite the impact of artificial intelligence on knowledge exchange is acknowledged, extant research does not analyze sufficiently how knowledge co-creation is actively redefined through the implementation of digital technologies based on AI in smart cities (Ferreira *et al.*, 2021) and how this redefinition can encourage the development of innovation (Van Der Graaf and Veeckman, 2021).

For this reason, to address these gaps and in line with the recognized interconnection between knowledge co-creation (KCC), value co-creation and the emergence of joint innovation (co-innovation) in current smart cities ecosystems, the aim of the work is to reveal, firstly, the key enabling dimensions for knowledge co-creation in contemporary smart education, and to explore, secondly, how these can be integrated synergistically to give birth to new strategies, practices and rules for the community.

3. Methodology

To respond to the two research questions, the empirical research analyzes the smart projects based on AI implemented in four Italian cities after the diffusion of Covid-19. The sample is composed of the cities that have been ranked in the top five of Ernst & Young Smart City Index

(2020): Milan, Turin, Bologna and Trento. Data has been gathered from the official websites of municipalities, of government and from strategic documents and statistics on smart cities.

The analysis is based on an exploratory qualitative approach and adopts the technique of content analysis as inquiry (Losito, 1996), which permits to extract from texts (the unit of analysis) a smaller number of categories and enrich, revise and broaden the variables employed to guide the analysis to derive new concepts (Krippendorff, 2004). The textual data is analyzed through semantic processes based on a coding procedure, performed independently by three researchers. The method employed to analyze data is substruction (Dulock and Holzemer 1991), a logical transformation of concepts from general to specific and beyond. Substruction permits researchers to constantly mediate between the logical transition from general variables to specific keywords (deduction) and the logical transition from keywords to further specific sub-dimensions (induction).

The exploratory qualitative approach does not pursue the aim of generalizing results or of making statistical inferences from the sample to the population but seeks to assess the validity of some conceptual dimensions identified in literature or to identify new concepts emerging from data to revise extant conceptualizations (Charmaz, 2006; Gummesson, 2017).

The content analysis performed aims at detecting the key ecosystem's dimensions that enhance knowledge co-creation processes in Italian smart cities that employ AI-based tools for smart education (RQ1). Next, based on the analysis of the key dimensions of KCC, the new kinds of novelties co-created in the education ecosystem are examined (RQ2). The final aim is to detect classify some enabling factors that can support contemporary smart cities in the management of crisis through the creation of a technological, cultural, and social ecosystems that can enhance education services by generating for all the actors involved.

The content analysis sketch, that guided data analysis, has been elaborated starting from the key dimensions of KCC and innovation in service ecosystems discussed in the theoretical background. For each research question, some key variables and sub-variables have been specified to obtain some questions to be administered ideally to the texts (see Table 1).

Tab. 1: The content analysis sketch

Research questions	Variables	Keywords	Key questions administered to the text
RQ1	MICRO-LEVEL	Personal motivation Learning opportunity	1) Which are the potential barriers to the use of smart technologies? 2) Which AI-based tools are used utilize digital skills?
	KNOWLEDGE GENERATION	Organizational culture Management style Beliefs Skills Attitude Willingness to engage	3) Which to improve individual's willingness to engage? 4) Do stakeholders own and share a smart attitude?
	MESO-LEVEL	Resource integration Interactions	1) Are the stakeholders engaged in common projects to share resources and knowledge?
	KNOWLEDGE SHARING KNOWLEDGE CREATION	Experience Engagement Distributed decision-making Co-design	2) Are stakeholders engaged in the co-design of the service? Is their feedback collected to improve the services? 3) Which are the key AI-based technologies to boost education daily activities (lessons, courses, exams)? 4) Which are the main AI-based tools for improving learning experience?
	MACRO-LEVEL	Mind-set and culture for education Learning and teaching culture Orientation to learning Citizens' commitment Democratization in the access to technology	1) Is the new knowledge generated employed to reframe community's culture? 2) Which are the AI-based technologies that supported the retention of knowledge and data collection? 3) Did the organizational mind-set toward education and the digital culture of citizens change after the creation of smart projects based on AI? 4) Which are the smart projects based on AI that contributed the most to change the culture and the perspective on education?
RQ2	CO-DEVELOPED INNOVATION		
	Micro-level	Individual dimension	-new skills -improved acceptance of technology -renewed attitude toward the use of new technologies for learning
	Meso-level	Interactive dimension	- new interactions modalities - new ways of experiencing learning and living education service - new modalities for resource sharing
	Macro-level	Collective dimension	- renewed culture for the community - new routines and rules for teaching and learning - renewed/ new mind-set for education

Source: our elaboration

The enabling dimensions for knowledge co-creation (RQ1) and the potential innovation outcomes of KCC (RQ2) are used as macro-categories in the content analysis sketch to guide the administration of the interviews. The goal is to reveal the new practices and novelties (renewed/new relational and interactive modes, routines, etc.) generated in the education ecosystem. The variables have been classified through a critical re-elaboration of service ecosystems and service innovation literature. The potential novelties that can be co-developed in the urban ecosystem new digital skills for users and new orientation for organizations, new interaction modalities and the renewal of community's culture (Troisi *et al.*, 2021).

The content analysis aims at detecting the influence of AI-based solutions on knowledge creation in contemporary smart education in micro, meso and macro-contexts. The researchers not only observed the new modalities for knowledge co-creation introduced after the advent of pandemic but also the new ways of offering services and the new rules and institutions that drive the new digitalized education services.

4. Findings

4.1 RQ1: Knowledge co-creation in smart education ecosystem

The findings have been sub-divided into the three contextual levels of service ecosystems in which the smart projects and the technological tools based on AI implemented in the various cities have been classified to detect the knowledge co-creation practices in Italian smart education system

4.1.1 Micro-level: knowledge generation

At micro- level, the smart projects based on the use of AI seek to remove the barriers to use of technology, by enriching students' digital skills and providing them with free access to technological service and with the possibility to enjoy free technological services.

For instance, Turin Smart City launched "Hackability", a platform to solve technical problems for students and teachers that should use distance learning tools and to offer economic (discount, free devices) and psychological support (live chat for assistance and orientation) for the adoption of technology to use digital tools. Moreover, Bologna smart city, through "We are here" project, dedicated to people with disabilities, aims at ensuring the continuity of learning activities interrupted by the health emergency and at enhancing the digital knowledge of users. In Rome, robotics has been utilized to assist digitalized learning processes for students with disabilities and special educational needs (Mathisis project, "Managing Affective learning through intelligent atoms and smart interaction", implemented in the program Horizon 2020). The platform acknowledges the degree of attention of students to increase or decrease the difficulty of questions.

Hence, to address the first research question, the practices for knowledge creation has been redefined to enrich and renew the digital skills of students and teachers. In addition, not only the modalities of service provision have been reframed but also the organizational orientation of education institutions that rethought the service digitally. A technological ecosystem based on robotics and AI has been created to engage students, remove inequalities in the access to technology, support them psychologically and technically with new training and self- assessment tools

4.1.2 Meso-level: knowledge sharing and creation

At meso-level, the Italian smart cities investigated introduced different open platforms to reframe the experience of service delivery, increase the social connections and improve the realization of online learning processes.

For instance, Trento smart city launched a platform (“Digital lounge”) to improve students’ participation in the co-design of services by collecting their suggestions and feedback on the use of digital tools and on the quality of teaching in real time. Moreover, through the open innovation project “All Connected”, the smart city of Turin provided support to distance learning, by allowing students to exchange ideas and to co-designing new services.

These tools develop learning experience and human-computer by simplifying online teaching and learning in real-time and the use of platform for distance courses (Meet, Teams, Zoom), that support the creation of an interactive atmosphere.

AI is employed also for the implementation of learning management systems (LMS) such as Brainly, online platform where students can share knowledge, answer to questions from other students and co-create shared solutions to problems. Moreover, in Italian schools, Century Tech, an AI platform for teaching and learning has been introduced to offer students free resources for training and the possibility to create personalized learning paths.

In addition, IRS-based tools, such as “Kahoot!AS” can facilitate knowledge co-creation between students and teachers through the gathering of insights and ideas. Students can view and comment other students’ suggestions, by playing a key role in the resolution of problems and improving the service by co-creating innovative solutions. Similarly, augmented reality permits to reframe the service environment by boosting interactions and providing training tools.

As for the redefinition of knowledge sharing and creation, it can be noticed that all the stakeholders are actively engaged through technology-mediated interactions in the co-design of education service by integrating their unique knowledge and improving at the end the overall knowledge of the ecosystem by introducing new ways of co-creating educational value.

4.1.3 Macro-level: knowledge retention

Lastly, at macro-level, the Italian smart cities implemented a series of tools that boost students’ and teachers’ commitment by introducing new rules for the provision of education in the community.

Trento Smart city tried to ensure the continuation of cultural activities, by launching a platform for free digital contents and e-books and digital landing, MLOL (media library online). Turin launched some technology tools based on AI for course evaluation that allow at self-evaluating performance and seizing opportunities for service innovation and continuous improvement. Bologna created a network of educational and training agencies is created to promote active citizenship, develop a sense of social and cultural belonging to the city, experiment advanced forms of lifelong education. The project “Minimizing the influence of CoROnavirus in a Built Environment” aims at improving the quality of the university training offer by launching new online training modules for universities.

Moreover, new tools to evaluate students’ and teachers’ performances and opinions are introduced to collect data and create new knowledge that can be stored in the ecosystem and used for the creation of new value in the future service delivery.

The cities launched also a series of tools to assess teachers’ and students’ opinion on the education service and to administer online surveys to evaluate users’ perception and satisfaction of service. In this way, not only students access to user areas are monitored but data on their online behaviors and students and on teachers’ performance is collected. A software based on AI neural networks (MorphCast) permits to monitor the class during online lessons by detecting lack of attentions. The platform permits to store and process quickly data for future consultations. This permits to collect ideas, to store them and to transform them into proposals for new service, by ensuring knowledge retention.

Hence, as for knowledge retention, the collection of small data ensures the creation of personalized learning experiences by improving students’ self-knowledge about their progresses. Teachers and institutions can analyze data on students and through predictive analysis can foster the introduction of new services.

4.2 RQ2: The emergence of innovation

The redefinition of KCC in Italian smart cities through the creation of an AI-based ecosystems can encourage the emergence novelties in Italian at micro, meso and macro-levels.

As for the micro- level of knowledge generation, education institutions, universities but also private companies in the three cities establish strategic collaborations to provide economic support to students, boost their digital knowledge and acceptance of new technologies and simplify the access to technology. In this way, a new organizational mind-set and new modalities for service provision are introduced to engage students and offer training to increase their abilities in the use of the new technologies for distance learning introduced to comply with the limitations imposed by Covid-19.

As for meso-level of knowledge sharing, creation and co-creation, Italian smart cities implemented an integrated set of projects to improve social connections, interactions and experience and strengthen knowledge sharing in the provision of education service. Open innovation platforms can further promote actors' integration of resources and can encourage co-learning. Hence, new practices for resources and knowledge exchange and for new value creation are created, accepted and established in the ecosystem. The active participation in the redefinition and co-design of service empowers students by enhancing their performances and boosting their know-how and digital culture.

These activities can establish a common mentality to address the crisis through shared goals. The different platforms employed to boost learning experience can improve both actors-to-actors and human-technology interactions by complying with restrictions of time and distance.

As for knowledge retention, the cities analyzed launched different projects to increase social inclusion, sense of belonging to community and to raise commitment and participation. Through the incorporation of the new knowledge co-created (retention), new routines, institutions and a new culture for digital learning are internalized in the ecosystem. Through re-institutionalization, the new technological tools introduced to address the crisis can become accepted instruments to reframe education service durably even after the end of pandemic. The tools can orient the ecosystem toward the constant development of innovation and continuous improvement.

The cycle of knowledge co-creation, if restarted constantly to search for continuous improvement can constantly transform the ecosystem by sharing in it a proactive orientation for changes and innovation that pursue the ongoing enrichment of well-being over time.

5. Discussion

The findings of the study permit to introduce a conceptual framework that represents the knowledge co-creation processes generated within the smart education ecosystem of Italian smart cities.

At the micro-level of knowledge generation, the AI-based tools can enrich students and teachers' willingness to adopt the new technologies for distance learning and improve their digital knowledge by removing any resistance in the use of technology. Hence, new digital knowledge is created in the ecosystem at micro-level and, then, shared at the meso-level of resources integration and interactions occurring during the learning experience.

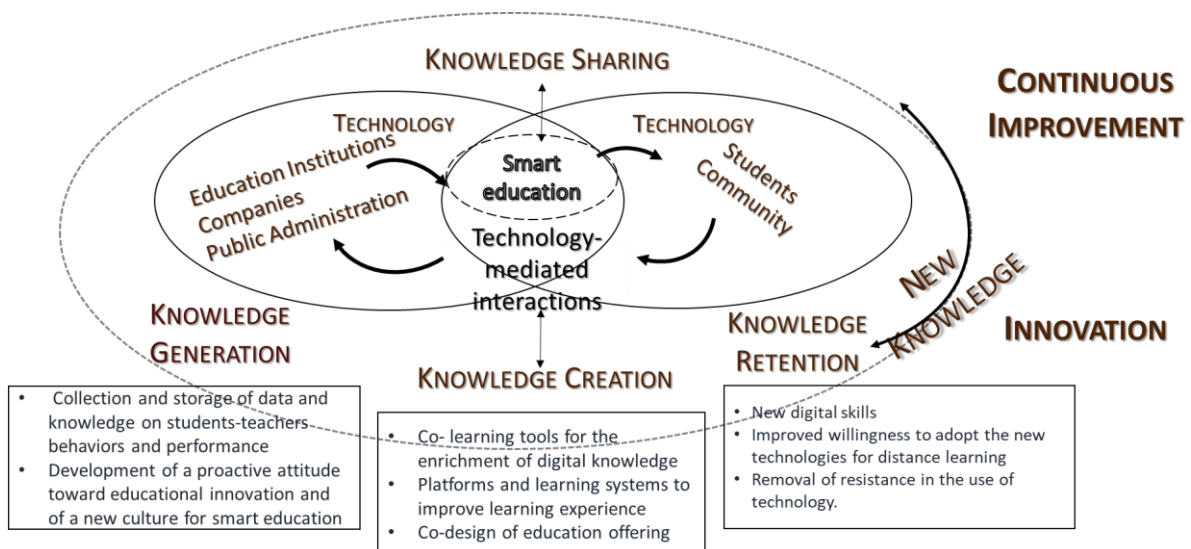
At meso-level of knowledge sharing and creation, platforms and learning systems based on AI can improve learning experience and promote the knowledge sharing to extract new knowledge and co-create learning. Teachers' and users' feedbacks can be collected by helping the assessment of students' progress and motivation. At this level, cooperative learning, one of the key concepts in education science, is co-developed. Through co-learning tools, knowledge sharing is boosted and the skills of teachers and students are enriched and renewed over time.

At macro-level of knowledge retention, the possibility to store the new knowledge co-created can ensure continuous improvement by developing a proactive attitude toward educational

innovation in the ecosystem. Collecting data on users' behaviors can help teachers undertake decisions and readapt in progress the methodological approach for teaching according to the information obtained. The stored data can be analyzed through analytics to attain new knowledge on students' preferences, learning advancements, orientation and satisfaction. Hence, a new approach for smart education is introduced by redefining the culture, symbols and languages of education service.

Figure 1 shows the ecosystem's enablers of knowledge co-creation in smart education. The re-institutionalization of the novelties generated is depicted through the bidirectional arrow (Peters, 2016). At the end of the process, the new practices for service delivery, introduced as emergent tactics to fight the pandemic in the short run, can be internalized in the ecosystem and can become stable routine for service delivery. For instance, online teaching can be maintained even after the end of Covid-19 to contain costs, simplify and fasten interactions with students and colleagues, enhance students' capability to learn concepts (with the rewatching of lessons).

Fig.1: The ecosystem's enablers of knowledge co-creation and innovation in smart education



Source: our elaboration

The re-institutionalization of the new practices can foster the emergence of innovation and allow cities at transforming the limitations posed by pandemic into opportunities for innovation. After he acceptance at macro-level, a new rule can become an institution and be translated into a shared practice practices within the entire education ecosystem.

At the end of the process, users' beliefs, attitude and digital skills are improved systematic co-learning can be generated (Austin and Hopkins, 2004) and can give birth, in turn, to the continuous renewal of knowledge. The new orientation, service modalities and routines for education delivery can remodel the ecosystem as a whole, from a technological, cultural and social standpoint (Troisi *et al.*, 2020).

6. Concluding remarks

The results of the empirical research show how smart cities, reframed as ecosystems, can address the challenges and opportunities posed by Covid-19 through AI-based tools by redefining knowledge co-creation strategies to give birth to new knowledge, rules and institutions (Gervilla *et al.*, 2020). The findings obtained allow at introducing a conceptual framework that can identify the enabling factors for knowledge co-creation in contemporary smart education by using AI-based tools.

The interpretative schemes offered by service ecosystems view allow at investigating: 1) the enabling factors for the reshaping of education service and of the KCC processes involved in this service to comply with the technological, social, cultural requirements imposed by the pandemic; 2) the dynamic and cyclical recombination of these drivers to foster the emergence of innovation and continuous improvement. Ecosystems perspective can not only help the identification of the new technologies and practices introduced in smart education to fight global health emergency but also hypothesize a potential transition from knowledge co-creation and the constant readaptation of ecosystem to generate continuous improvement (Polese *et al.*, 2020b).

The findings confirm the suitability of service ecosystems view as a conceptual framework that can offer powerful interpretative schemes for the multilevel analysis of relational patterns (Leone *et al.*, 2021) and knowledge co-creation in smart cities. The qualitative research proposed seeks to bridge the gaps identified in extant research by classifying the different kinds of knowledge co-creation practices enabled by AI-mediated interactions in smart cities and to explore the relational shades and the different kinds of novelties co-created by actors in each level. Hence, at micro-level, new modalities of technology-mediated interactions allow cities at providing users with the psychological support to remove barriers to the use of technology and with digital skills to enhance the ability to use the new digital tools. At meso-level, the use of AI-platforms introduces a new shade of knowledge co-creation that enhances cooperative learning and emphasizes the redefinition of experiences. At macro-level, the possibilities to collect and analyse data offered from AI open new opportunities to improve constantly the provision of services and to propose innovation starting from users' feedbacks.

Thus, the findings show that the use of AI in value and knowledge co-creation not only can influence users' attitude and resistance to the use of technology (Solakis *et al.*, 2022) but that the application of AI-based tools can create different and enhanced relational patterns among actors by encouraging the emergence of novelties (new skills, new experiences, new learning and teaching practices). At each level of the city-ecosystem, through the proposition of the conceptual framework, the study identifies the different kinds of enabling dimensions for knowledge co-creation (technologies for distance learning, platforms, new approaches to smart education) and the different kinds of innovative outcomes (new digital skills, attitude and mind-set, new interactive modalities for co-created teaching and learning, new possibilities for knowledge renewal and improvement through data analysis and knowledge sharing).

6.1 Managerial implications

According to a managerial standpoint, the results of the study can shed light on the redefinition of interaction modalities introduced using the different kinds of technologies implemented to meet the challenges posed by the global epidemic and can advance a first step for the classification of the enabling factors for the development of innovation opportunities through crisis resolution.

The framework can show management and urban policy-makers how to successfully implement AI-based solutions in education services to comply with the technological evolution posed by pandemic and to support the emergence of new knowledge and innovation. The analysis of the different smart projects implemented in Italian smart cities to redefine education can provide research with a useful theoretical foundation to derive, conceptualize and measure the construct of knowledge co-creation in future quantitative studies. The framework can increase managers' and policy-makers' understanding of the impact of AI on KCC in smart education ecosystem by clarifying how ecosystems re-adaptation to address Covid-19 can lead to the introduction of new practices that can change education service in the long run.

The analysis of the new interaction modalities for co-learning that can be activated through the new distance learning tools can help scholars and managers identify some drivers to survive global crisis. For instance, through the classification proposed in the study, managers and policy-makers can understand what is the most suitable combinations of technology, human actors and knowledge sources to implement successful AI-based solutions in smart cities. The findings show that the

application of technology per se is not sufficient to create benefits but policy-makers should evaluate carefully the most and the least appropriate AI-based tools for the different contexts and for the different stakeholders in the ecosystem (education suppliers and institutions, students, citizens, universities, research centers) who have different aims and needs.

By identifying the psychological and cultural dimensions as two potential enablers/obstacles for knowledge co-creation, the results of the study can outline policy implications. City managers and policy-makers who aim at boosting the implementation of AI in their cities should provide economic assistance to users (especially to elderly) in the use of new technologies and can promote free courses for citizens to teach digital skills. Moreover, collaborations with schools, universities and research centers can boost citizens' and students' awareness on the potential and on the risks of new technologies, can promote open innovation and can help youngsters to acquire digital skills and to be more competitive on the labor market.

6.2 Theoretical advancements

The paper proposes some theoretical advancements on the categorization of the different technological tools that can support the knowledge management process (generation, sharing, creation, retention) throughout the different moments of education service delivery (pre-delivery, learning experience, post-delivery).

The study shows that psychological and human components can act as key drivers for the proper exploitation of AI-based tools. In fact, users', citizens' and students' attitude toward technologies and their digital skills should be improved to ensure a proper application of AI in smart cities ecosystems and to generate economic and social benefits and well-being. The analysis of the key enabling dimensions of successful knowledge co-creation can reveal the most useful strategies for the enrichment of people's knowledge to foster the emergence of capabilities which can develop, in turn, opportunities for innovation. The integrated framework proposed categorizes the key dimensions of service ecosystems that, if properly combined, can foster the emergence of new practices of knowledge co-creation and the co-development of novelties (new modalities of interactions, new technology, new products/services, new smart mind-set and cultural, educational and social elements). Moreover, the integrated framework obtained from the re-elaboration of results can help identify the most proper combination of AI-based tools to generate innovation across the different levels of ecosystems, hence simultaneously at individual, relational and institutional level by generating multilevel processes of open innovation.

The key limitations of the study can be found in the methodological criticalities related to adoption of qualitative content analysis as an inquiry, which does not permit the extension of the findings obtained from the sample to the general population or to other contexts. Hence, to validate and enhance the degree of generalizability of the framework, comparative case studies can be performed. The sample can be broadened to include Italian smart cities with lower economic availability or to compare international smart cities. To assess the validity of the dimensions included in the conceptual framework, future research can start from the results proposed in the study to apply the classification of the different enablers of knowledge co-creation and of the different innovation outcomes to other contexts, such as tourism or healthcare. Mixed methodology can be employed to integrate qualitative research (grounded theory, case study, observation, semi-structured interviews) with quantitative research (by developing measurement based on the dimensions identified) and validate, modify or broaden the conceptual framework proposed. In addition, the relationship between value co-creation, knowledge co-creation and innovation can be further investigated.

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The more, the better: Towards a holistic assessment of city brand personality and image

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Abstract

Framing of the research. *City brand image and city brand personality are the two common facets of city brand equity, the latter being an emerging field of inquiry within the broader context of place branding.*

Purpose of the paper. *Through the systematic critical assessment of related literature, we argue for the insufficiency of both brand personality and brand image constructs in their application to such a complex, multifaceted reality as a city. Accordingly, the paper's goal is threefold. First, we theorize a new construct, the city brand personality/image dyad. We adopt a systemic perspective to advocate for the construct's greater usefulness and explanatory power. Second, we showcase a possible way of quantifying the perceived dimensions of a construct through exploratory statistical analysis of lexical information mined from specific city-related internet forums (subreddits). Finally, we suggest a methodological framework for measuring the projected facets of the construct and the implications of the discrepancy between the projected and perceived city brand personality/image dyad.*

Methodology. *Thematic synthesis of scholarly documents systematically included for the review is performed in the first part of the paper. Next, we perform a principal component analysis complemented by agglomerative hierarchical clustering to measure the perceived city brand personality/image dyad of big successful cities. The sampling is purposeful and is based on the well-known Resonance Consultancy Best Cities ranking.*

Results. *Four potential successful city brand types are identified, of which three currently exist. The fourth type, a highly permanent city with a touristic appeal, remains a theoretical possibility.*

Research limitations. *The main limitations are the non-random sampling of cities, unclear valence, and the dualistic (either/or) nature of the proposed city brand taxonomy.*

Managerial implications. *Local administration and city managers can use our classification to shape their city communication and city branding efforts more efficiently. Moreover, suggested methodologies may be adapted to successfully measure and realign the projected and perceived facets of any existing city brand.*

Originality of the paper. *Compared to both city brand personality and image, the city brand personality/image dyad accounts for the greater complexity of a city brand; thus, it is far more valuable for a comprehensive understanding of city brand equity.*

Keywords: *city brand equity, city brand personality/image dyad, systematic literature review, principal component analysis, agglomerative hierarchical clustering*

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1. Introduction

City brand equity, while encompassing the value of the city brand, has always been hard to define and measure, particularly for its two most studied facets: city brand personality and image (Priporas *et al.*, 2019). Moreover, due to the conceptual ambiguity of city branding, it has frequently been conflated with destination branding, a concept primarily related to tourism (Kaplan *et al.*, 2010).

In line with recent research, we argue that city brand personality and image are conceptually distinct from the eponymous facets of destination brand equity (Huang *et al.*, 2013; Kim and Lee, 2015). While both stem from the broader notion of place brand equity, we disagree with those scholars who reduce city brand personality and city brand image to mere tourist concerns (Echtner and Ritchie, 1993; Hankinson, 2004; Pike, 2002; Walmsley and Young, 1998). Indeed, identifying the facets of city brand equity appears to be more challenging. Not only geographical considerations and tourist attractions need to be considered, but also natural resources, local products, characteristics of cityness, local institutions, infrastructure, and many others (Dinnie and Dinnie, 2004; Fan, 2006; Sansone, 2012; Sansone and Bruni, 2012). Furthermore, due to the presence of numerous interest groups, the ownership of the city brand is uncertain (Fan, 2006).

When it comes to the city brand equity, the difficulty arises in treating city brand personality and city brand image separately (Priporas *et al.*, 2019). For instance, there exists no clear demarcation between the more personality-like attributes of a city or, in Aaker's terms (1997), a set of human characteristics associated with a city brand and the city image, typically a more grounded material manifestation of the latter (Ferreira and Dionísio, 2019).

The goal of the present study is threefold. First, through a systematic literature review of city brand personality and city brand image, we show how the two are better conceptualized as a single dyadic entity. Therefore, we advance the study of city brand equity by developing a novel concept of city brand personality/image dyad, arguing for both its conceptual validity and practical usefulness. Second, we further develop the related methodology by showcasing a possible way to quantitatively derive perceived facets of the city brand personality/image dyad. The latter goal is accomplished by analyzing social media forums related to the largest world cities operationalized as successful. Finally, we outline a methodological framework for measuring the projected facets of the construct and briefly discuss the implications of the discrepancy between the projected and perceived city brand personality/image dyad.

The study begins with a systematic evaluation of related literature on both city brand personality and city brand image. Then, major ontological, epistemological, and methodological challenges related to both constructs are reported as emerging from the reviewed literature. Consequently, the concept of city brand personality/image dyad is theorized. The latter, we argue, is more suitable for assessing city brand equity holistically, given the systemic, complex, and dynamic nature of a city brand (Lucarelli, 2012, Lucarelli and Berg, 2011). The concept of a dyad encompasses aspects of both city's brand personality and image.

Figure 1 synthesizes the theoretical positioning of our study. Note that for better presentational clarity, city brand personality and image are separated. However, the dialogic relationship between the two is represented by the double-sided arrow.

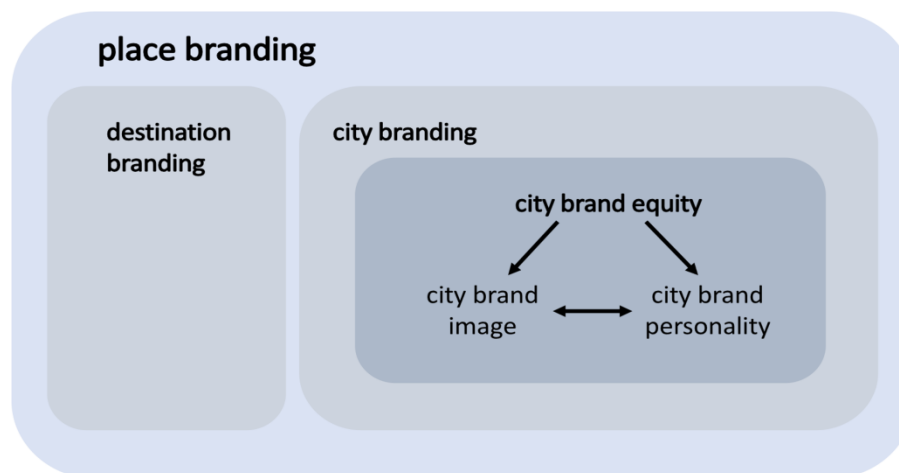
Regardless of the added value of considering articles dealing solely with destination and place branding, we have mainly focused on city branding for two reasons. Firstly, as the reviewed literature suggests, destination branding is too narrowly centered on mere aspects of tourism (Kaplan *et al.*, 2010), contrary to our goal of assessing the city brand holistically. Indeed, even authors explicitly studying city brand equity frequently conflate the two (De Carlo *et al.*, 2009; Górska-Warsewicz, 2020; Kim and Lee, 2015; Sahin and Baloglu, 2011). Secondly, place branding is a broader concept, of which city branding is only a small part. While assessing the literature on place branding could have been potentially helpful (Wäckerlin *et al.*, 2020), the systematic aspects of the review would be precluded due to the broadness of the topic. After all, the goal of the review section of the paper was not a complete assessment of all the literature on the topic but a theoretical

saturation of themes and concepts through systematic means to provide a solid argument for the ontological, epistemological, and methodological issues of considering city brand personality and image separately. This was achieved by openly coding the retrieved papers and then analyzing and refining the qualitative codes.

Two perceived city brand personality/image dyad dimensions are derived in the empirical section. These are transience/permanence and touristic/domestic appeal. While not being the first of its kind (Glinska and Rudolf, 2019; Kaplan *et al.*, 2010; Lee and Suh, 2011; Murao, 2014; Sahin and Baloglu, 2011; Tugulea, 2017), the proposed city brand classification is unique, as it is based on one of the largest samples of cities up-to-date (96) used for the extraction of city brand dimensionality of any type (including city brand personality and image). Moreover, cities are considered holistically (Macionis and Parrillo, 2001), and both material attributes of the city image and immaterial personality-like descriptors are analyzed.

The results originate from the principal component analysis (PCA) of city-related communities on Reddit. The traits are derived based on the frequencies of city-related words in the titles of user-created threads within selected city-related subreddits. Moreover, the sample of cities is based on the 2021 Resonance Consultancy ranking of Best Cities with over one million inhabitants (*World's Best Cities*, 2021). The sampling is purposeful. However, given the intrinsic difficulty of treating cities as units of analysis, generalizability is partially sacrificed to the feasibility.

Fig. 1: Conceptual positioning of some city brand equity constructs



Source: our elaboration

Based on the resulting dimensions of the dyad, the existence of four ideal types of successful city brands is theorized. Additionally, agglomerative hierarchical clustering reveals that three such types currently exist: transient domestic cities, permanent domestic cities, and high permanency touristic cities. According to the cluster analysis of cities in the sample, the fourth ideal type, a transient touristic city, is mainly theoretical. As such, it represents an interesting opportunity for city managers, communicators, and marketers in terms of more effective evidence-based city branding.

Finally, we outline a possible methodology for measuring the projected city brand personality/image dyad and then discuss the importance of aligning the dyad's projected and perceived facets. We also suggest a possible way of evaluating the discrepancy between the two.

2. City brand personality/image dyad: exploring the necessity for the novel concept

2.1 City brand personality and image: a systematic literature review

We started with the evaluation of the historical development of the city brand personality concept. Therefore, we decided to perform a more rigorous literature search to assess most of the

available scholarly contributions on the topic. A core methodological toolset of the systematic literature review was used, given the relative specificity of the topic (Snyder, 2019; Xiao and Watson, 2019). Indeed, as the subject of a systematic review needs to be specific and circumscribed (Snyder, 2019), we opted to exclude place brand equity-related keywords, restricting search criteria to the explicit mentions of city-brand equity (more specifically, city brand image and personality). The tradeoff, of course, is between completeness and feasibility. We opted for the former, as theoretical saturation of themes and topics was set as one of the main goals of the review part of the paper.

The review protocol was created before the literature search, in line with the suggestion of Xiao and Watson (2019). The proper protocol was essential for a thorough and systematic literature evaluation as it diminished the risk of research bias in data selection and analysis and improved the review's reliability (Xiao and Watson, 2019). The protocol for the review comprised research questions, criteria for article selection and inclusion, and other critical review elements. The authors discussed all the points in detail and unanimously agreed on the final version of the protocol.

Only electronic databases were accessed to conduct literature searches. The protocol did not include any backward or forward searches. Therefore, only keyword-based search queries were used to appraise the literature. Scopus and Web of Science were used to conduct the searches. The decision is based on the recommendations of Gusenbauer and Haddaway (2020). According to the authors, both Scopus and Web of Science are multidisciplinary search systems categorized as primary for the scope of a proper systematic review.

The Preferred Reporting Items for Systematic Review (PRISMA 2020) checklist was adopted for the stages of identification, screening, and inclusion of papers in the review (Page *et al.*, 2021). PRISMA represents the widely accepted methodological standard for performing systematic literature reviews and meta-analyses in medicine and related fields (Moher *et al.*, 2009). Given the potential value of systematic literature reviews in business and management studies (Snyder, 2019), we found it useful to follow the PRISMA checklist closely, specifically for the selection process.

Assessing state of the art on city brand personality was the initial goal of the systematic literature review. However, the subsequent coding of the results (at first open, then axial) revealed a high degree of relatedness between city brand personality and image, contrary to the more conventional brands for which the two could be more neatly separated. Accordingly, the search results for city brand personality formed the basis for the systematic literature review and were subsequently complemented by a less nuanced, albeit rigorous, search for city brand image-related research articles.

At first, the following query was used on Scopus:

(TITLE ((personality) OR (traits) OR (personality AND traits) OR (big AND five)) AND TITLE ((city) OR (cities))) AND (LIMIT-TO (SRCTYPE, "j"))

We performed the search looking for keywords only in the papers' titles. This filtering allowed us to limit the findings to papers directly related to the city brand personality concept. We put no limit on the publication year; however, to screen out less reliable results, we limited the publication type to "journal article." The query yielded 104 results. The screening of titles and abstracts narrowed the results to 11.

The query on the Web of Science was performed using identical criteria while keeping in mind the syntactic differences between the two search engines:

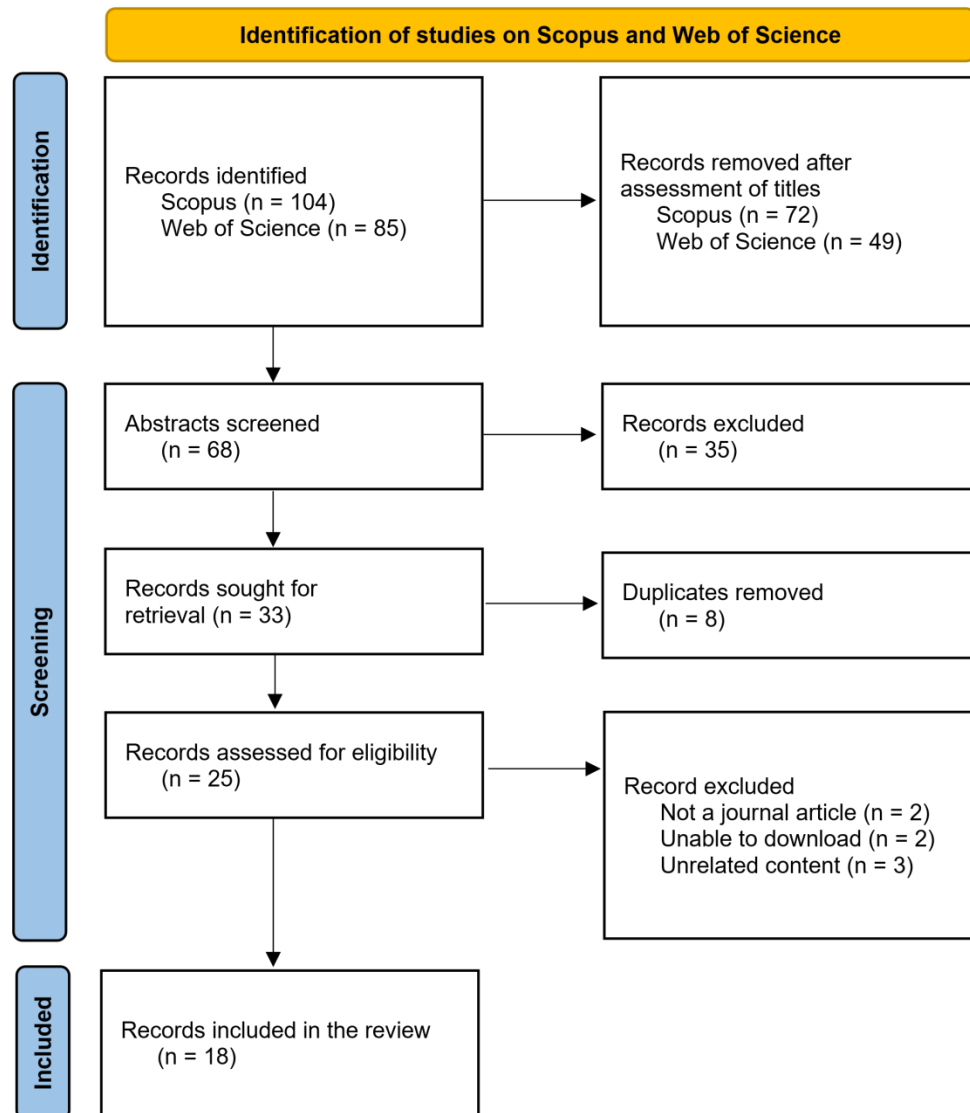
((TI=((personality) OR (traits) OR (personality AND traits) OR (big AND five))) AND TI=((city) OR (cities))) AND (DT= ("ARTICLE"))

The query resulted in 85 results, subsequently narrowed to 10.

After combing the articles from the two sources and removing the duplicates, 18 articles were included in the final review. Such a drastic reduction in both queries resulted from putting no restrictions on a particular research area or discipline. Accordingly, a large amount of unrelated scholarly literature has filtered through. Indeed, we decided not to adopt stringent constraints in the first place to ensure that all related results could be potentially included (Snyder, 2019; Xiao and Watson, 2019).

Figure 2 shows the PRISMA-based flow diagram of information flow through different phases of articles' selection.

Fig. 2: Stages of papers' selection



Source: our elaboration, based on PRISMA 2020 flow diagram template (Page *et al.*, 2021)

Four researchers were involved in the initial screening of articles-consequently, decisions about the inclusion and exclusion of articles were agreed upon and less biased by personal subjectivity and reflexivity.

Typical grounded theory methods were used to analyze the included scholarly records (Bryman, 2016). In particular, articles were first open-coded. Then, axial coding was used to refine emerging themes, categories, and issues. Theoretical saturation was also achieved; therefore, collecting and analyzing additional research articles, in particular within the broader realm of place brand equity, was no longer necessary.

Table 1 reports the included articles in chronological order, alongside the journals where they were published and their relative importance as quantified by the number of citations as of the end of 2021 when the searches were initially performed. For each article, we also offer a brief thematic synthesis of the main themes and issues discussed therein.

Tab. 1: City brand personality. A thematic synthesis of included journal articles

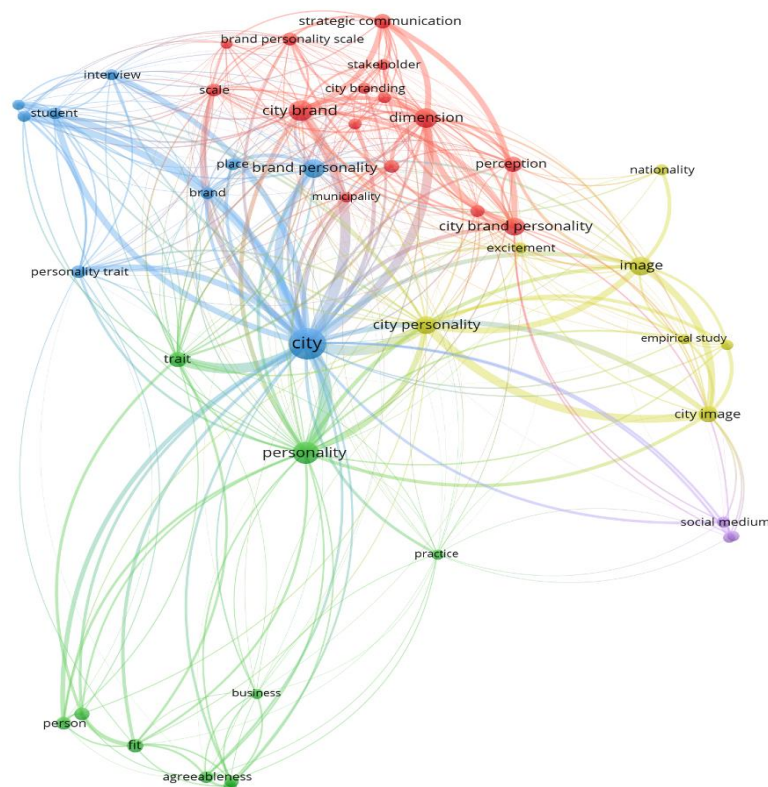
Paper (by year)	Journal	Citations	Summary
De Carlo <i>et al.</i> , 2009	Journal of Place Management and Development	119	First implicit mention of city brand personality concept in marketing. Emphasis on tourism. The author, however, does not differentiate between destination brand personality and city brand personality. However, the concept is de facto applied for the qualitative assessment of Milan.
Kaplan <i>et al.</i> , 2010	European Journal of Marketing	356	Most cited in the research field of city brand personality. For the first time, the concept is explicitly recognized as different from the destination brand personality. Elaborating on the more general brand personality notion of Aaker (1997), city brand personality is defined as a set of human characteristics associated with the city brand. Factor analysis is applied to the results of a survey of university students in order to distill six personality traits of three Turkish cities (Izmir, Ankara, and Istanbul). The personality traits are excitement, malignancy, peacefulness, competence, conservatism, and ruggedness. Overall, the procedure is isomorphic to Aaker's study of conventional brand personality traits (Aaker, 1997). The resultant traits, indeed, mirror that of Aaker closely.
Sahin and Baloglu, 2011	Anatolia	192	Second most cited study up to date. Unlike Kaplan <i>et al.</i> (2010), authors fail to differentiate between city brand personality and destination brand personality. Only the city of Istanbul is studied. Moreover, the results put more emphasis on the structural characteristics of a city, more similar to the concept of city image.
Lee and Suh, 2011	International Journal of Tourism Sciences	46	Aaker's original Brand Personality Scale (BPS) scale is adopted and modified (Aaker, 1997). Personalities of 18 Korean cities are evaluated as perceived by tourists. Five identified dimensions are sincerity, excitement, technology, high class, and femininity.
Ahmad <i>et al.</i> , 2013	Canadian Social Science	44	The city brand personality of Bandar Melaka (a UNESCO heritage site) is evaluated. BPS is again used as a starting point. Four resulting city personality traits are peacefulness, malignancy, sophistication, and uniqueness.
Huang <i>et al.</i> , 2013	Journal of Travel & Tourism Marketing	30	Structural characteristics closer to the notion of city image are again considered. The study focuses on the regional context of Buffalo, NY. Five dimensions are culture, food, nature, shopping, and sports.
Larsen, 2014	Journal of Destination Marketing & Management	49	First of its kind netnographic qualitative evaluation of city brand personality. Shanghai online communities are studied. No fixed classification of traits is proposed.
Glińska and Kilon, 2014	Procedia - Social and Behavioral Sciences	43	Authors study city brand personality dimensions of Polish cities as desirable by local city governments. BPS is again adopted and modified. Three specific dimensions are identified: peace, neatness, and conservatism. However, the authors acknowledge that the brand personality of a city may have more dimensions than the personality of conventional brands.
Murao, 2014	Procedia Technology	2	City personality is inferred from the aggregation of personality traits of inhabitants of five cities. OCEAN model of personality traits is used. The personality of individuals is inferred from their Twitter posts.
Kim and Lee, 2015	International Journal of Tourism Cities	65	The tourism marketing perspective is adopted. BPS scale is again used and slightly modified. Identified dimensions are excitement, sincerity, and sophistication.
Bleidorn <i>et al.</i> , 2016	Psychological Science	86	OCEAN model is again generalized to a city level, although through a more traditional, survey-based methodology.
Amatyakul and Polyorat, 2017	International Journal of Business and Economic Affairs	9	Qualitative study. The authors emphasize the need for an in-depth qualitative assessment of city personality as opposed to quantitative dimensionality studies. 281 possible personality traits of Thai cities are identified. The authors also emphasize the co-existence of both positive and negative city personality traits.
Tugulea, 2017	Sustainability	12	BPS scale is again modified. Three city brand personality dimensions are peacefulness/sincerity, malignancy, and competence.
Zhou <i>et al.</i> , 2017	International Journal of Psychology	25	42 Chinese cities are studied. In a similar fashion to Murao (2014) and Bleidorn <i>et al.</i> (2016), the big five personality traits (OCEAN model) are extended to a city level through aggregation. The goal is to investigate person-city personality fit.
Vinyals-Mirabent and Mohammadi, 2018	Communication & Society	12	Contrary to most previous studies, which primarily focus on perceived personality, the projected city brand personality of Barcelona is studied by analyzing the lexical content of two official city websites.
Glińska and Rudolf, 2019	Sustainability	9	The projected personalities of 34 Polish and Ukrainian cities are studied by analyzing the related information on the official municipal Facebook accounts. Like in the case of Vinyals-Mirabent & Mohammadi (2018), the study is unique in shifting focus from perceived to projected facets of city brand personality.
Ferreira and Dionísio, 2019	Sustainability	9	By factor analyzing 35 variables in the Pordata dataset, the authors identify five characteristics of Portugal cities: longevity, fecundity, economy, overall conditions, and overpopulation. While not explicitly dealing with city personality as defined by Kaplan <i>et al.</i> (2010), the study is interesting. Indeed, it prioritizes structural characteristics closer to the notion of city brand image.
Priporas <i>et al.</i> , 2019	Journal of Business Research	29	Both the brand image and personality of Thessaloniki are studied, as perceived by its young citizens. Five original dimensions of BPS are maintained for the city brand personality. On the other hand, the four structural dimensions composing Thessaloniki's brand image are municipal services, leisure, environment, and prosperity.

Source: our elaboration

To better grasp the breadth of the topic, a term co-occurrence map was constructed based on the text data in abstracts and titles of 18 retrieved papers (Figure 3). VOSviewer (version 1.6.18) was used to build and visualize the respective network. Full counting was chosen as a counting method. The threshold was set to a minimum number of occurrences equal to three. Of 624 terms, 78 meet the threshold criterion. Out of those, 34 were excluded as non-pertinent to the topic but to a more general research methodology (e.g., *effect*, *relationship*, *item*, *relative importance*). Forty-four terms entered the analysis, and association strength was chosen as the normalization method.

The most interesting aspect of the network is the presence therein of the terms *image* and *city image*, both directly connected to the term *city personality*. Therefore, the topography of the network further confirmed the results of the qualitative analysis of the included papers regarding the interconnectedness of the two city branding concepts irrespective of their theoretical separation by many scholars (Ferreira and Dionísio, 2019; Priporas *et al.*, 2019). Accordingly, we decided to perform a complementing, albeit less nuanced, systematic search of scholarly records explicitly dealing with city brand image. A simple “in-title” search on the Web of Science and Scopus combining *city*, *brand*, and *personality* keywords (*city (Title) AND image (Title) AND brand (Title)* for Web of Science, and *(TITLE (city) AND TITLE (image) AND TITLE (brand))* for Scopus) has produced only twenty-two and thirty-five documents respectively, compared to almost four times the numbers resulting from similar, albeit more nuanced, queries related for city brand personality.

Fig. 3: Term co-occurrence map in abstract and titles of city brand personality-related papers



Source: our elaboration in VOSviewer (version 1.6.18)

Due to the emphasis on the structural material aspects of reality, the city brand image appears much easier to operationalize properly. It is, indeed, valid for the broader concept of brand image, which also seems more developed than brand personality. Surprisingly, when it comes to city branding, city brand personality has exerted a more significant influence in the respective research area as opposed to city brand image. Moreover, most of the identified articles overlapped with that of city brand personality; some were mainly irrelevant to the topic, and some were not proper

journal articles. After excluding all the “gray literature,” merging the results, and removing the duplicates, nine additional articles were identified dealing exclusively and explicitly with the city brand image concept. Table 2 reports the included articles in chronological order, alongside the journals where they were published, the number of citations, and a brief thematic synthesis of the main themes and issues discussed therein.

Tab. 2: City brand image. Exclusively related papers

Paper (by year)	Journal	Citations	Summary
Vanolo, 2008	Cities	445	The case study of a typical Italian industrial town (Turin). The author is the first to reflect on the efforts to promote image-related branding policies as the city transitions into a post-industrial economy. Surprisingly, regardless of the current number of citations, not a lot has been done to advance the study of city image after the article was released. The concept of city image has been either set aside or subsumed by some authors within the concept of city brand personality.
Vanolo, 2015	Cities	137	Published eight years later, the article constitutes a series of reflections on what has changed and evolved in the city of Turin in terms of urban branding practices since the previous article by the same author.
Wong and Liu, 2017	Urban Policy and Research	26	Authors reflect on city image building initiatives in China over the last 30 years. Specifically, the paper revisits the neo-Marxist notion of “right to the city.”
Ci and Choi, 2017	Quality & Quantity	11	The first quantitative study of city image (as an explicitly mentioned concept). Using network analysis, the authors show how citizens of Seoul share similar images of the city. Moreover, the authors find a significant discrepancy between city image as perceived by citizens and city identity. The latter concept is akin to the projected city image.
Manyiwa <i>et al.</i> , 2018	Journal of Place Management and Development	30	A survey-based study of 107 residents of Bratislava and 100 tourists. Partial least square structural equation modeling reveals the positive effect of improving perceived city brand image on tourists’ emotional attachment to the city.
Dastgerdi and Luca, 2019	Geographica Pannonica	24	In order to advance theoretical understanding of city image and identity branding, the authors analyze 35 articles (mainly on a broader place image branding). Results suggest that enhancing a city’s image requires holistic planned actions of stakeholders on various urban levels.
Ye and Jeon, 2020	Social Semiotics	3	A semiotic image scale of the Chinese city brand is developed. The emphasis of the paper is, however, on tourism.
Wäckerlin <i>et al.</i> , 2020	Place Branding and Public Diplomacy	10	The concept of city branding is discussed within the broader framework of place branding. Authors study how the place image and identity are related. Network analysis is used to compare image and identity networks of polycentric regions.
Jawahar <i>et al.</i> , 2020	International Journal of Tourism Cities	11	A survey-based study of the visitors of the most prominent contemporary art events in India. The authors explore the relationship between event image and the creation of the host city’s brand equity (in particular, city brand image).

Source: our elaboration

2.2 City brand personality/image dyad: a holistic way to conceptualize city brand equity

2.2.1 Methodological, epistemological and ontological positioning and the definition of research questions

Three broad classes of considerations emerge from the literature review: epistemological, ontological, and methodological.

Epistemological considerations are two.

First, city brand personality and image can be studied as perceived by those to whom the two are communicated and from the perspective of those who project them. The latter, including personality/image aspects projected through municipal websites, and official social media channels, have been investigated rather infrequently (Glinska and Rudolf, 2019; Vinyals-Mirabent and Mohammadi, 2018). A projected city brand personality/image can be defined as a set of “strategies carried out by local government authorities or other institutions using various methods of promotion” (Glinska and Rudolf, 2019, p. 6) to communicate desired aspects of urban reality to city inhabitants, investors, and visitors (Govers *et al.*, 2007). Conversely, perceived city brand personality/image concerns “the perception of the brand’s personality of a given [urban] place by a specific target group (for example, tourists or residents)” (Glinska and Rudolf, 2019, p. 6).

Second, there exists a clear distinction between studies emphasizing cities as tourist destinations and cities as places where one lives and works. The former studies are still the majority (De Carlo *et al.*, 2009; Huang *et al.*, 2013; Kim and Lee, 2015; Lee and Suh, 2011; Sahin and Baloglu, 2011;

Vinyals-Mirabent and Mohammadi, 2018) and are closely related to the concept of destination brand personality and image. However, more researchers have started envisioning the city brand personality and image concepts holistically (Ferreira and Dionísio, 2019; Kaplan *et al.*, 2010; Murao, 2014), considering the viewpoints of different types of urban stakeholders.

The above epistemic concerns lead to the two research questions:

RQ1. What is the relationship between projected and perceived city brand personality/image dyad, and how can the two be successfully measured and compared?

RQ2. What traits of a city brand personality/image dyad can be distinguished as perceived by both tourists and inhabitants of a city?

From the ontological perspective, there exists no clear demarcation between city brand image and city brand personality (Azoulay and Kapferer, 2003). While, in most cases, city brand personality is understood as the totality of human characteristics that people attribute to a city (Kaplan *et al.*, 2010; Kim and Lee, 2015; Lee and Suh, 2011), a handful of researchers envision city brand personality in more structural-thus grounded in proximal reality-terms, more akin to the concept of brand image (Ferreira and Dionísio, 2019; Huang *et al.*, 2013; Sahin and Baloglu, 2011).

As Table 2 shows, city brand image lags behind city brand personality-excluding Vanolo's (2008) paper-in terms of the chronological emergence of the concept, overall number of citations, and the number of published contributions. Moreover, it suffers from the same ills as city brand personality. Precisely, the lack of methodological coherency, overdependence on more general brand image scales, the lack of holistic perspective, small sample sizes, the emphasis on the perceived brand image as opposed to projected (sometimes conceptualized as city identity), and a strong accent on the tourist perspective more akin to the area of destination branding.

Accordingly, a third research question can be formulated as follows:

RQ3. What traits of city brand personality/image dyad can be derived by analyzing the broadest range of urban-related observations (associated with both city brand image and personality)?

Methodological concerns are inextricably linked to ontological and epistemological issues. More emic, qualitative studies are required for an in-depth understanding of individual cities (Bryman, 2016). The latter, however, has rarely been done (Amatyakul and Polyorat, 2017; Huang *et al.*, 2013). On the quantitative side, so far, one of the broadest samples of cities investigated in a single study on city brand personality includes forty-two units of analysis (Zhou *et al.*, 2017). Moving from a single case or multiple cases to larger samples can undoubtedly contribute to the generalizability of the results (Singleton and Straits, 2010). Nonetheless, an essential amount of details may be lost in the process; thus, favoring generalizability to a deep understanding can also be detrimental (Guba and Lincoln, 1994).

Furthermore, whenever quantitative methods are used, the authors of previous studies mainly rely on convenience sampling. It is well understood that it is difficult, if not impossible, in most cases, to randomize the selection of cities. Given such a complex unit of analysis, the list of applicable methodological approaches is also limited. However, when data sources allow for flexibility, other types of sampling should be encouraged. For example, purposeful sampling can shed additional light on the phenomenon of interest. Hence, the final research question is the following:

RQ4. In what way a purposeful sampling of cities can increase the methodological robustness of quantitative city brand equity-related studies?

2.2.2 Defining city brand personality/image dyad

Given the intrinsic difficulties in separating the two concepts, their interrelatedness within the urban contexts (Formisao *et al.*, 2021), and the lack of methodological soundness in evaluating only specific city aspects without considering the holistic picture of the emerging city system (Macionis

and Parrillo, 2001), both city brand personality and image constructs appear to be insufficient in capturing the complexity of urban brand equity. After all, a city is promptly operationalizable considering all major lexical categories: nouns, adjectives, and verbs, both as the result of processual structuration and as a process.

Indeed, in the former case, a city can be viewed as a structured reality reified mostly in nouns (Berends and Deken, 2021). This makes it simpler to devise an empirical investigation of urban reality that is promptly interpretable in terms of city brand image (Berends and Deken, 2021). However, in emphasizing structural “image” characteristics—such as administration, transportation, nature, economy, and architecture—there is a high risk of omitting essential dynamics related to more immaterial “personality” aspects.

Viewing city brand equity in terms of adjectives and verbs (more akin to a concept of city personality) calls for in-depth qualitative investigations, performed—so far—only by a minority of researchers (Amatyakul and Polyorat, 2017). Alternatively, many scholars readily adapt existing brand personality scales without considering the idiosyncratic characteristics of a city brand (Ahmad *et al.*, 2013; Kim and Lee, 2015; Lee and Suh, 2011), particularly the over-used Aaker’s (1997) scale (BPS) in a one-size-fits-them-all approach. Finally, some academics extend the big-five traits model (OCEAN) to a city, inferring city personality from the aggregation of the personalities of its inhabitants (Bleidorn *et al.*, 2016; Zhou *et al.*, 2017). In this case, a city personality is reduced to a mere summation of the personalities of human agents.

Overall, on a closer look, the “personality” aspects of a city seem difficult, if not impossible, to separate from its structural “image” characteristics. Accordingly, the holistic approach calls for the broadest possible evaluation of a city’s brand equity, considering image and personality equally relevant and integrated into the dyadic relationship. On the one hand, the personality facet covers immaterial, systemic, and dynamic aspects of a city more prone to being identified by verbs and adjectives. On the other hand, the image facet integrates personality, covering structural static aspects/traits.

Given all the above considerations, we argue that both city brand personality and city brand image are insufficient concepts, incapable of capturing the holistic dynamics of urban structuration. Alternatively, we suggest that future studies of city brand equity should adopt a more integrated vision of the two. More so, authors should strive to treat city brand personality and image as a dual, inseparable concept. We termed the latter the “city brand personality/image dyad.”

In the following section, we further develop the concept as well as showcase one possible way to study its perceived dimensions holistically. In doing so, we also address all the outlined epistemic, ontological, and methodological shortcomings of the previous studies as addressed by the four research questions.

In accordance with the RQ4, and contrary to most existing studies in the field, the sampling procedure is not based on mere convenience. Indeed, we explicitly strive to explore the perceived city brand personality/image dyad of the largest world cities classified as “successful.” Our sampling size is also one of the biggest up to date (96 cities). Moreover, we answer RQ3 and RQ2 by analyzing the broadest range of lexical categories (nouns, verbs, and adjectives) without discriminating between types of urban stakeholders (i.e., tourists and inhabitants).

RQ1 is answered in the later section, in which we propose one possible way to study the projected aspects of the dyad while also highlighting the importance of minimizing the discrepancy between its projected and perceived facets and suggesting one possible framework for the measurement of the discrepancy.

3. Investigating perceived city brand personality/image dyad of big successful cities

3.1 Research design, operationalization, data gathering, and data preparation

To uncover the dimensions of the perceived city brand personality/image dyad of big successful cities, we assumed the broadest ontological and epistemological positions (accordingly to RQ3).

That is, in addition to the more elusive descriptive categories more relevant to human personality, we considered the structural characteristics of a city, such as its buildings, transportation, natural and artificial attractions, services, and infrastructure. Furthermore, the perceived city brand personality/image dyad of big successful cities has been investigated from the point of view of both tourists and inhabitants to capture the greater complexity and dynamism of a city brand (Sansone, 2012; Sansone and Bruni, 2012) in accordance with the RQ2.

To investigate the broadest number of cities-as units of analysis-we decided to gather data directly from social media instead of using a more traditional administration of existing scales through surveys. Indeed, as emerged from the systematic review, internet-based approaches to studying city brand equity are becoming increasingly common (Glinska and Rudolf, 2019; Huang *et al.*, 2013; Larsen, 2014; Vinyals-Mirabent and Mohammadi, 2018). The unintrusive study of online communities can also reveal social dynamics that are naturally occurring within a digital landscape. Thus, the potential sources of biases and systematic errors traditionally associated with survey-based data gathering are absent, and ecological validity is high (Groves, 2004). Additionally, the entirety of the written content of the online community can be downloaded and analyzed (Baumgartner *et al.*, 2020).

A set of Reddit's city-related subreddits was chosen for the analysis. These subreddits (usually named after the city, e.g., *r/london*, *r/paris*) are rich with discussions on city-related topics of different kinds. Moreover, a simple empirical investigation of any significant city-related subreddit reveals the heterogeneous nature of its participants, ranging from tourists to longer-time visitors (e.g., visiting students and permanent inhabitants) and city inhabitants. Discussions are also mostly city-centered and on-point. Unlike many other online communities, each city-related subreddit represents an enclosed, dedicated digital environment that, to some extent, mimics and replicates the space-time dialectics of actual cities. Furthermore, Reddit is quite often used by academics for heterogeneous research purposes (Del Valle *et al.*, 2020; Medvedev *et al.*, 2019; Ovadia, 2015); therefore, it represents a well-investigated reliable source of textual information

In accordance with the RQ3, we based the sample of cities on a 2021 Resonance Consultancy ranking of Best Cities with a metropolitan area of over one million inhabitants (*World's Best Cities*, 2021). According to the Resonance Consultancy website, "the ranking evaluates each qualifying city across the six pillars of place equity: Place, Product, Programming, People, Prosperity, and Promotion" (*World's Best Cities*, 2021). The ranking methodology used by Resonance Consultancy appears to be solid and multifaceted. Indeed, the annual rankings of the company are among the most authoritative when it comes to the evaluation of the broader appeal of larger urban centers. Moreover, given the difficulty of truly randomizing the selection of city-related subreddits (not all famous cities have a dedicated subreddit, especially outside the US), the Resonance Consultancy ranking constituted an excellent starting point, as it provided the project with a provisional list of one hundred cities that can be operationalized as "successful" and "big" for which dedicated subreddits do exist and thrive.

Initially, all 100 city-related subreddits were assessed, corresponding to the related cities from the Resonance Consultancy ranking. After verifying that the content of related city-related subreddits is indeed centered on city-related topics, we mined their content using the *RedditExtractoR* package (Rivera, 2021) in RStudio (version 1.4.1717). For the intent of the analysis, only thread titles were gathered, excluding individual comments. It allowed us to screen out all the contents unrelated to specific cities, which was frequently the case in users' answers. On the other hand, thread titles were always city-related and relatively specific.

The extracted content was then exported and analyzed in MAXQDA (release 20.4.1). To avoid discriminating across lexical categories, no predetermined dictionary was used as the basis for the words' exclusion. Instead, we considered the frequency of all words in the thread titles. The lemmatization was applied to control for different spelling and inflected forms. For the final analysis, all city-related words were retrieved from the frequency table all the way to the frequency of 200 (chosen beforehand as "the point of arrest").

All the nouns, verbs, and adjectives presumably related to the concept of city brand personality and image were jointly selected by the researchers to increase the inter-rater reliability of the final list. No stringent criteria were put on the selection process, allowing even remotely related words to be chosen (e.g., *sunset, beauty, drive, fire, and snow*). The procedure yielded 145 most frequent city-related words across all sampled cities. Due to the inactivity of their respective subreddits, four cities were excluded from the final sample (Bucharest, Doha, Minsk, and Muscat), bringing down the number of units of analysis to 96.

3.2 Analysis and findings

3.2.1 Towards the theoretical model of big successful city types

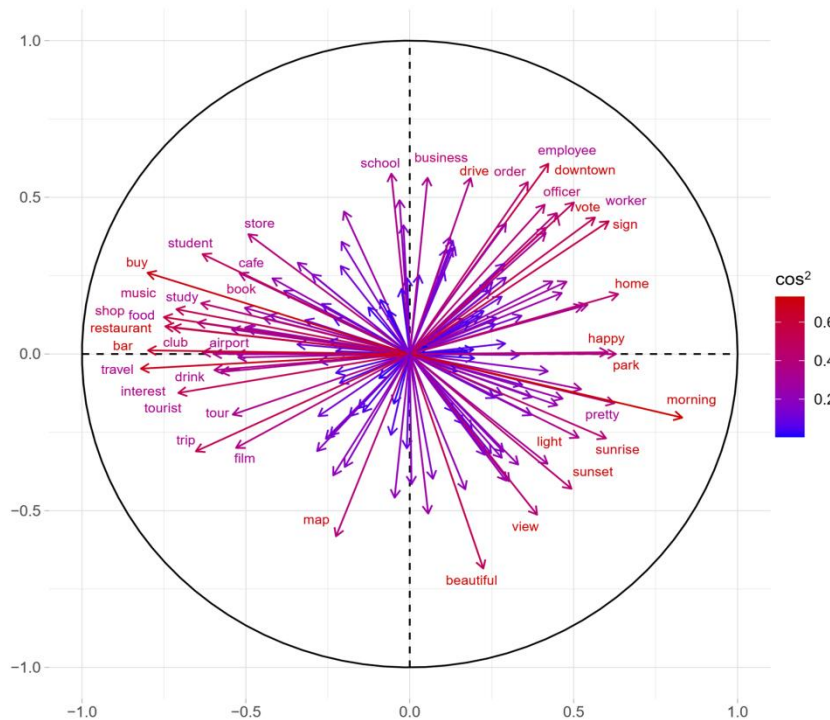
To derive a theoretical model of big successful city types according to their perceived city brand personality/image dyad, we first calculated the relative frequencies for each of the 145 city-related words according to the following expression:

$$rel. frequency_k^i = \frac{abs. frequency_k^i}{\sum_{j=1}^{145} abs. frequency_j^i}$$

where i denotes the unit of analysis (96 cities), k and j denote a generic city-related word (one of 145).

We then exported the data into R, scaled it to the unitary variance, and ran a principal component analysis. One hundred forty-five city-related terms entered the PCA as active variables. In total, 95 uncorrelated dimensions were extracted from 145 variables. The high ratio between the two (0.65) shows the relative uniqueness and idiosyncrasy of all cities in the sample-hence, all the active variables were relatively uncorrelated. However, the first two dimensions stood up, accounting for 23.42% of the total inertia (15.68% for the first dimension and 7.74% for the second). The contribution of the remaining dimensions to the total inertia was insignificant and, hence, uninterpretable. Accordingly, we focus here on the two most significant dimensions.

Fig. 4: PCA. Distribution of 145 active variables over the first two dimensions



Source: our elaboration in RStudio (version 1.4.1717). \cos^2 denotes the contribution of variables to the plane's construction. For presentational clarity, only variables with \cos^2 bigger than 0.3 are labeled

The analysis of shared commonalities between big and successful cities was performed by looking at the contributions of active variables to the definition of the two most significant dimensions, as shown in Figure 4. A careful analysis of the coordinates of the active variables within the correlation circle allowed us to identify two criteria according to which the world’s most successful cities are distributed on the PCA plane.

Horizontally, cities to the left of the vertical axis are most likely to denote not permanent, leisure-related, short-term, and transient features (e.g., *café, store, bar, book, drink, student, trip, buy, tourist, travel*). Conversely, cities to the right of the vertical axis emphasize more permanent, enduring, and intransient characteristics of a city (e.g., *home, morning, downtown, park, beautiful, worker*). Accordingly, horizontal axes can be understood in terms of transiency vs. permanency.

Vertically, cities above the horizontal axis highlight mundane (e.g., *school, drive, store, business, worker, officer, employee*) or leisure-oriented (e.g., *restaurant, music, buy, café, food*) everyday city-related activities and entities. Characteristics that are either structurally related to tourism (e.g., *tour, trip, map*) or directly experienced in pursuing tourist activity (e.g., *view, beautiful, pretty*) are located below the horizontal axis. As a result, the vertical axis might be thought of in terms of domestic vs. touristy appeal.

Two clarifications are, however, required. First, various scholars ascribe varying connotations to “transiency.” Typically, the connotations are negative: from excessive urban growth and the associated proliferation of commuters (Bissell, 2018; Rinella, 2019) to more substantial human movements such as migrations, displacements, and expulsions (Bork-Hüffer *et al.*, 2016). Our definition of transiency is an entirely unrelated concept, primarily referring to the city’s apparent dynamism-even elusiveness-as perceived by urbanites and visitors alike. Thus, a city with a bustling nightlife, an abundance of recreational activities, and a well-developed post-industrial economy, though with fewer significant landscapes-natural and manufactured, historically contextualized and modern-can be described as prototypically transient.

Second, while the “appeal” dimension appears to be more aligned with the concept of city brand image than with city brand personality, it is difficult to untangle the two in the case of a complex emergent reality such as a big metropolitan center (Macionis and Parrillo, 2001). Nevertheless, in defining the dimensions of a city brand personality/image dyad, such a distinction is not essential given the dualistic ontology of the two facets. For example, it is not merely the interaction of a person with a café, sunset, school, or business that constitutes the “appeal,” but a more profound, long-lasting perceptions and feelings that arise from such interactions-closely related to a city’s personality.

The two dimensions can be further understood by means of the two-by-two matrix. As shown in Table 3, four ideal types of big successful cities may be theorized based on the interaction patterns between the two dimensions of perceived brand personality/image dyad of sampled cities.

Tab. 3: Four ideal brand types of “big successful” cities

	Transience	Permanence
Domestic appeal	Resident-friendly metropolis bursting with leisure activities but lacking monumentality of certain European cities. A prototypical successful Asian city	A calm, resident-friendly city with a well-preserved historical center and highly developed efficient suburban network. A prototypical successful American city
Touristic appeal	For example, a postmodern tourist-oriented city. Likely, a greenfield development centered, among other activities, around spectacular leisure projects	A tourist-oriented city with a rich, complex, layered history. A prototypically European metropolis

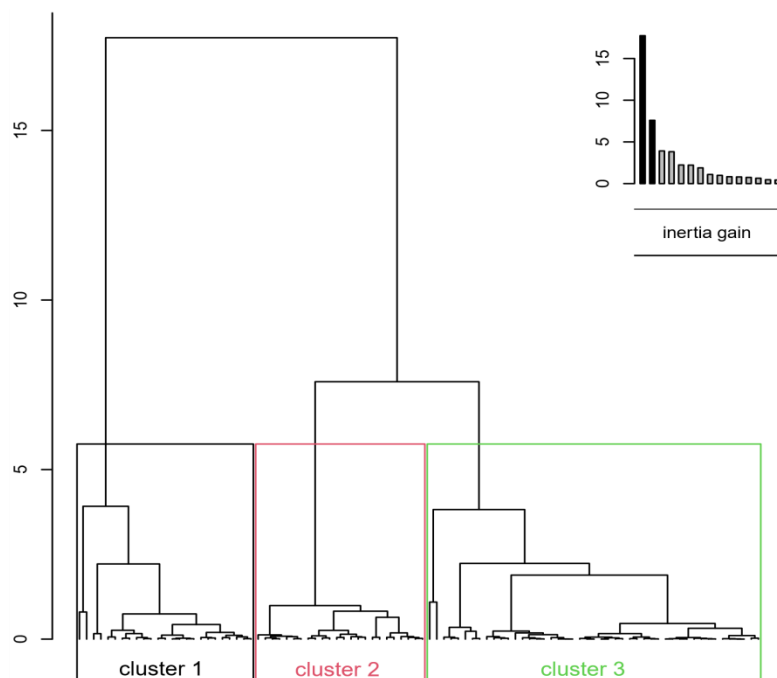
Source: our elaboration

3.2.2 Personality/image dyad of today's big successful cities: distribution and analysis

Agglomerative hierarchical clustering was performed to understand the actual distribution of sampled cities within the four theoretical categories. The five most significant PCA dimensions were kept for the analysis. The Euclidean distance was used to measure the similarity between pairs of individual cities. Ward's method was preferred to measure the closeness between the groups to ensure the partitioning with small within-class variability and high between-class variability.

Figure 5 shows the respective cluster dendrogram. The grouping of successful cities into three clusters was deemed acceptable, as inertia gains from four classes and onward are relatively small. Indeed, the dendrogram branches are shorter from the fourth and onward branches (see Figure 5). Moreover, the sum of within-cluster inertia was automatically calculated for each partition, and the suggested three-fold partition was recommended as optimal.

Fig.5: Cluster dendrogram of 96 sampled cities



Source: our elaboration in RStudio (version 1.4.1717)

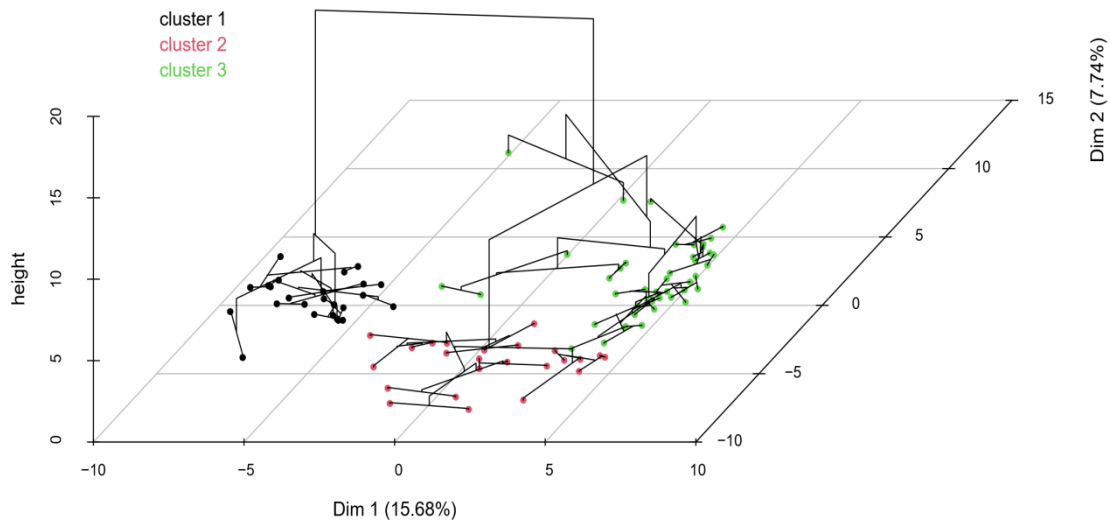
Figure 7 shows, for each cluster, fifteen lexical units that contributed the most to its creation (p-value less or equal to 0.05). Cluster 1 is characterized by the frequent mentioning of terms like *buy*, *bar*, *music*, *study*, *club*, *shop*, and *restaurant*. Thus, leaning towards the north-western part of the plain (see Figure 6), the cluster mainly denotes transient cities with a high domestic appeal. In terms of geographical patterning, the cluster comprises primarily Northern and Central European (Helsinki, Oslo, Hanover, Warsaw, Krakow) and Asian (Bangkok, Shanghai, Beijing, Osaka) cities.

Cluster 2 is mainly characterized by terms like *beautiful*, *view*, *amaze*, *map*, *sunset*, *tower*, *old*, *museum*, and *street*. Given its positioning on the PCA plain (south-east), the cluster can be interpreted as composed of cities with high permanency and substantial touristic appeal. Geographically, it comprises the most important Southern and Central European cities with rich history and architecture: e.g., Brussels, Barcelona, Madrid, Cologne, and London. San Francisco is one significant exception. Indeed, judging from its positioning within the cluster, it can be described as the most “European” among American cities. Montreal, also belonging to the cluster, is, similarly, the Canadian city perceived as the most “European.”

Cluster 3, primarily perceived through terms like *worker*, *sign*, *downtown*, *driver*, *employee*, *home*, and *drive*, denotes the prototypical permanent city with the high domestic appeal. In

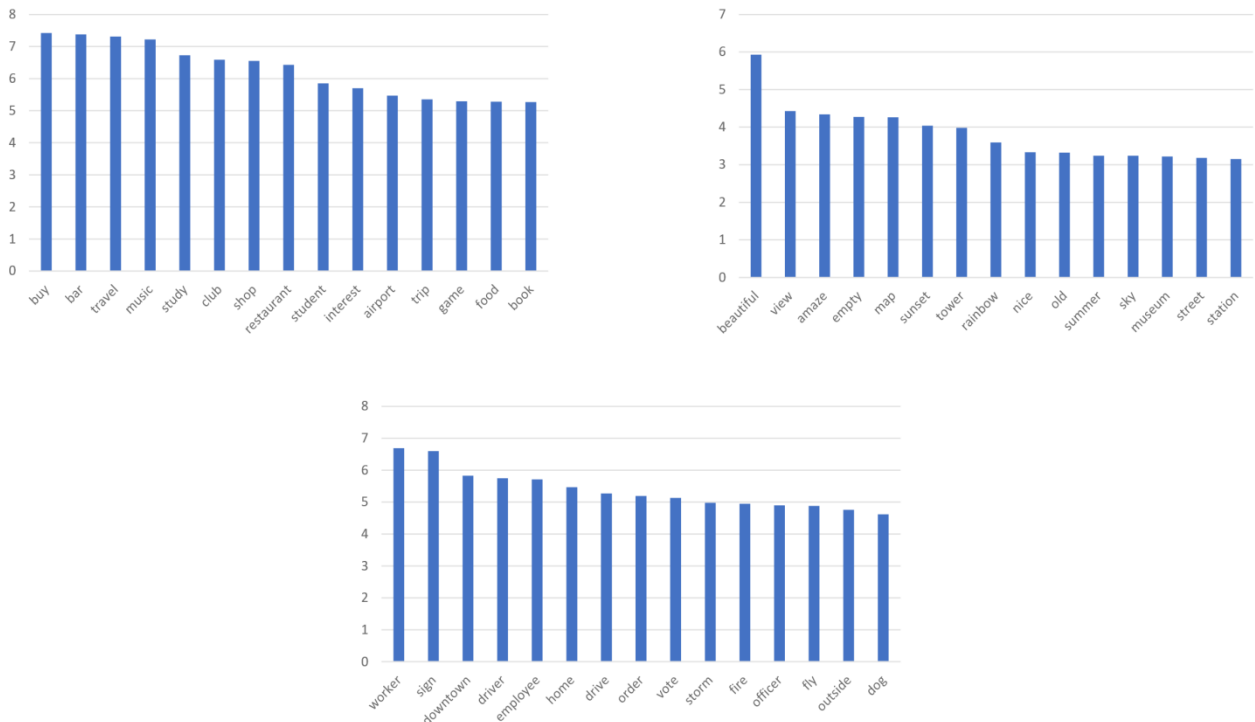
geographic terms, it is mainly composed of the US and Canadian cities, except for Kuwait, Dubai, and Singapore, all three forming a small subcluster on the fringe of Cluster 3.

Fig.6: Cluster dendrogram projected on the PCA city map



Source: our elaboration in RStudio (version 1.4.1717). Labels are omitted for higher presentational clarity

Fig.7: 15 Most significant (p-value less or equal to 0.05) variables in each cluster



Source: our elaboration. Top left - cluster 1; top right - cluster 2; down - cluster 3

The only successful city type that remains purely theoretical is a transient city with a high touristic appeal. Indeed, this fourth ideal city-type is not represented by any cluster, with some of its characteristics subsumed by Cluster 1 (e.g., *travel*, *trip*, *game*) and Cluster 2 (e.g., *map*). As a consequence, the fourth city-type largely remains an unexplored theoretical possibility. As an ideal type (in purely Weberian terms), it may be envisioned, for example, as a newly developed city project centered around spectacular leisure.

4. Measuring the discrepancy between perceived and projected city brand personality/image dyad: a proposal of a possible analytical framework

In this section, for the purpose of discursal completeness, we will briefly address RQ1 by outlining an essential connection between projected and perceived facets of the dyad, as well as the importance of the proper alignment between the two for a successful city brand creation and communication.

So far, only a few researchers have undertaken the measurement of either projected city brand personality or image (Glinska and Rudolf, 2019; Hanna and Rowley, 2019; Kim and Lehto, 2013; Vinyals-Mirabent and Mohammadi, 2018). It is not surprising, though, as such measurements present significant difficulties. After all, the perceived facets of city brand equity can be easily captured through surveys or automatized social media mining. The same is not valid for the projected city brand personality and image. Typically, only a handful of people are responsible for city communication efforts (e.g., through municipal social media sources). Moreover, different city municipalities and other city-related public institutions use a heterogeneous communication mix. Additionally, whenever the communication platforms are shared, different cities may use them differently and for various purposes. All this makes the automation of data gathering and analysis—unlike we did for the perceived city brand personality/image dyad measurement—a truly daunting task.

For the reasons outlined, the quantitative content analysis represents one of the few feasible techniques to effectively measure different facets of projected city brand equity. Indeed, in most cases, the few studies evaluating projected city brand personality and image have adopted quantitative content analysis as their primary data analysis strategy (Glinska and Rudolf, 2019; Govers and Go, 2004).

The most frequently used source for content analysis is written text. However, the content analysis may also be used to analyze all types of media content, including images, sounds, and videos (Bryman, 2016; Stemler, 2015). This flexibility, indeed, is ideal for projected city brand equity evaluation based on analyzing cities' official communication efforts on social media and municipalities' own websites.

Accordingly, one way to measure the projected city brand personality/image dyad is the following: for each city in the sample, an ample amount of textual and non-textual information should be gathered (including from official social media channels, official travel guides, and municipal websites). The homogeneity of analyzed websites is not important (and is, indeed, impossible). The available data should be coded deductively. According to Elo and Kyngäs (2008, p. 107), “deductive content analysis is used when the structure of the analysis is operationalized on the basis of previous knowledge.” In our case, four deductive code categories can be defined based on the four already established theoretical categories of big successful cities (Table 3). The relative frequency of codes should constitute the basis for devising the set of indicators to measure the projected city brand personality/image dyad dimensions, isomorphic to their perceived counterparts.

Within the broader context of brand equity, when it comes to value creation in consumers' minds, a misalignment between perceived and projected facets (e.g., image, personality, awareness, associations) is typically perceived as detrimental. In a sense, a significant discrepancy between projected and perceived facets of city brand equity may foster the depreciation of a city brand. Indeed, according to Kim and Lehto (2013, p. 118), “value for the destination can be created in the consumer's mind only when he or she understands and appreciates the communicated brand images.” Accordingly, “if the projected and perceived brand image gap is to be understood, it needs to be measured” (Kim and Lehto, 2013, p. 128). The same appears to be true for the perceived and projected city brand personality/image dyad (Glinska and Rudolf, 2019; Vinyals-Mirabent and Mohammadi, 2018).

There exist different ways to operationalize the value of a generic brand (Keller and Brexendorf, 2019). However, when it comes to cities, the Resonance Consultancy ranking of Best Cities, used as a basis for the sample in the present study, represents one such excellent operationalization. PCA

coordinates for the two most significant dimensions from the study of perceived facets of city brand equity can then be compared with the content analysis-based indicators of projected city brand personality/image dyad. For comparison, both scores can be rescaled to zero mean and standard deviation equal to one. In this way, each sampled city can be represented by the two points on the two-dimensional plane: one for its perceived and one for the projected city brand personality/image dyad measure. At this point, the level of misalignment between perceived and projected city brand personality dyad (Δ) for each city in the sample can be measured as the Euclidean distance between two points on the plane. Finally, a correlational analysis may be performed, measuring the relationship between the projected-perceived personality/image dyad discrepancy (Δ) of successful cities and their position within, for example, the aforementioned Resonance Consultancy Best Cities ranking. A significant negative correlation between the degree of discrepancy and the city's rank is hypothesized (in the sense that a higher discrepancy between projected and perceived dyad leads to a lower city score within the ranking).

5. Discussion and conclusions

The goal of the present article is threefold. First, by means of critically assessing the literature on the two most studied facets of city equity (city brand personality and image), we want to highlight their insufficiency in capturing the dynamic complexity of a typical urban system. Alternatively, we argue for a more holistic measure, termed the “city brand personality/image dyad.” Second, we propose a methodological framework compatible with the holistic view of city brand equity to measure the perceived dimensions of the dyad. To showcase the feasibility of assessing city brands in an all-inclusive and rounded manner, we measure the perceived city brand personality/image dyad of a sample of cities from the 2021 Resonance Consultancy ranking of Best Cities with more than one million inhabitants. Finally, we briefly discuss the challenges and difficulties in measuring the projected city brand personality/image dyad and the possible way of calculating the discrepancy between the projected and perceived facets of the dyad.

All 96 sampled cities turned out to be highly idiosyncratic (as was revealed by the significant PCA dimensionality) and geographically scattered throughout the globe. However, being primarily interested in their commonalities rather than differences, we were able to identify two shared dimensions of successful city brands: perceived transiency/permanency and perceived domestic/touristic appeal. This allowed us to hypothesize the existence of four types of big successful cities, three of which were then confirmed by the hierarchical agglomerative clustering. The fourth type of successful city brand is mostly hypothetical and, as such, represents an important opportunity for city managers, marketers, and communicators as a potential unexplored niche of city branding. Besides, the four ideal successful city brands may be used to orient official city communications on social media. On the other hand, the administrators of already thriving cities may use the proposed classification and methodologies to measure and realign their projected and perceived city brand personality/image dyads in order to increase the value of the respective city brands.

The resulting classification could also be useful for other researchers working in the area. Indeed, city brand personality and image are still either treated separately or conflated with other place brand equity typologies, especially destination branding. However, a city, as a complex emerging reality, must be studied holistically, considering the perceptions and considerations of all its stakeholders. In this sense, our classification is unique as, for the first time, it considers the perceptions of the variety of city users, not only tourists. Moreover, to the best of our knowledge, the sample of cities used for the analysis is one of the largest up-to-date within the field of study. High ecological validity is also expected, as the non-intrusive methods were used to collect conversation-related data across city-related online communities.

Finally, the study of the perceived city brand personality/image dyad is not immune to significant limitations. Regardless of the considerable sample size, the sampling was not random.

Therefore, caution is needed in generalizing the results beyond the cities included in the sample. The data for the analysis was mined from specific city-related subreddits. Certain response sets and biases within and across communities are not excluded. Consequently, age, gender, nationality, and other demographics of Redditors should also be considered in future studies. More varied text analysis techniques should also be applied. For example, topic modeling or sentiment analysis might help avoid the problems related to unclear valence. Indeed, it was not always possible to discriminate between positive and negative affective connotations of selected words and topics.

The nature of the proposed taxonomy is highly dualistic. For instance, it conceptualizes domestic and touristic appeal as opposites. The same goes for transiency and permanency. Therefore, it does not allow for the existence of big successful cities with simultaneously high touristic and domestic appeals or cities that are both highly permanent and transient. It is also important to highlight that, unlike certain facets of the classifications of Amatyakul & Polyorat (2017), Kaplan *et al.* (2010), and Tugulea (2017), none of the emerging dimensions should be interpreted negatively. Indeed, the empirical investigation of the perceived dimensions of the construct aimed to showcase the methodology of deriving perceived city brand personality/image dyad of big successful cities only.

Moreover, we firmly believe that a quantitative project alone is not enough to understand and describe all the nuances of successful city branding. Only in-depth ethnographically grounded single case studies of individual cities are appropriate for such a broad research scope. On the quantitative side, larger sample sizes and a more purposeful selection of cities as units of analysis should be accompanied by detailed analyses of interrelated aspects of both projected and perceived city brand image and personality.

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Virtual Try On technologies and consumer acceptance: comparing Generation X and Generation Z

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Abstract

Objectives. *This paper aims to examine the elements that influence consumer motivation of two generational cohorts towards Virtual Try On (VTO) technologies in the context of fashion and apparel retail. Building on the Technology Acceptance Model (TAM), our study proposes new dimensions and categories such as image quality perception and experience with social media as factors that contribute to the acceptance or non-acceptance of VTO technology of two generational cohorts.*

Methodology. *Using a qualitative approach, semi-structured focus groups were conducted for each generational cohort examined. After transcription, researchers performed open coding, axial coding and selective coding to develop a conceptual framework of categories and sub-categories. ATLAS.ti was used to assist the coding and analytical process.*

Findings. *Our study finds that experience with social media and image quality are considered as key antecedents influencing perceived usefulness, perceived ease of use and perceived enjoyment, and are the core categories where the most significant differences between generations are found. This study also highlights an increased concern for privacy from younger individuals in using a VTO tool.*

Research limits. *Results of this study could be more generalizable with a wider sample for each focus group. Additionally, a quantitative should be included to reinforce the findings.*

Practical implications. *This study shall be helpful not only for academics but also for managers and practitioners in the fashion and apparel retail industry by helping them shape timely and effective strategies to promote digitalization within their companies. Furthermore, highlighting the differences in consumer motivation and perception of VTO technologies, managers could leverage different core topics to address their audiences and thus making communication strategies more effective.*

Originality of the study. *This study, building on the Technology Acceptance Model, proposes an enriched and integrated framework that sheds light on the motivation of the consumer in technology adoption leveraging a generational perspective comparing Generation X and Generation Z. Furthermore, our research contributes to extant literature by adding new elements which may be included in the TAM to understand which factors led to a positive (or negative) attitude toward a specific VTO technology.*

Key words: *Virtual Try On; fashion retail; Technology acceptance model; Generation X; Generation Z*

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1. Introduction

In 2020, global Fashion and Apparel industry (F&A) showed a revenue of 1.46 trillion U.S. dollars (Statista, 2020) and is forecast to reach 2.25 trillion U.S. dollars by 2025. Within this industry, expenditure in artificial intelligence (AI) amounted to 474.5 million U.S. dollars in 2020 and is expected to grow at an annual compound growth rate (CAGR) of 36.9% from 2019 to 2027, to reach 4.4 billion U.S. dollars by 2027. This trend has been also boosted by the necessity to face Covid-19 pandemic and abide to sanitary measures adopted by the majority of governments (Sen *et al.*, 2020). In particular, social distance rules and apparel disinfection have led F&A retailers to rethink and digitalize the most basic shopping activities, such as trying on clothes. Enhancement of the consumer experience is increasingly important in retailing (Lemon and Verhoef, 2016).

Digitalization, through consumer-facing technologies (Boardman *et al.*, 2020), has provided key interactive technologies (Javornik *et al.*, 2016) for retailers to offer consumers new ways to integrate online interaction with the desired product and in-store shopping. These technologies are applied to devices that enable consumer to interact with the product while in store, or while browsing the website. Despite the growing interest in the combination of fashion and digital innovation, little attention has been paid to the acceptance that different generational cohorts have towards a specific technology: Virtual Try On (VTO). To deepen the field of research on the acceptance of new technologies, in particular VTO, by different generational cohorts, we aim to answer to the following research question:

Which elements influence consumers' acceptance of and motivation toward VTO device between GenX and GenZ in the context of fashion retail?

To answer our research question, a qualitative research approach was adopted (Acharya *et al.*, 2018). Two focus groups have been conducted with the aim to obtain data from a purposely selected group of consumers (Nyumba *et al.*, 2018) and, more specifically, to gather information on the perception of two different generations towards the use of VTO technology implemented by retailers. After focus groups were transcribed, leveraging Corbin and Strauss' analytic approach which involves open, axial, and selective coding through Atlas.ti (version 9), a conceptual framework of categories and relationships has been developed (Ting *et al.*, 2021).

Building on the Technology Acceptance Model (TAM) we propose a conceptual framework that includes salient categories emerging from the focus groups (i.e., social media experience, image quality) to highlight the elements that influence consumer motivation of two generational cohorts towards VTO technologies in the context of F&A retail. In fact, our main purpose is to examine whether two specific generations (i.e., Generation X and Generation Z) have a different approach towards technology adoption and which are the characteristics that shape their perception.

The research contributes to the advancement of the research in the field of digitalization in the retail sector by shedding light on the perception that different generations have over the characteristics of this technology, with particular reference to perceived ease of use, perceived enjoyment, and perceived usefulness. Furthermore, the study incorporates additional variables that allow for a better understanding of the phenomenon of VTO device acceptance by two different generations, which differ in terms of their expectations, needs and preferences.

The research paper is organized as follows. First, a theoretical background is presented, and extant literature analyzed to highlight the principal contributions in the field. Second, we presented the methodological approach in answering our research questions and in conducting the qualitative research. Finally, the paper concludes by discussing findings, implications, and future research directions.

2. Theoretical background. Virtual Try On technologies: a new driver for digitalization in the fashion retail industry

Digitalization has been, and still is, one of the most significant disruption of modern society (Hagberg *et al.*, 2016). Digitalization affects many elements of everyday life, and shopping is among them. In fact, in the fashion and apparel retail sector digital technologies, such as virtual fitting rooms, smart mirrors or interactive mirrors have transformed the way consumers interact with goods but also with retailers (Priporas *et al.*, 2017). Academics have long strived to find an explanation of the factors influencing individuals' acceptance of digital technologies (Cruz and Boughzala, 2014) providing the scientific community models and frameworks attempting to explain them (Qasem, 2021). The most leveraged model in academic literature has been developed by Fred Davis in 1989, the Technology Acceptance Model (TAM), to explain consumers' attitudes toward a technological device.

The model aims to explain why individuals choose to use (or not) technologies leveraging two dimensions: perceived usefulness (PU) and perceived ease of use (PEOU). PU is generally defined as "*the extent to which a person believes that using a system will help in enhancing his/her performance*" (Kamal *et al.*, 2020, p.3), whereas PEOU is "*the degree to which a person believes that using a system will be free of mental effort*" (Hansen *et al.*, 2018, p.4). This model has been widely used by academics in order to understand consumers' acceptance of digital technologies in the fashion retail (e.g., Kim and Huang, 2020), by including additional variables such as perceived convenience (PC), perceived time-saving (PTS) and curiosity (e.g., Wei *et al.*, 2020, Manis & Choi, 2019). The current studies on the importance of integrating digital technologies within the stores and e-commerce websites mainly focus on consumers' expectations, which is a very important indicator as it influences both their perception and satisfaction (Priporas *et al.*, 2017).

Digitalization has brought important advantages in the retail sector (Beck and Crié, 2018), providing consumers with a more private and less invasive shopping experience (Tamer, 2021). However, the lack of physical apprehension is of one the major disadvantages (Beck and Crié, 2018). To provide a more realistic experience, fashion retailers have implemented VTO systems in order to overcome the online environment's limitations (Qasem, 2021), to enhance and integrate consumers' online shopping experiences (Liang *et al.*, 2020) and to offer sensory input to fashion e-shopping (Qasem, 2021). Virtual Try On is a form of image interactivity technology (IIT) that simulates users' online shopping experience (Liu *et al.*, 2020). VTO refers to different types of virtual tools that enable consumers to try out accessories, clothes, or make-up directly on their reflected image, thus shoppers can see themselves virtually wearing various items (Sanchez-Ferrer *et al.*, 2019).

Early types of VTO have been developed in the context of jewelry, glasses, and make-up, and utilized avatar- or photo-based try-on (Plotkina and Saurel, 2019) while modern technologies offer users a completely immersive shopping experience (Cheng, 2017) by simulating consumers' physical figure with virtual models based on human measurements (e.g. Bulgari virtual shopping experience). For example, in the context of eyewear, consumers can look at themselves wearing the desired glasses by looking into the camera and the reproduction accompanies the movements of the head and gives a three-dimensional reflection of the effect one would have in person.

To explain the adoption of VTO technologies, previous studies have built on theories such as the Technology Acceptance Model (Zhang *et al.*, 2019) and the unified theory of acceptance and use of technology (e.g., Qasem, 2021). Beck and Crié (2018) revealed that the presence of a VTO on a website significantly increase the curiosity about the product, the online patronage intention, and the purchase intention, suggesting that consumers are more likely to buy a fashion product when there is a VTO on a website. Also, VTO experiences produce higher novelty, immersion, enjoyment and usefulness that positively enhance the online shopping experience (Qasem, 2021).

However, functions of VTO are related to uncertainty and cognitive dissonance (Beck and Crié, 2018). For example, Plotinka and Saurel (2019) show that VTO can sometimes create less enjoyable shopping experiences than traditional product presentation, possibly due to technological

limitations and poor augmentation quality. Although there are mixed feelings about the functional performance of VTO technologies (i.e., accuracy, attractiveness, and interactivity) and retailers are aware that the physical shop is still the first point of contact with the consumer, they are showing great enthusiasm about how it can become a game-changer that will transform the fashion retail landscape in the future (Lee and Xu, 2020).

3. Digitalization and user acceptance: a generational perspective

Extant literature has investigated how VTO applications affect online consumers' decision making from different perspectives (Zhang *et al.*, 2019), but still little has been said on in technology adoption from a generational perspective (Qasem, 2021). Consumer expectations in a smart retail environment differ as different generations tend to have different beliefs about new digital technologies (Calvo-Porrall and Pesqueira-Sanchez, 2019).

The Generational Cohort Theory (GCT) claims that populations can be divided into generation cohorts on the basis of years of birth (Ladhari *et al.*, 2019), and extant literature has proven that different generations have different attitudes, work behaviors and use of technology that significantly influence their purchase patterns and shopping behavior (Lissitsa and Kol, 2016). Particularly, previous studies have mainly focused on understanding preferences and expectations of the most tech-savvy consumers, mostly represented by Millennials and Gen Z. However, the last few years have seen a move of Generation X towards the digital world: Anderson (2017) highlighted that about 76% of Gen Xers spend most of their days using social media platforms or online shopping. The rise of Generation X as smart technologies users requires an in-depth analysis of how they react to new technologies implemented by retailers, as individuals spend the most online, about 15% more than Gen Y, and roughly 25% more than the average adult pays out for online purchases (Lissitsa and Kol, 2016).

However, Generation Z is the most prominent demographic on social media and can navigate the digital world with more technological skills compared to the oldest generations (Priporas *et al.*, 2017). GenZ comprises young adults born between 1995 and 2000. It is the first generation to be exposed to technology since its birth, and that partially explains why Gen Z developed different characteristics compared to the generations before them (Wood, 2013). Gen Z is characterized by a massive use of social media, dictated by a desire to temporally escape from reality (Wood, 2013) and an outstanding interest in new technologies (Kapusy and Logo, 2017). Being born into a digitally mature world, Gen Zers are heavy user of technology, they care more about the experience, and have higher expectations compared to other generations (Priporas *et al.*, 2017). Companies are forced to keep up with this new reality, since product tailoring and customization is fundamental to gain their loyalty (Dabija and Lung, 2019). In a smart retail environment, Gen Z is a technology-oriented group, since individuals are heavy online shoppers of customized applications. Those characteristics make the Z Gen a challenge since individuals behave differently from other generations (Priporas *et al.*, 2017).

Generation X's are people who were born between 1965 and 1980. It is one of the most highly educated generations in history and can be described as technologically savvy, skeptic and pragmatic (Burgiel and Sowa, 2017). The presence of Gen X in the virtual world will continue to grow as connectivity increases, and therefore we can expect an increase in on-line purchasing income (Lissitsa and Kol, 2016). As consumers, Gen Xers prefer to make purchases based on traditional search; however, they increasingly use new technologies to conduct research and online shopping (Braga, 2019). Although they come from different backgrounds, with different expectations and different skills (Priporas *et al.*, 2017), they are both active online and they are able to re-define production and consumption, since Gen X have more spending power than any other generation (Peralta, 2015), and Generation Z's extensively use of social media is influencing digital marketing, online communication and brand-consumer relations (Giarla, 2019).

4. Methodology

In order to explore which elements influence consumers' attitude towards a VTO technology, a qualitative research approach was used (Acharya *et al.*, 2018). Academics consider qualitative research to be an appropriate technique to understand attitude and behaviors as it provides a deeper understanding of the object of the study and allows the identification of a new phenomenon that had not previously been considered (Lorenzo-Romero *et al.*, 2021). In this context, two face-to-face focus groups were conducted in a semi-structure manner to ensure that questions led to natural and interactive conversations.

4.1. Data collection

Focus groups were conducted in July 2021. Each focus group comprised six participants, in accordance with Kreuger's (2001) ideal sample size recommendation, as it allows researchers to examine different experiences, perceptions, thoughts and feelings. The target group has been determined by the purpose of the study (Plummer-D'Amato, 2008). Following O'Nyumba *et al.* (2018), individuals participating to the same focus group shared the same characteristics. For both sessions, we selected the participants based on the following: generational cohort (Gen X or Gen Z) and buying habits (both online and offline), to ensure that each focus group was homogeneous. The number of males and females was the same for each focus group. All participants were students or workers from northern Italy.

Each focus group lasted approximately one hour and has taken place a location which is familiar to the respondents to make them feel comfortable. The content of the focus group has been audio-recorded and then transcribed by the authors. Before starting, an interview schedule has been drafted to outline times, topics and questions leveraging Kreuger's research design (e.g., opening questions, introductory questions, key questions and ending questions).

Focus groups consisted in three sections. First, participants were shown how the interview would take place. Their consent to the recording was sought and an attempt was made to establish a climate of mutual trust, so that they felt free to express their opinions throughout the interviews. Secondly, the purpose of the research was explained to participants, so they could have an overview of the topic. Finally, they were asked to use their smartphones and virtually try on some of the glasses on the Bulgari e-commerce site.

4.2. Data analysis

After focus groups were transcribed, researchers performed open coding, axial coding and selective coding in order to build a conceptual framework of categories and relationships (Ting *et al.*, 2021), leveraging TAM. The whole coding process was followed by qualitative data analysis using Atlas.ti (Paulus and Bennett, 2017). To begin the data analysis process, meaningful sentences were coded as concepts (Ting *et al.*, 2021). First open codes were created using an IN VIVO process, naming the codes with phrases or words from the highlighted text. Constant comparison of data with data and data with codes is key to this process (Maher *et al.*, 2018). At the end of this stage of analysis, a first delineation of relevant concepts with its frequency of use has been reached.

Axial coding is the process of grouping open codes into categories within which codes were brought together based on the presence of a common meaning, with a pithy code from that group reflective of the core content being selected as a group heading (Cascio *et al.*, 2019). During this phase, networks started to be built to study the relationships between codes and citations.

Finally, selective coding, the process of choosing one category to be the core category, and relating all the others to that category, has been performed. It enabled the researchers to select and integrate categories of organized data from axial coding in meaningful concepts, which have been integrated into TAM to make it suitable for the context.

5. Findings

The findings from our research highlight six core categories that have been incorporated into TAM with the aim of understanding which elements influence consumers' attitudes towards use a VTO tool. Dimensions, with relative sub-dimensions, are summarized in Table 1.

Tab. 1: Dimensions and sub-dimensions

Dimensions (Selective code)	Description	Sub-dimensions	Quotes
Image quality	The quality of the reproduced image influences the perceived usefulness.	Inaccurate replication Immaturity	«It could be useful to me if the replication was accurate» - Z gen «Functional improvements still need to be made» - X gen
Experience with social media	The habit of using social networks results in less perceived enjoyment, and a lower perception of image quality.	Instagram filters Social network use	«It looks like an Instagram filter to me, but badly done» - Z gen «This is something we have already seen on social media» - Z gen
Privacy	Concern for privacy influences attitude towards use.	Privacy: concern Privacy: resignation	«I would prefer to use the service from the computer so that I can black out the camera» - Z gen «We are constantly being listened; our privacy doesn't exist anymore» - X gen
Perceived enjoyment	The degree to which the use of a VTO device is regarded as entertaining.	Entertainment Novelty Lack of experience	«It was almost a game, we had fun. Maybe because we didn't know it» - X gen «It's just to show how the glasses fit on your face» - Z gen
Perceived usefulness	The degree to which a VTO provide a true and accurate representation of the consumer's features with the intention to stimulate the purchase of the virtually worn product.	First product approach Convenience Uselessness to buy	«You get an idea of what looks good on you, so then you don't go and try on 500 glasses, you try on the shape you've seen that looks good on you» - X gen «I might try them out first, then go to the shop and buy them anyway» - Z gen
Perceived ease of use	The degree to which virtually trying on accessories is free of mental and physical effort.	Need for help Accessibility difficulties	«Without your help I wouldn't have made it» - X gen «With these devices you cut off a large part of the population because they are not so intuitive» - Z gen

Source: authors' elaboration

Core categories are now discussed in detail, with supporting citations from both Z and X group.

5.1. Image quality

Our findings indicate that the quality of the image reproduced through the tool is an external variable that influences perceived usefulness. Furthermore, during the category analysis, it was found that the perceived quality of VTO technology is influenced by a consumer's experience of using social media. Indeed, the analysis showed a more critical attitude towards image quality on the part of individuals belonging to Generation Z, who continually compared the technology to the social networks they use routinely. On the contrary, individuals belonging to Gen X did not dwell on the technical characteristics; they rather focused on looking at their own reflection, joking that their glasses would fall off if they moved their head. Within the core category of VTO perceived quality, two sub-categories were highlighted to grouping the considerations that emerged during the interviews. First category, *Immaturity*, emerged since the examined technology was considered to be “at an embryonic stage”, “insufficiently developed yet” and “still to be developed from a functional point of view”. Within this sub-category, no differences were found between generations. Both considered the VTO technology to be more of an experiment than a useful tool for purchasing glasses.

The perception of poor device quality is mainly reflected in the perception of poor image quality. This is the reason why the second sub-category has been named *Inaccurate replication*. One respondent from Gen Z group mentioned that “either it is very well done, to keep the level of the brand high, or it is better to avoid it. Despite I have the latest iPhone model, I found the camera quality to be very poor”. Gen Zers were dissatisfied with the way their images appeared on the screen, considered grainier and less accurate than those usually visualized with their smartphones. In fact, they unanimously found that “the image does not represent me, it is not accurate, I look like a doll”.

5.2. Experience with social media

Our findings indicate that experience with social media influences the perceived ease of use. More experience with social media influences the perception of the quality of images produced by the VTO technology, and the perceived enjoyment in using it. Respondents from the Z group have continually compared the VTO technology to Instagram's VR/AR filters. In fact, participants' considerations were grouped into two sub-categories named "*Instagram filters*" and "*Social network use*". One of them mentioned that "*it's nothing new. We deal with those applications every day. For this to work, something truly spectacular would have to be done*". On the contrary, Generation X's participants did not mention any similarities with social networks. The youngest generation, on the other hand, emphasized the negative aspects of the VTO. These considerations led the participants to devalue the brand; one respondent mentioned that "*it looks like an Instagram filter to me. I could imagine something like this from a lower-profile brand, but not from Bulgari*". Other said "*the image of Bulgari, after seeing this, has gone down a lot, like Zara or Bershka*".

5.3. Privacy

During the coding process, two sub-categories were delineated: *Resignation* (Gen X) and *Concern* (Gen Z). Concern has been expressed most strongly by younger individuals, who said they would feel safer using the computer because they could obscure the camera. According to one respondent "*when opening the camera, they should indicate - only allowed when using the app - or something like that, to make you feel safer. Like phone maps. If I don't want to afterwards, I don't want to*". It also emerged that many of the participants black out their computer's webcam every time they surf the Internet. On the contrary, individuals belonging to Generation X expressed more resignation than concern. They showed awareness of the impossibility of full control of their data, and there was no reference to any measures to be taken to protect one's privacy. In this regard, one respondent from X group said "*if you know the medium you use, you know that your privacy doesn't really exist*".

5.4. Perceived enjoyment

In this study, we define perceived enjoyment as the degree to which a person considers the experience with VTO technology entertaining. Within this category, three sub-categories were highlighted: *Entertainment*, *Novelty* and *Lack of experience*. In fact, our findings indicate that less experience translates into more perceived enjoyment. Consequently, it was individuals belonging to Generation X who emphasized the concept of fun. One respondent, whose comments were representative of those of the majority, said "*it was funny. Maybe because we didn't know it. We paid more attention to the fact that the glasses fall off if you go down with your head, rather than how they fit on our face*". On the contrary, Generation Z did not focus on the playful characteristics of the technology since it was not perceived as something new by them.

5.5. Perceived usefulness

Perceived usefulness of a fashion VTO device is associated with its ability to provide a true and accurate representation of the consumer's features with the intention to stimulate the purchase of the virtually worn product. During the coding process, participants' considerations concerning ease of use were grouped into three sub-categories.

The first was named *First product approach*. Participants described the VTO technology as useful as it allowed them to see the products on sale for the first time, without having to visit the store. This sub-category is strongly influenced by the participants' preoccupation not to find all the models of glasses in the store. A respondent from Z group called the technology a "*virtual shop window*" as it allows you to get closer to the products by selecting those of interest.

The concept of *Convenience*, the second sub-category, was mainly articulated in saving time and saving money and has been exclusively expressed by participants belonging to Generation X, even though there were differing opinions within the group. In this regard, one respondent from X group said “*it is important for me to save time*”. On the other hand, a further comment was “*These channels would take away the pleasure of walking out of the shop with a bag*”.

Uselessness to buy is the third sub-category emerged from the analysis. There were no differences between the considerations from the two generations examined: both pointed out that “*zero utility sales*”. All participants consider necessary to go to the shop anyway to make the purchase, as “*we don't trust you to do a test only virtually*”. This negative feeling is influenced by perceived poor image quality, which leads them to carry out a further fitting in the physical shop.

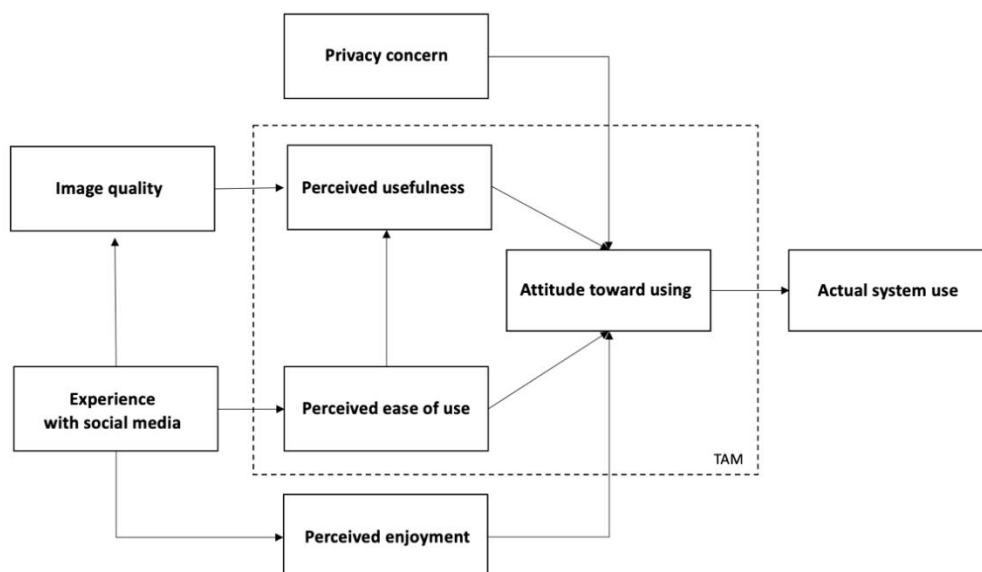
5.6. Perceived ease of use

Our findings indicate that more experience with social media translates into greater perceived ease of use. The “perceived ease of use” selective code comprises two sub-categories named *Need for help* (recurrent code in Gen X group) and *Accessibility difficulties*. Participants from both generations observed that “*it's not so easy to access. These technologies cut off a large part of the population*”, and this has led to the technology being defined as particularly “user unfriendly”. Despite participants belonging to Generation Z did not experience any difficulties in using the technology shown, they described it as “*not particularly intuitive*”. Differently, the Gen Xers needed help to test the glasses on their faces. Having experience with online shopping did not help in using VTO technology. One respondent, accustomed to shopping online, said “*without your help I probably would not have done it*”.

6. Discussion and conclusions

Building on TAM literature, we propose an extended framework to explore generational attitude towards VTO technology in the context of Fashion Retail Industry (Figure 1).

Fig. 1: Extended framework in the context of a VTO technology



Source: authors' elaboration

According to Davis (1989), perceived usefulness is the degree to which a consumer believes that using a particular system would enhance his or her job performance, and has been found to have a

significant impact on attitude toward using the technology (Liang et al, 2020). In line with (Qasem, 2021), the VTO technology allows consumers to conveniently try out all items from home and to access a wider variety of garments than they would find in the physical shop. However, participants found no value in buying the products; both Generation X and Generation Z stated that they preferred to buy directly in the shop, partially relying on the virtual testing. Leveraging TAM, our findings indicate that perceived usefulness is influenced by the perceived quality of one's own reflected image. As the application did not allow a realistic fit of glasses on the face, the perceived usefulness is reduced. According to the respondents, the problem was that the technology could not exactly translate the specificities of the glasses and participants' faces, creating "*a doll-like effect*". Additionally, participants stated that "*colors do not match reality*". Hence, similar to Plotkina and Saurel (2019), we confirmed the negative impact of low image quality on the overall user experience, especially that of the younger generation. As already stated, the concept of dissatisfaction with image quality was not mentioned by Generation X. One of the reasons may lie in the phone model: all participants belonging to the younger generation owned the latest iPhone model, in contrast to the Gen Xers. The concept of "uselessness to buy" has been strongly reiterated by respondents from Generation Z, which were more critical because of their previous experience with social networks (Instagram filters).

Given the importance of the social media experience factor, it's been included in the model as key antecedent influencing image quality perception, perceived ease of use and perceived enjoyment. According to Davis (1989), perceived ease of use can be defined as freedom from difficulty or great effort. All else being equal, it is argued that a technology perceived to be easier to use is accepted positively by users over another (Mugo *et al.*, 2017). The research showed that the habit of using social networks enables individuals to experience fewer difficulties in using technology. Nevertheless, participants from both Generation X and Z noted that the VTO technology is not easy to use, and this has led to a negative attitude toward use.

Perceived enjoyment has been introduced as a major behavioral belief besides perceived usefulness and perceived ease of use to influence the attitude and finally the intention to use an innovative device such as VTO (El Shamy and Hassanein, 2017). In line with Lee *et al.* (2019) it's been found that perceived enjoyment affects intention to use a VTO technology. Additionally, our findings indicate that previous experience with social media translates into less perceived enjoyment. Although both generations are active on social platforms, Instagram has a predominantly younger audience, with more than half of its users being under 35 years old, while the average age of Facebook is around 40, with a significant presence of users over 46 years old (*Digital 2021*). All participants from the X group did not own Instagram; since AR filters are mainly present on Instagram and Snapchat, individuals from Gen X had no experience with these technologies and therefore emphasized the concept of enjoyment in using them. Participants from Gen X emphasized the concept of novelty and fun, but our findings indicate that the perception of technology as a 'game' distracts attention from the usefulness and, consequently, the purpose of the technology: to stimulate consumers to buy glasses. On the contrary, respondents from Z group were more interested in analyzing how the glasses look on their face, just as they would have done in a shop.

Privacy concern affects how people interact with technology (Nuzulita and Subriadi, 2020). In this study, it was found that privacy concern influences attitude toward using, and this contributed to marking the difference between the two generations surveyed. This concern leads to a negative attitude towards the examined technology, since participants belonging to Generation Z claimed they did not feel safe using the device. Particularly, the concern is mainly about photos on smartphones. They expressed a willingness to be reassured about the protection of their data: one respondent from Z group suggested "*they should indicate that the camera only opens when the device is being used*".

The present study attempts to address some gaps and in doing so makes important contributions. First, it extends the research on technology acceptance by proposing a theoretical framework to explore the factors influencing consumers' attitude toward using a VTO tool. Hence, the proposed

VTO acceptance model is used in the current context by adding experience with social media and image quality as key antecedents influencing perceived usefulness, perceived ease of use and perceived enjoyment in using a VTO tool. Secondly, this study contributes to fill the gap in literature regarding individual differences and their role in technology adoption by comparing two opposite generations, which had not yet been compared in the context of VTO technologies.

Also, this study provides some useful information for managers in profiling both Generation X and Generation Z consumers. As expected, different generations respond differently to online retail experiences. Our findings suggest that previous experience with social media, a characteristic element of the youngest generation, is a strong predictor of consumers' attitude towards using VTO technologies for online apparel shopping. This leads ZGens to adopt an attitude of rejection toward the technology as it is too similar to the social media they usually use.

However, our results show that individuals belonging to Generation X are more intrigued by new digital technologies. For this reason, managers should adapt their strategies considering the growing interest of the oldest generation in the new digital tools. In fact, our findings suggest that this generation is easier to impress and has lower expectations regarding the image quality and the performance of technology itself.

As one of the main limitations of these tools is the difficulty to access, online retailers should consider the digital capabilities of the older generation. In fact, instead of focusing on making digital technologies more sophisticated, they should make them as simple as possible to increase the interest of XGens consumers. For example, it could be useful to make the camera more easily accessible since most of the participants had difficulties understanding how to position their face. Additionally, it might be interesting to include Italian indications, as many XGens have a low English level.

Regarding the youngest individuals, it is crucial to find new ways and contexts to attract their attention. Given the large number of hours this generation spends on social network, fashion companies might integrate these digital tools in their Instagram pages, for example by creating special filters for Instagram stories. Additionally, synergies could be created between social network pages and VTO applications.

7. Limitations and future research

Although this study provides interesting insights about the adoption and acceptance of a VTO device, it has some limitations that should be considered in future studies. First, although the number of participants in each focus group was in line with Krueger's (2001) technique, the restricted number might have limited the representativeness of the results. To extend the applicability of the findings to the wider population, focus group could be carried out in future with a higher number of participants for each group. Otherwise, several focus groups could be carried out for each generational cohort, with further internal subdivisions (e.g., level of instruction/education level, gender, online purchase frequency) to obtain a better description of the phenomenon.

For future study, research could use different data analysis methods (e.g., quantitative or mixed method, including a questionnaire or a survey-based approach and an interaction analysis between participants) to reinforce the data obtained, which may provide better insight and understanding on how consumers react to VTO technologies from a generational cohort point of view. Additionally, further considerations emerged after using the device (e.g., need for human relationships, preference for physical shops) were not taken into consideration; future research can be conducted to explore the influencing factors and behavioral responses of consumers after using a VTO device. Finally, the research could be extended by analysing other types of VTO technologies applied in the fashion retail (e.g., VTO make-up, virtual fitting).

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Nutritional claims and framing effect: how does the way of communication impact on the product perception?

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Abstract

Framing of the research. *The paper falls within the literature concerning food claims and the framing effect theory, expanding knowledge on the topic.*

Purpose of the paper. *The research tested the effectiveness of alternative ways of communicating the same information (the absence of added sugars in the product) through nutritional claims. Their impact on consumer perceptions was explored in terms of perceived healthiness, perceived quality, attitude toward the product, purchase intention, and willingness to pay.*

Methodology. *Images of fruit juice bottle were used as a stimulus and two versions of the pack were created: one with negative claim “no added sugar” and one with positive claim “only fruit sugars”. Data were collected by means of a web survey for a total of 122 completed questionnaires.*

Results. *Results demonstrated the greatest effectiveness on consumer perception of the claim with positive frame compared to the claim with negative frame.*

Research limitations. *The research investigated a single product category (fruit juices) and a single ingredient (sugar). More stimuli should be considered.*

Managerial implications. *The results offer useful information to food companies about the way of communication through product packaging and, in particular, through nutritional claims.*

Originality of the paper. *The paper analyzes two types of labels that have never been studied in the literature, extending the knowledge in the context of the framing effect theory with reference to nutritional claims.*

Keywords: *nutritional claim; sugar claim; framing effect theory; packaging; product perception; consumer behavior.*

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1. Introduction

Packaging is becoming an increasingly important part of the product (Underwood *et al.*, 2001; Underwood, 2003) thanks to its ability to create identity and differentiation, to develop promotional activities, and to communicate with consumers. Among the elements that compose it, food claims are recognized as means of communication (van Trijp and van der Lans, 2007) to inform consumers about a) a particular nutritional characteristic of the product like “content claim” (e.g., “sugar-free”, “no palm oil”) or “comparative claim” (e.g., “reduced sugar”, “more fibers”) (Buil and Brouns, 2015; Mayhew *et al.*, 2016; Vergura *et al.*, 2019); b) a relationship between product and health like “health claim” (e.g., “calcium may help improve bone density”, “in line with a heart-healthy diet”).

Nutrient content claim (or nutrition claim) is “any claim that states, suggests or implies that a food has particular beneficial nutritional properties due to the energy, nutrients or other substances it contains, contains in reduced or increased proportions or does not contain” (European Commission, 2006). It represents a packaging cue useful to aid consumers in food choice and to guide them to healthier food (Kaur *et al.*, 2017; Kristal *et al.*, 1998; Talati *et al.*, 2017). Otherwise expressed, nutrition claims may modulate the consumers’ perception and behavior toward the product (Prada *et al.*, 2021). Since healthy diet has become crucial for people’s wellbeing (Ares *et al.*, 2014), the relevance of claim on product packaging increases, both for consumers and industries (Bech-Larsen and Scholderer, 2007; Kreuter *et al.*, 1997; Perez-Escamilla & Haldeman, 2002). Hieke *et al.* (2016) found that in the European context around 26% of pre-packaged foods had a healthy or nutritional claim. In addition, the health value importance of consumers when making food buying decisions intensified during the Covid19 pandemic and its related restrictions periods (Smiglak-Krajewska and Wojciechowska-Solis, 2021). In particular, Jribi *et al.* (2021) highlighted that the pandemic condition enhanced consumers’ interests to food product labels.

However, Anastasiou *et al.* (2019) have shown that the effectiveness of claims depends on the correct interpretation and understanding of the information provided by the consumer. Unfortunately, this does not always happen (Campos, 2011). For instance, similar claims, such as “reduced fat” and “low fat”, may not be distinguished (Levy and Fein, 1998); a product with a “low cholesterol” claim may be perceived as low in fat (Reid and Hendricks, 1994); contextually, potentially negative product attributes (e.g., high fat) can be hidden by claims that enhance some positive elements (e.g., with fibers) (Wellard *et al.*, 2015).

In general, when a product has a food claim on its packaging, consumers tend to perceive it more positively than it actually is; this is the positivity bias of the so-called “magic bullet” effect (Roe *et al.*, 1999; Williams, 2005). Therefore, a product with a claim will be judged more positively than one without. And, if the positive perception deriving from the claim on a specific ingredient is generalized to other characteristics/elements of the product, we are also dealing with the “halo effect”, that is an overgeneralization effect (Chandon *et al.*, 2007). Thus, for food claims to be truly effective, a supportive educational environment for consumers is needed (Lawrence and Germov, 2004).

The “framing effect” ranks among the range of effects which influence the claim efficacy and the product perception by consumers. Specifically, it refers to the way of presentation of problem, information, or choice options, thus shaping the consumer’s decision-making process. According to framing literature, negative information tends to attract more attention than positive one (Baglione *et al.*, 2012, Hoefkens *et al.*, 2011; van Kleef *et al.*, 2005) and has a stronger impact on consumer behavior (Verbeke and Ward, 2001). This happens because, as explained in the Prospect Theory by Kahneman and Tversky (1979), people tend to avoid a possible loss compared to achieving a possible gain; therefore, a negative framing has more impact than a positive one.

Regarding food claim, it can be framed as either avoiding a negative or gaining a positive outcome (Broemer, 2004). For instance, the same benefit can be communicated as a disease risk reduction (e.g., reduction of cardiovascular risk) or as a health enhancement (e.g., safeguards cardiovascular health). If, according to the Prospect Theory, people demonstrate greater preferences for nutrition and health claims when outcomes are expressed as possible losses than as possible

gains (Levin, 1998); by contrast, the Regulatory Focus Theory (Higgins, 1997) argues that there are individual differences in the effect of framing, depending on whether the focus is on promotion or on prevention. This is why the results about claim's framing effect are still inconclusive.

In this study we explore nutritional claims in order to understand how effectively they communicate the absence of added sugars in a product. In particular, the research carried out intends to compare two different claims that convey the same information, but in two different frames: "no added sugar" vs "only fruit sugars".

To our knowledge, there are no studies in literature that have investigated the effects generated by these types of food claims on the consumer's perception of the product and on their purchasing decisions. Filling the gap in the existing knowledge, we look into consumer perceptions in terms of perceived healthiness, perceived quality, attitude toward the product, purchase intention, and willingness to pay.

The results offer relevant insights to food industries on how to communicate product characteristics through nutritional claims and contribute to the advancement of knowledge in the food claim literature.

The paper is organized as follows. The next section reviews the relevant literature and formulates the research question. In the "Method" section the research design, the material used as a stimulus and the data collection procedure are explained. The subsequent sections present the study results and discussions, highlighting theoretical and managerial implications and suggestions for further research.

2. Literature review and research question

2.1 Framing effect on food claims

Although the literature on the framing effect is consolidated, in the context of food claims the results of prior research are often inconsistent.

In the Levin's well-known study (Levin, 1998), meat's attribute conveyed in a positive framing ("75% lean meat") generated more positive product evaluations compared to an equivalent negative framing ("only 25% fat"). However, according to Van Kleef *et al.* (2005), the effects of framing vary depending on the type of outcome/attribute communicated by the claim and on the specific context. In addition, if the claim with reduction disease risk determines higher purchase intention respect to claim with function health, there are no effects on appeal, credibility, and ability to convince. The evidence that framing effect depends on the type of outcome/attribute has also been proven by qualitative studies (FSA, 2002; Svederberg, 2002).

Although the direction of the framing effect in the claim topic is not established, it is certain that the way the information is presented affects the perception and behavior of the consumer. Therefore, it is interesting to deepen the knowledge in this area to understand how different claims, that report the same information, influence the consumers' decision-making process.

2.2 Sugar-related claims

Excessive sugar intake is harmful to health behavior associated with low-quality diets and obesity (WHO, 2003; He *et al.*, 2018; Johnson *et al.*, 2009); this is why it must be kept under control and avoided as much as possible. To answer this problem, the food industry has begun to replace sugar in products, at first, with artificial sweeteners (e.g., saccharine, aspartame), and more recently, with natural sweeteners (e.g., stevia, thaumatin).

How does the consumer react to this change?

Realini *et al.* (2014) stated that the use of stevia in beverages is a better option compared to the no-added sugar option: the improved health benefits generated by the total elimination of sugar do not seem to be able to compensate the worsening in consumers' perceived taste. Natural sweeteners,

instead, evoke sweet taste or enhance the perception of sweet taste. Contextually, Kamarulzaman *et al.* (2014) revealed that consumers were willing to consume products with stevia as a substitute for sugar.

However, many people believe that when a product is made healthier by changing its ingredients, its sensory characteristics are negatively affected (Lähteenmäki *et al.*, 2010, Nørgaard and Brunsø, 2009, Raghunathan *et al.*, 2006). This has also been demonstrated with reference to perceived taste: as the healthiness of the product increases, the perceived taste decreases (Bialkova *et al.*, 2016, Fenko *et al.*, 2016). This is why the sugar reduction or replacement by sweeteners can decrease consumer hedonic perception (Raghunathan *et al.*, 2006). Prada *et al.* (2021) demonstrated that when a product had a sugar-related claim it was evaluated as healthier, less caloric, and less tasty compared to the regular counterpart. These evidences explain why consumers tend to prefer conventional products compared to their sugar-reduced alternatives (Markey *et al.*, 2015).

2.3 Research question and measured variables

Despite the results of several studies that highlight the preference of conventional products (with sugar), the food industry continues to reduce or eliminate sugar from products, in order to improve the health and well-being of the population. This is why it is so important to understand how to effectively communicate to the consumer the absence of sugar in the product, without affecting their perceptions and propensity to buy it. Therefore, the proposed paper aims to answer this question:

“How does the different way of communicating the absence of added sugars in the product affect consumers’ perceptions and their behavioral intention?”

In particular, since some food industries that produce fruit-based products have decided to sweeten them through fruit sugars instead of added sugars, our study intends to test two types of claims communicating the absence of the latter to evaluate their impact on consumer decision-making. The claims tested are: “no added sugar” vs “only fruit sugars”. Referring back to the framing effect, the first is a negative claim, which communicates the total absence of an ingredient; the second one has a positive value as it refers to an ingredient present in the product.

In order to answer the research question, the following variables were considered: perceived healthiness, perceived quality, attitude toward the product, purchase intention, and willingness to pay.

Perceived healthiness is defined as “an individual’s perception that a specific food product will positively contribute to one’s health” (Iles *et al.*, 2018). It is influenced by different factors: type of raw materials, product origin, conservation method, packaging, and so on. (Bonner and Nelson, 1985; Poulsen, 1999). In turn, perceived healthiness acts on eating patterns (Paquette, 2005). Foods can be considered as healthy or unhealthy (Carels *et al.*, 2006; Carels *et al.*, 2007) based, for example, on some stereotypical beliefs connected to their names (Oakes, 2006), or on their perceived fat content (Carels *et al.*, 2006). This categorization may bias estimations of caloric content of products (Carels *et al.*, 2006, Carels *et al.*, 2007): “healthy” foods were perceived as low caloric compared to “unhealthy” foods.

Perceived product quality has been defined as the consumer’s judgment about a product’s overall excellence or superiority (Anselmsson *et al.*, 2007); it is a global assessment characterized by a high abstraction level (Zeithaml, 1988). According to Dodds *et al.* (1991), perceived product quality represents a mediator between extrinsic cues and perceived consumer value. The packaging and its elements (e.g., labels and claims) figure among the product’s extrinsic cues.

Attitude is a psychological tendency, an index of the degree to which a person has a favorable or unfavorable evaluation toward an object - a subject, an event, a behavior (Ajzen and Fishbein, 2005). Therefore, it reflects a person’s evaluation (Ajzen and Fishbein, 1977) and plays a crucial role in determining intentions and behaviors (Dabholkar, 1994). Attitude derives from consumer

beliefs, experiences and stimuli assessment, marketing stimuli included (Bagozzi, 1986; Wang and Heitmeyer, 2006), such as packaging.

Finally, choice behavior is operationalized as purchase intention and willingness to pay. Purchase intention, one of the main constructs studied in the marketing literature (Tsiotsou, 2006), represents the principal direct antecedent of actual behavior. Contextually, willingness to pay, the maximum price a buyer accepts to pay for a product (Kalish and Nelson, 1991; Kohli and Mahajan, 1991; Wertenbroch and Skiera, 2002), affects purchase intention (e.g., Prakash and Pathak, 2017) and is guided by packaging elements (Hao *et al.*, 2019).

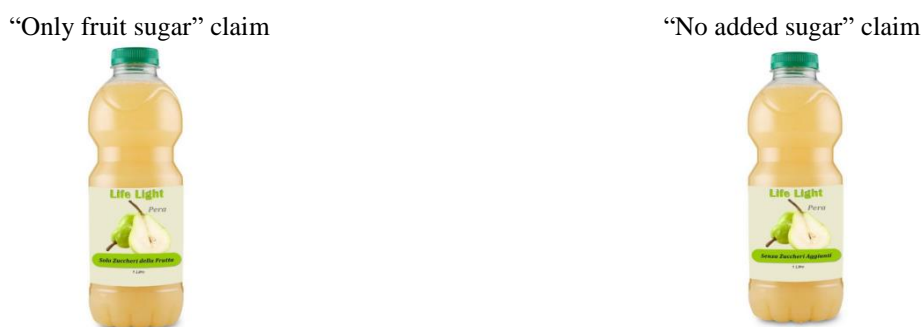
3. Methods

In the present research, images of fruit juice bottle were used as stimuli. Two versions of the pack were created: one with negative claim (“no added sugar”) and one with positive claim (“only fruit sugars”). To avoid any influence deriving from consumers’ familiarity with the product, the bottles created did not correspond to products available on the market, and the brand used was fictional (Fig. 1).

Data was collected by means of a web survey by posting the questionnaire link on various social network pages. Respondents were equally and randomly distributed among the two experimental conditions and, after viewing the stimulus image, they answered the questions. In total, 122 questionnaires were collected: 61 for “no added sugar” claim and 61 for “only fruit sugar” claim.

Research’s latent variables were measured using scales that have been well validated in the literature (Tab. 1). The three semantic differential scale of Bui *et al.* (2013) was used to assess perceived healthiness. The perceived product quality was measured through the four-items of Dodds *et al.* (1991) scale and the attitude toward the product through a set of three bipolar adjectives of Muehling *et al.* (1991). Questions measuring purchase intention were adaptations of the four-item scale proposed by Kaushal *et al.* (2016) and willingness to pay was collected through the three-item scale developed by Konuk *et al.* (2019). All statements were on a seven-point semantic differential/anchored (from “completely disagree” to “completely agree”) scale. The reliability of these scales was assessed through Cronbach’s α and appeared satisfactory for all the constructs ($\alpha > 0.70$; Cronbach’s alpha coefficients are shown in Tab. 1).

Fig. 1: Stimuli



Source: our elaboration

Finally, in order to control the tendency in eating healthily between the two groups, the variable “general health interest” was measured using Roininen *et al.* (1999) eight seven-point scales, each anchored by “unlikely” and 7 “likely” ($\alpha = 0.70$). The level of health interest was high for both groups (“no added sugar” claim $M = 4.830$; “only fruit sugar” $M = 4.889$) and the difference was not significant (Mann-Whitney $U = 1975.500$, $p = 0.556$).

Participants’ average age was 38.98, ranging from 19 to 72 ($SD = 5.834$); 67 per cent were female and 33 per cent were male.

To answer the research question, a series of parametric t-tests were carried out using the IBM SPSS statistical software (SPSS Inc, Chicago, IL; release 25.0).

Tab. 1: Measurement scales and reliability indices

Scale	Items	Cronbach's Alpha
<i>Perceived healthiness</i> (Bui <i>et al.</i> , 2013)	Poor source of nutrients - Rich source of nutrients	0.914
	Not very nutritious - very nutritious	
	Not healthy - very healthy	
<i>Perceived quality</i> (Dodds <i>et al.</i> , 1991)	The probability that the product is reliable is (very high - very low)	0.956
	The quality of the composition of the product is: (very low - very high)	
	The quality of the product is (very low - very high)	
	The probability that the product is safe is: (very high vs very low)	
<i>Attitude toward the product</i> (Muehling <i>et al.</i> (1991)	Bad - Good	0.901
	Unfavorable - Favorable	
	Negative - Positive	
<i>Purchase intention</i> (Kaushal <i>et al.</i> , 2016)	I intend to try the product.	0.931
	I am interested in buying this product.	
	Maybe I will buy this product.	
	I will recommend this product to others.	
<i>Willingness to pay</i> (Konuk <i>et al.</i> , 2019)	I am willing to spend more to buy this product.	0.958
	It is acceptable to pay a surcharge to purchase this product.	
	I am willing to pay more to buy this product.	
<i>General health interest</i> (Roininen <i>et al.</i> , 1999)	The healthiness of food has little impact on my food choices (r).	0.700
	I am very particular about the healthiness of food I eat.	
	I eat what I like and I do not worry much about the healthiness of food (r).	
	It is important for me that my diet is low in fat.	
	I always follow a healthy and balanced diet.	
	It is important for me that my daily diet contains a lot of vitamins and minerals.	
	The healthiness of snacks makes no difference to me (r).	
I do not avoid foods, even if they may raise my cholesterol (r).		

Source: our elaboration

4. Results

To answer the research question, the Mann-Whitney U non-parametric test was used.

The results showed the better effectiveness of the claim with positive frame “only fruit sugars only” compared to the claim with negative frame “no added sugar” on consumer perception.

Specifically, respondents perceived fruit juice with the claim “only fruit sugars” to be healthier and of higher quality than fruit juice with the claim “no added sugars” (respectively, $M=4.951$ vs $M=4.120$, $U= 2476.000$, $p<0.05$; $M=4.000$ vs $M=3,266$, $U= 2362.500$, $p<0.05$). The attitude toward the product also improved significantly when the claim on the label had a positive frame compared to when it had a negative one ($M=5.224$ vs $M=4.306$, $U= 2539.000$, $p<0.05$). Finally, the type of claim also influenced the choice behavior: both the purchase intention and the willingness to pay were greater when the claim was expressed in a positive way compared when it was expressed in a negative way ($M=3.955$ vs $M=2.700$, $U= 2658.000$, $p<0.05$; $M=3.962$ vs $M=3.470$, $U= 2109.500$, $p=0.200$). However, only in the case of purchase intention the difference was statistically significant.

The cell means and standard deviations of the independent variables are shown in Table 2.

Tab. 2: Cell means and standard deviations of the independent variables

	“No added sugar” claim		“Only fruit sugars” claim	
	Mean	SD	Mean	SD
Perceived healthiness	4.120	1.601	4.951	1.440
Perceived quality	3.266	1.547	4.000	1.485
Attitude toward the product	4.306	1.479	5.224	1.180
Purchase intention	2.700	1.560	3.955	1.628
Willingness to pay	3.470	2.014	3.962	1.830

Source: our elaboration

5. Discussion and conclusion

Food claim is an important packaging cue able to guide consumers choice toward healthier foods and to improve their diet (Cowburn and Stockley, 2005). Its ability to determine the behavior toward the product (Prada *et al.*, 2021) makes it an element of interest for literature, both from a theoretical and managerial point of view.

If, on the one hand, the effectiveness of claims varies based on their correct interpretation and understanding by the consumer (Anastasiou *et al.*, 2019), on the other hand, the way in which the claims are set up also influences their perception and, therefore, their effectiveness. According to the framing effect theory, the way of presentation of problem, information, or choice options, has an impact on the consumer’s decision-making process. Specifically, negative frame tends to have a stronger impact on consumer perception (Verbeke and Ward, 2001) and to attract more attention than positive frame (Baglione *et al.*, 2012, Hoefkens *et al.*, 2011; van Kleef *et al.*, 2005). However, with regards to food claims, the results of prior research on framing effect are inconsistent.

The present study intends to deepen the knowledge on this topic, focusing on sugar nutritional claims. Specifically, based on the framing effect theory, two different ways of communicating the absence of added sugars in a product were tested in order to verify their impact on the consumer perception. In so doing, the paper contributes to the literature on the role of packaging as a communication vehicle, focusing on food claim. In particular, it increases the understanding of the framing effects on consumer decision-making process. Filling the gap in the existent knowledge, we considered the consumer perception and behavioral intention in terms of perceived healthiness, perceived quality, attitude toward the product, purchase intention, and willingness to pay.

The research demonstrates the better effectiveness of claims with positive frame “only fruit sugar” compared to those with a negative frame “no added sugar”. The use of the claim that emphasizes the presence of only fruit sugars inside the product is able to significantly improve its perception in terms of healthiness, quality, and attitude toward it, up to increasing the buy propensity. These results confirm that the way in which information is presented can change the opinion of consumers and, consequently, their decision-making process, as supported by the framing effect theory. They also support the Levin (1998) results with reference to sugar ingredient: product’s characteristic conveyed in a positive framing generates more positive product evaluations compared to an equivalent negative framing. However, our findings are in contrast with previous studies on framing effect which demonstrated the superiority of the negative frame, over the positive one, able to have a stronger impact on consumer behavior (e.g., Verbeke and Ward, 2001). This contrasting result with some of the previous literature represents an interesting finding worthy of attention and further investigation. If, according to Prospect Theory, negative framing has more impact than positive framing because people tend to avoid a possible loss compared to achieving a possible gain, this does not seem to be confirmed in the case of sugar content in products. An explanation for this result could be derived from the importance of sugar in the perceived taste and deliciousness of food: declaring a total elimination of sugar from the product may negatively impact the perception of its quality and tastiness (Raghunathan *et al.*, 2006).

The present research not only contributes to deepen scientific knowledge, but also offers useful managerial insights to food companies. In particular, it gives precise indications about the communication methods to be adopted on the pack to convey the product characteristics. Knowing how to communicate and what to emphasize about the presence or absence of an ingredient is a crucial information since it affects purchasing choices. It is therefore a significant strategic choice, considering the information overload that characterizes the product packaging. It is important to choose the right communication methods to maximize the effectiveness of the nutritional messages. With specific reference to sugar, a communication with a positive frame, which enhances the presence of a specific alternative ingredient, is more effective than a communication that highlights the total absence of the ingredient. Declaring the total absence of added sugars in a product worsens its perception, not only in terms of quality, but also in terms of healthiness, negatively affecting the propensity to buy it.

This study provides an important starting point for future research. First, it should be replicated considering both other products and other ingredients. This would allow the results obtained to be generalized to all food categories, or to identify different results depending on the ingredient considered in the claims. Second, the study could be expanded by adding a tasting test to measure the action of the claim on the perceived tastiness of the product by the consumer. Finally, the consumer's actual purchasing behavior with respect to the different claims should be explored.

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Founder-Involvement in R&D and SMEs Performance

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Abstract

Objectives. *The aim of the paper is to shed light on the pivotal role of founders initial and enduring involvement in R&D and its reflexes on SMEs performance.*

Methodology. *Starting from theoretical propositions, a conceptual framework was outlined and operationalized in terms of a mediation/moderation model. We further tested it on a random sample of 350 low research-intensive SMEs located in Southern Italy. An augmented cross-sectional design, which measures key variables using different sources at different time points, was employed. We adopted a seemingly unrelated regression to jointly analyze variables and their interactions.*

Findings. *We observe that founders involvement in R&D matters for SMEs performance. We also found evidence that founders involvement in R&D-SMEs performance association is mediated by R&D resources and innovation outputs. At the same time the founders involvement in R&D-R&D resources association is negatively moderated by founders multiple involvements in the firm activities.*

Research limits. *Our study is affected by various limitations. As an example, only revenue-based measures are used as a proxy of firm performance. In addition, for controlling heterogeneity in estimates, data refer to a well-defined time window as well as to manufacturing SMEs located in specific geographic areas of Italy.*

Practical implications. *Our study reveals that founders - with their firm- and context-specific capabilities - while enmeshed with R&D activities, contribute to SMEs performance. Policy makers should create incentives for founders to be involved to some extent in inventive activities. Further implications are also envisaged for both funding and training educational services.*

Originality of the study. *Building on the intersection between resource orchestration and competence-based perspectives, we conceived and empirically analyzed founders as key actors for inventive resource orchestration at the firm level and how and under what conditions the resource orchestration made by founders is likely to nurture the performance even of low research-intensive SMEs.*

Key words: *Resource orchestration view and competence-based perspectives; Founders involvement in R&D; SMEs performance.*

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1. Introduction

Studies of economics, organizational theory, and technology management (Crossan and Apaydin, 2010; Anderson, Potočnik *et al.*, 2014; Botelho, Fehder *et al.*, 2021) have long acknowledged the essential role of innovation as an engine of economic growth as well as of firms core competences and sustainable competitive advantage (Schumpeter, 1934; Porter, 1980). This holds especially true when it comes to Small and Medium-sized Enterprises (SMEs), i.e. firms separately owned by a founder that are not dominant in their field of business (D'Amboise and Muldowney, 1988). Despite their limited size, SMEs are an important source of economic development and job creation at a national level (Acs and Audretsch, 1991; Acs, 1992). In the United States, on data released in 2021 by Census Bureau, SMEs accounted for 39% and 47% of the total payroll and of the total employment in 2018, respectively. In China, according to the OECD scoreboard 2020, SMEs contribute up to 60% of GDP and up to 75% of job creation. In Europe, data by the Eurostat outlined that in the last five years SMEs have created around 85% of new jobs and provided two-thirds of the total private sector employment. In Italy, SMEs matter too, being long at the core of national research in management (e.g., Lorenzoni, 1969; Golinelli, 1974; Varaldo and Bellandi, 1974; Rullani and Vicari, 1999; Silvestrelli, 2004).

Even in the light of SMEs limited size, resource poverty, and vulnerability to competitive threats (D'Amboise and Muldowney, 1988), innovation is essential to SMEs performance (Harrison, Mykytyn Jr *et al.*, 1997; Bruque and Moyano, 2007; Haeussler, Hennicke *et al.*, 2019). In particular, SMEs can achieve several unique benefits from innovations (Rosenbusch, Brinckmann *et al.*, 2011) such as higher quality and better products and services (Damanpour, Walker *et al.*, 2009) which, once introduced in specific market spaces, offer SMEs opportunities to grow without experiencing though head-to-head rivalry with main competitors (Porter, 1980). However, innovation is also a source of significant complexity for SMEs. Because of their resource poverty, SMEs are constrained on the number of innovations that can be introduced, not to mention the possibility to alternate from one technology to another over time. Moreover, decisions in SMEs are often highly unstructured and the owner-founder plays a key role in the decision-making process. As a consequence, the decision to adopt innovations is likely to be affected by the capabilities and the role played by the owner-founder, whereas in large organizations such decision relates more to the overall firm's strategy (Welsh and White, 1981).

Given the relevance and at the same time, the complexity of innovation in SMEs, understanding whose competences are the leading forces that enable SMEs to successfully introduce innovations is a topic of great interest for research in the field of management. Building on the intersection between the literature on orchestrating capabilities in a firm strategy (Sirmon, Hitt *et al.*, 2011) and the capabilities-based perspective (Haeussler, Hennicke *et al.*, 2019), within research-intensive firms, extant studies have addressed the positive influence of founders initial and enduring involvement in R&D activities on firms performance. However, there is little to no empirical evidence of the mentioned positive effects in low research-intensive SMEs as well as of the mechanisms through which positive effects stemming from founders involvement in R&D are channeled to organizational performance, specifically in SMEs.

In our study, considering the pivotal role of owner-founder capabilities for SMEs innovation (Thong and Yap, 1995; Lee and Cheung, 2004), we contribute to the research stream on the linkage between founders involvement in R&D and firms performance (Haeussler, Hennicke *et al.*, 2019) by theoretically exploring and empirically analyzing the chain of consequences of the strategic decision of founders to be involved and remain engaged in R&D on SMEs performance. Specifically, we discuss how the founders involvement in R&D-SMEs performance linkage is mediated by R&D resources and innovation outputs. Such mediators are thus considered as reflexes of orchestrating capabilities fluxing out from founders involvement in R&D. In addition, because of resource poverty, founders may play different roles in SMEs. Assuming that human capabilities are bounded and thus can be exhausted when applied to different contexts at the same time, we propose

that the multiplicity of founders involvement in areas different from R&D will induce a negative effect on the founders involvement in R&D-R&D resources association.

Our propositions were tested on a random sample of 350 manufacturing, low research-intensive SMEs located in the Southern regions of Italy. From results, we observed that, as for research-intensive firms, founders involvement in R&D is likely to increase SMEs performance, as well as to positive affect investments in R&D. Greater levels of investments in R&D resources are likely to generate positive effects on R&D outputs which, in turn, tend to increase both the share of total revenues from newly introduced products and sales growth. We further observed a negative moderating effect of founders multiple involvements on the founders involvement in R&D-R&D resources association.

Thus, our paper deals with an important and emerging issue in the management field and offers fresh insights on who and whose capabilities are key for research resource orchestration at the firm level and how and under what conditions such resource orchestration made by founders is likely to enhance the performance of low research-intensive SMEs. Our work then contributes to the research stream that «*emphasized the outstanding role founders play in their firms*» (Mueller, Haeussler *et al.*, 2018), a role that is not restricted to the sole research-intensive firms.

2. Theoretical framework

2.1. A theory of resource orchestration

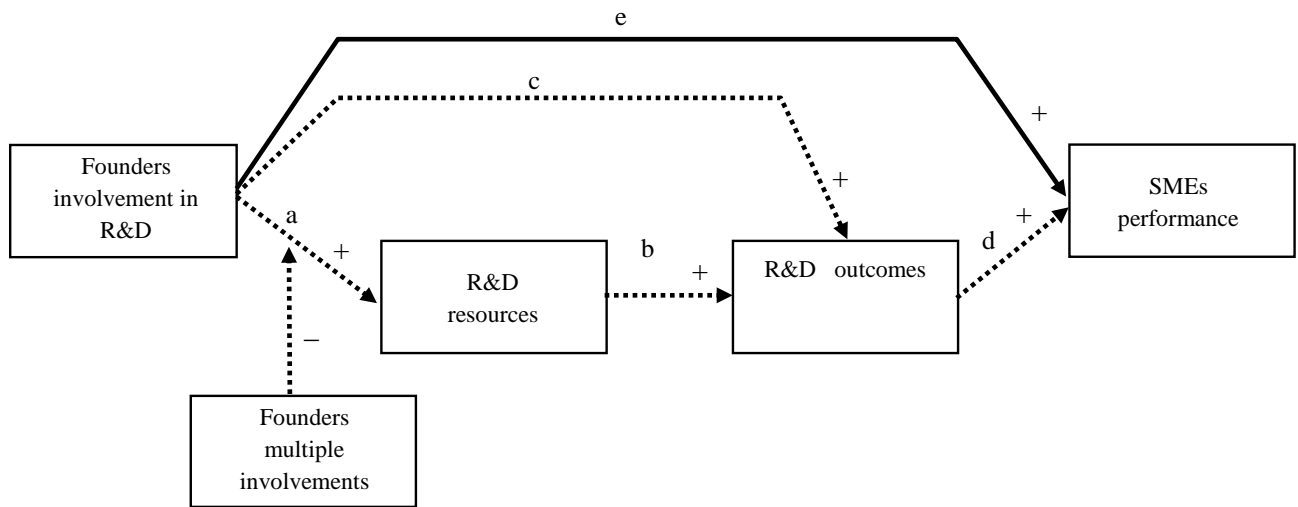
Within the resource-based view, resources include all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm on a semi-permanent base that enable the firm itself to conceive of and implement strategies that improve its efficiency and effectiveness (Barney, 1991). To contribute to firms competitive advantage, owned resources must both be of strategic importance (Barney, 1991) and used with proficiency (Penrose, 1959). As for the strategic importance, resources need to be valuable, rare, difficult to copy, and organizational-specific (Barney, 1991; Grant, 2021). As for their use, resources need to be orchestrated (Ndofor, Sirmon *et al.*, 2011; Sirmon, Hitt *et al.*, 2011) and, as well established by the Italian business management tradition (Fazzi, 1982; Ceccanti, 1996; Golinelli, 2000), such an orchestration requires key people using their skills and capabilities to structure resources, bundle and thus leverage them to set up strategies that lead to a sustainable competitive advantage (Porter, 1985).

Among key people orchestrating resources within SMEs, the competence-based view focuses on founders and their competences. In general, competences are defined as the ability of an individual or a team to perform with a minimum level of functionality and with repeated, reliable performance a coordinated set of activities, utilizing organizational resources, for the purpose of achieving a particular end result (Helfat and Peteraf, 2003). In SMEs, a founder contributes with his/her beliefs and expectations to set up the firm, brings to the firm his/her competences and with the firm makes his/her competences to develop and enrich in a path-dependent manner. His/her competences, combined with other organizational capabilities, make it possible to shape key elements of the firm itself, such as its organizational structure, decisions, boundaries, performance, life-cycle, and dynamics (Hodgson, 1998; Colombo and Grilli, 2005). Therefore, founders are the key candidates to play the role of resource orchestrator, especially in the area of R&D of SMEs (Haeussler, Hennicke *et al.*, 2019).

Accordingly, a theoretical framework linking founders initial and enduring involvement in R&D and SMEs performance, given mediators (R&D resources and R&D outputs) and moderator variables (founders multiple involvements) is proposed (Fig. 1). Arrows with the solid line are to represent indirect effects while the one in the dotted line is to indicate the direct effect of founders involvement in R&D on SMEs performance. The idea behind underlying the depicted model is that

founders specific competences are key inputs to transform R&D resources into enhanced SMEs performance.

Fig. 1: The proposed theoretical framework



Source: our elaboration

In Fig. 1, the solid lines represent direct effects while dotted lines mean indirect/mediated effects of the founders involvement in R&D on SMEs performance. More in detail, associations *a*, *b*, *c*, and *d* indicate indirect effects, while association *e* is the direct effect on the founders involvement in R&D-SMEs performance linkage.

2.2. SMEs founders and their contribution to SMEs performance

Prior studies have well established that the founders mix of entrepreneurial, financial business management, human relations, and networking competences (Mitchelmore and Rowley, 2010) is a valuable, rare, difficult to imitate as well as to replace, resource, since it is heterogeneous across different firms and, once combined with other firms resources and capabilities, it is also organizational-specific. Far from just stating that founders competences matter, extant literature assumes that they produce significant, positive benefits for firms performance (Chandler and Hanks, 1994), especially when such competences are infused into R&D activities (Haeussler, Hennicke *et al.*, 2019). Therefore, we suggest the following baseline hypothesis.

H1. *SMEs with founders involved in R&D display a higher performance than SMEs without founders involvement in R&D.*

Starting from the aforesaid baseline hypothesis, we advance that the positive effect of founders involvement in R&D on SMEs performance is channeled via the R&D resources. In structuring R&D activities, founders and other individuals are very different. Founders involvement in R&D is an indication of the functional orientation of the firm (Boeker, 1989), inventive activities matter and, given that resource allocation is influenced by set priorities (Gouda, Radhika *et al.*, 2013), R&D activities deserve attention in terms of resource allocation. In addition, despite resource poverty in SME, founders involved in R&D have more power and entrepreneurial status to influence the share of resources to be allocated toward inventive activities rather than other individuals (Fahlenbrach, 2009). Indeed, resource allocation decisions of founders have the inherent legitimacy afforded the owners of private property; thus, while managers have to compete with others in charge of different functions in the allocation of scarce resources, founders can override

such a competition, being likely to define the share of available resources to be invested in R&D. Furthermore, although the amount of available resources to be invested in different firms areas is a fixed pie for other individuals, founders can exploit their networking capacities and knowledge of investors (Mitchelmore and Rowley, 2010), thus making available to the SMEs more resources to be invested in R&D activities. In addition, because of their involvement within firms, along with their equity shares, founders may have a very different risk-attitude from other individuals. Such a risk-profile can induce founders to divert more available scarce resources from current combinations to newly productive activities (Block, 2012). There is empirical evidence that a major obstacle in R&D investments in SMEs is the owner unwillingness to get involved in innovative activities (Kalantaridis, 1999), not to mention that when CEO position is held by a founder, firms invest more in R&D than other businesses in which the same role is played by a professional manager (Lee, Kim *et al.*, 2016). Remembering that innovation is generally a network-based or collaborative phenomenon (Endquist, ed., 1997, pp. 8-9), founders involvement in R&D is relevant even when SMEs are part of “helix” partnerships, also because founders are particularly able to use public and private (formal and informal) channels for knowledge exchanges (Haeussler, 2009; Mueller, Haeussler *et al.*, 2018). Therefore, we suggest the following hypothesis.

H2. SMEs with founders involved in R&D are likely to have more R&D resources than SMEs without founders involvement in R&D.

Because of the inherent uncertainty, unknowability, and variability, R&D activities require stability, particularly of long-term goals and priorities (Thamhain, 2003). Such stable long-term goals and priorities are anchors on which very complex activities can be built. The stability of long-term goals and priorities affects people involved in R&D, especially in those leading inventive activities. Since founders are less likely to be changed than other individuals engaged in inventive activities (Fahlenbrach, 2009), the former can provide research activities the required stability - at least in terms of goals and priorities - on which successful inventive outcomes may be grounded. In addition to a stabilizing function, founders involvement in R&D also contributes to enriching the R&D activities, thanks to founders specific capabilities, such as technical competences, the ability to motivate other individuals individually and in work-teams, and human relations skills. In summary, founders can contribute to inventive activities, by *«directly stabilizes and enriches firms’ technical capabilities while at the same time enhancing founders’ competence as they deepen their technological knowledge»* (Haeussler, Hennicke *et al.*, 2019, p. 293). Lastly, founders involvement in R&D may contribute to pioneering inventive activities toward the production of innovation outcomes, thus giving a direction to the creative process which mixes and consistently combines existing and new ideas to generate new configurations of products and processes. Founders specific capabilities like intuition, imagination, and seeing the big picture about firms potential areas of competitive advantage as well as an understanding of customers needs, give a preferred direction to inventive activities toward the production of valuable innovations. From an empirical perspective, it has been found that ownership by lone founders positively affects not only investments in R&D resources but also the level of R&D outputs (Block, 2012). In the same vein, it has been noted that founders *«with greater human capital are more likely to yield innovation outcome»* (Kato, Okamuro *et al.*, 2015, p. 114). Therefore, we suggest the following hypothesis.

H3. Given founders involvement in R&D, higher R&D resources are likely to increase R&D outputs in SMEs

Since leveraging is the process of using a company’s capabilities to achieve performance benefits (Sirmon, Hitt *et al.*, 2011), a SMEs which has successfully structured and bundled R&D resources, thus it owning or controlling them to establish capabilities, has still to exploit such capabilities to generate value (Lichtenstein and Brush, 2001). This component of resource orchestration is driven by entrepreneurial competences including, among others, founders specific

skills in identifying viable market spaces, introducing valuable products to the customers, and defining appropriate distribution channels (Mitchelmore and Rowley, 2010). Assuming that *«leveraging strategies are often idiosyncratic to a firm's capabilities»* (Sirmon, Hitt *et al.*, 2007, p. 284), founders involvement in R&D enmeshes R&D resources and capabilities with entrepreneurial specific capabilities that were accumulated over time (Dierickx and Cool, 1989), and, at the same time, it infuses the same resource and capabilities with founders vision which comprises the direction of perceived opportunities which a firm should navigate to. As leveraging implies moving resources toward a goal (Sirmon, Hitt *et al.*, 2011), founders can contribute with their competences in searching, seizing, and exploiting market opportunities (Danneels, 2002; Gruber, MacMillan *et al.*, 2013). Thanks to founders involvement in R&D, structured resources and developed capabilities become organization-specific, thus nurturing a firm sustainable competitive advantage. In other words, *«founder involvement in R&D goes beyond purely possessing technical capabilities: It spurs the ability to leverage them by delinking technological resources from specific applications as well as relinking them to specific products and market needs»* (Haeussler, Hennicke *et al.*, 2019, p. 293). This way, founders possess specific capabilities that, combined with the potential induced by R&D outputs, allow SMEs to achieve superior performance. Therefore, we suggest the following hypothesis.

H4. *Given founders involvement in R&D, higher R&D outputs are likely to enhance SMEs performance.*

2.3. *The mediating effects of R&D resources and R&D outcomes*

In our theoretical framework, controlling for R&D resources and outputs, the founders involvement in R&D-SMEs performance is expected to weaken. For example, a founder with specific capabilities in exploring and/or exploiting new technological and/or market opportunities could have very little effect on the SME innovation. This is because founders, although involved in the R&D, could be unable to make available adequate resources to inventive activities. Constraints in available resources may limit R&D outputs which, in turn, prevent firms from superior performance. In the same vein, thanks to the promotion effect of founders involvement in R&D inventive, SMEs could receive generous government subsidies to support research activities (Jiang, Wang *et al.*, 2021). However, due to coordination and cooperation costs in inventive activities, such a greater amount of resources may induce more innovation ideas but of mediocre standing (Baumann and Stieglitz, 2014), which, in turn, do not translate into greater levels of innovative outputs. Consequently, founders involvement in R&D, even if occurring in SMEs, might have very little effect on firm performance, given the supposed mediocre R&D productivity. This discussion leads to the following hypothesis.

H5. *Founders involvement in R&D-SMEs performance relationship is mediated by R&D resources and R&D outputs*

2.4. *The moderating effect of founders multiple involvements*

Apart from R&D, because of resource poverty and the key role played by founders, in SMEs founders can well hold dual or multiple involvements in functional areas different from R&D (Jiang, Wang *et al.*, 2021). The moderating effect of founders multiple roles on the founders involvement in R&D-R&D resources linkage is here envisaged by considering the impact of different priorities and pressures as well as the limits on the founders contribution to structuring R&D activities.

Founders involvement in a given functional area is an indication of the orientation of the firm and the priority assigned to such an area. Yet, founders involved in different functional areas may signal other firm priorities than research and invention (Boeker, 1989). In addition, resource

allocation to firms functional areas is influenced by upward influences stemming from middle and lower levels managers/officers (Currie, 1999). Therefore, founders involved in various functional areas are exposed to pressure which may drain resources out of R&D activities in favor of other functional areas that generate short-term, less uncertain, more controllable and/or easier to measure contribution to firms outcomes. Given a certain amount of available resources, a resource allocation depending on established priorities and influenced by upward pressures implies that founders with multiple involvements make investments in R&D competing with investments in other functional areas to a greater extent. Founders involvement in multiple functions tends to reduce investments made in R&D compared to firms with founders involved only in inventive activities. Consistently with the competence-based view, founders capabilities being highly specific and, at the same time, highly useful for structuring R&D activities, cannot be easily found and negotiated in a market. Absent a market and given the inherent biological and physical limits of founders, the flow of services spurring from founders specific capabilities are to be conceived as constrained. This argument parallels Penrose discussion of the constraints to the growth of the firm due to the limited managerial services (Penrose, 1955; Penrose, 1959). Since any functional area in which founders are involved is absorbing to some extent their capabilities, considering that founders services are in limited supply and cannot easily buy from the market, the greater the number of functional areas founders are involved in is, the lower the flow of services destined by founders to R&D activities are. This discussion leads to the following hypothesis.

H6. Founders multiple involvements negatively moderate founders involvement in R&D-R&D resources association.

3. Method

To empirically test our hypothesis, a survey is the chosen method. Although data as R&D resources, sales growth, and sales from new products are available from public sources, other information such as founders involvement in R&D and R&D outputs, in particular, the number of innovations produced by R&D activities, remain generally undisclosed, particularly in low research-intensive SMEs. Since one of the purposes of this paper is to address the salience of the mechanisms mediating and moderating the founders involvement in R&D-SMEs performance association, our research design is mainly cross-sectional. A cross-sectional design is an acceptable method of choice when a study is aimed to «*establish that the phenomenon is important (merely that it is understudied is insufficient), and then note that the first step is to ascertain some foundational relationships that are not currently understood*» (Spector, 2019, p. 135). As the main founders involvement in R&D-SMEs performance association has been already tested in a longitudinal design (Haeussler, Hennicke *et al.*, 2019), our paper offers a triangulation of established results in a different context and with a different design.

A cross-sectional design is affected by two main problems: common method variance and the inability to derive causal inferences. Therefore, this study combines measures collected from a personal interview with founders (e.g., founders involvement in R&D), others retrieved from public sources (e.g., R&D expenditures and sales growth) or accounting systems (e.g., the share of sales from new products), and other else provided by founders and then reviewed by experts (i.e., R&D outcomes in terms of innovations). Thus, using data from different sources, we mitigate the risk of the occurrence of occasion factors similarly biasing different measures.

As for the potential inability to derive causal conclusions because of the lack of temporal precedence between dependent and independent variables (Bowen and Wiersema, 1999), it is a material problem in all non-experimental settings, longitudinal research included. Nevertheless, such an issue is here faced by the adoption of a model channeling the effect of an independent variable on the dependent variable via mediators and moderators. At the same time, following extant literature (Aguinis, Edwards *et al.*, 2017), the survey was split into three periods, respectively

related to the measurement of R&D resources, of R&D outcomes, and SMEs performance (i.e., the share of new products and sales growth).

3.1. Sample

In our study we first defined the population of interest made by SMEs. A SME is defined as a business, independently operated, with total number of full-time equivalent employees less than 250 and with a turnover less than 50 million of euro. In order to reduce unexplained heterogeneity and to test our propositions in a setting of low research-intensity, population of interest was confined to manufacturing firms operating in the Southern part of Italy (i.e., *Basilicata*, *Calabria*, *Campania*, *Puglia*, *Sardegna* and *Sicilia*). Note that, according to “Europe 2020 indicators - R&D and innovation” report by Eurostat, the aforementioned regions show very limited research and development expenditures as well as limited innovative outputs compared to other Italian regions.

From the AIDA database, the total population of manufacturing SMEs located in the selected regions was 65,356, out of which 565,582 firms are located in the selected Southern Italy regions, 492,092 SMEs are firms with a number of employees less than 250 and turnover less than 50 million of euro. We selected a sample of 10% from the total universe. Firms included in the first sample were mailed to their legal address to participate in the survey; a month later, a reminder letter to not responding firms was sent. In total, we collected a declaration of participation from 366 firms. Then, an agenda of appointments for a face-to-face interview was set: out of 366 firms, 16 SMEs decided not to further participate in the survey. After collecting the data, we used the Mann-Whitney U test to detect differences between prompt/early participants and late/solicited participants. We also compared a subsample of firms that decided to participate in the survey with firms that later decided not to participate on publicly available data. From these comparisons, we did not observe any significant difference.

For the distribution of the sampled firms by industry, 47% are in the agri-food businesses, 6% in transportation services, 8% in the metal mechanical sector, 14% in furniture and wood industries, 12% in clothing and textile, 5% in chemical, 8% in computer, electronics and precision equipment. By region, the distribution is 9% in *Basilicata*, 21%, 10% in *Calabria*, in *Campania*, 23% in *Puglia*, 11% in *Sardegna* and 26% in *Sicilia*.

3.2. Variables

Two measures were used as dependent variables. The first one is the share of sales from newly introduced products in the firm (Dziallas and Blind, 2019). It is to capture the ability of SMEs to leverage the potential of inventive activities in new products sold in the market. The second measure is the difference between sales at time $t + 1$ and sales at time t , divided by sales at time t (Haeussler, Hennicke *et al.*, 2019). It is to capture the ability of SMEs to grow over time.

For the independent variable, founders are persons who contribute to setting up the new business. Their names are thus indicated in the deed of incorporation of the company. Given the time t a founder is involved in R&D if he/she has been in charge of inventive activities at times t , $t-1$, $t-2$, and $t-3$. Founders were asked to provide us with evidence of such involvement through organizational charts or board of meetings minutes. Turning to mediating variables, as a measure of R&D resources, we collected data on R&D expenditures and sales at times t , $t-1$, $t-2$, and $t-3$ as reported in annual reports, and calculated the ratio between R&D expenditures and sales. Considering that R&D intensity measures are highly correlated in time, we take the average value over the range period considered. For the number of innovations, empirical studies often employ patent data to measure innovation performance: such a measure may be appropriate for large as well as research-intensive SMEs, not for low research-intensive SMEs. In our sampled firms, patent applications are very few: nevertheless, it does not imply that a limited number of innovations was introduced. For several reasons, including doubts on the patentability of innovations, the cost and complexity of the patenting process, the preference for alternative methods of protecting

innovations (such as secrets), and the difficulty or impossibility to patent managerial and organizational innovations, patent data may be unavailable, misleading or reductive. Moreover, innovations different from product and process ones are important in SMEs, because the former complement the latter and are likely to make their benefits more appropriable (Donbesuur, Among et al., 2020). Accordingly, we measured R&D output with the number of innovations introduced, as indicated by the interviewed SME founders. Specifically, we asked him/her to list the innovations introduced in periods t , $t-1$, $t-2$, and $t-3$ in the firm, distinguishing among six types (see Tab. 1). Once collected the data, we reviewed the list of declared innovations at a firm level with two experts who were in charge to judge whether the claimed innovations were truly new or not. Only those innovations confirmed by both experts were considered.

Tab. 1: Descriptions of all the variables used in the analyses

Definition	Label	Measure	Role in the model
SMEs performance	<i>Npd</i>	Share of sales from newly introduced products over total sales at time $t+1$	Dependent variable
	<i>Sales_g</i>	Sales growth at time $t+1$ minus sales growth at the industry level	Dependent variable
R&D resources	<i>R&d_i</i>	Expenditures over total sales at time (average over three years period)	Mediator
R&D outputs	<i>R&D_o</i>	Number of innovations, distinguished in i) new materials, ii) new use for existing materials, iii) new product functionalities iv) new product designs; v) new production processes; (vi) new organizational and managerial methods	Mediator
Founder involvement in R&D	<i>I_rd</i>	A dummy variable: founder involvement in R&D in periods t , $t-1$, $t-2$, and $t-3$: 1 if yes, 0 otherwise	Independent variable
Number of other functional areas involving a founder at the same time	<i>N_inv</i>	Number of other functional areas which founder involved in R&D is in charge of at time t	Moderator
Founder gender	<i>Gender</i>	1 if founder involved in R&D is male, 0 otherwise.	Control variable
Founder age	<i>Age</i>	Age of founder involved in R&D at time t	Control variable
Founder tenure	<i>Tenure</i>	Founder involved in R&D number of years of in the firm at time t	Control variable
Founder education	<i>Education</i>	Founder involved in R&D highest degree (post graduate, graduate, high-school, mid-school, primary school)	Control variable
Localness of founder previous experience	<i>Localness</i>	1 if previous experience of the founder involved in R&D is in the same city in which he/she was born; 0.5 if in the same region in which he/she was born; 0 if outside the region in which he/she was born	Control variable
SME size	<i>Size</i>	Average number of full-time equivalent employees at time t	Control variable
Family involvement in the firm	<i>Family</i>	Number of other family members working in the firm at time t	Control variable
Industry	<i>Industry</i>	A dummy variable: 1 if the firm belongs to the selected industry, 0 otherwise	Control variable

Source: our elaboration

Tab. 1 shows that, as a moderating variable (i.e., founder's multiple involvements in SME), we measured at time t the number of other functional unities in which a founder is involved. Other functional areas are here referred to as finance, logistic, production, marketing, quality control, and human resources. For our independent variable, founders were asked to provide us evidence of such multiple involvements through organizational charts or board of meetings minutes. Because of the main cross-sectional design, given potential problems induced by omitted variables, we introduced a series of control variables. Some of them concern the background of the founder involved in

R&D, such as gender, age, tenure, education, and localness of his/her experience. Additionally, we controlled for firms size and the number of family members involved in the SMEs. In estimating the R&D resources-R&D outputs relationship, to control for cases with R&D expenditures equal to zero, we introduced a dummy variable which is equal to 1 in case R&D expenditures in periods t , $t-1$, $t-2$, and $t-3$ are equal to 0, and 0 otherwise.

3.3. Regression procedure

In order to test our propositions, given the independent, mediators, moderator, dependent, and control variables, seemingly unrelated regression (SUR) equations were adopted (Zellner, 1962). Such a model uses an asymptotically efficient, feasible, generalized least-squares algorithm that is particularly suitable to fit mediation and moderation models (Beasley, 2008). In this vein, SUR is able to jointly estimate parameters that can be used to separate out the total direct effect of founders involvement in R&D on SMEs performance and the indirect effect channeled via mediators (i.e., R&D resources and R&D outcomes), given the role of the moderating variable.

The selected procedure is also able to handle contemporaneous cross-equation error correlation, which is often observable in linear regression equations adopted in mediation/moderation analyses (Preacher and Hayes, 2008). Extant empirical research have also used the SUR for assessing the performance of SMEs (Yan and Guan, 2019; Johann, Block *et al.*, 2021) as well as for estimating and comparing indirect effects on categorical independent variables (Rochon, 1996), by using the procedure suggested by Hayes and Preacher (2014). In this study, three sets of linear regression equations were simultaneously estimated: (1) the effect of the founders involvement in R&D and potential confounders on the R&D resources; (2) the effect of founders involvement in R&D and R&D resources and potential confounders on R&D outputs; and (3) the effect of founders involvement in R&D, R&D resources, R&D outputs and potential confounders on SMEs performance.

Using the delta method as operationalized in the nlcom STATA-command (Feiveson, 1999), the total indirect effect of founders involvement in R&D via mediators/moderators on the SMEs performance was calculated. Since nlcom is based on the delta method, which assumes that the total indirect effect is normally distributed (Oehlert, 1992), standards errors and confidence interval using a bootstrap procedure (Preacher and Hayes, 2008) were calculated too.

4. Research findings

Pairwise correlation matrix among our variables of interest is reported in Tab. 2.

Tab. 2: Correlation table

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. <i>Npd</i>	1												
2. <i>Sales_g</i>	.15*	1											
3. <i>R&d_i</i>	.17*	.10*	1										
4. <i>R&d_o</i>	.27*	.11*	.25*	1									
5. <i>I_rd</i>	.15*	.14*	.13*	.19*	1								
6. <i>N_inv</i>	.01	.03	-.04	-.06	.50*	1							
7. <i>Gender</i>	.01	-.03	-.01	.05	-.09	-.19*	1						
8. <i>Age</i>	-.01	.03	-.01	.04	-.01	-.06	-.09	1					
9. <i>Tenure</i>	-.06	.02	-.04	.08	.01	-.03	-.12*	.87*	1				
10. <i>Education</i>	.07	.02	.18*	.08	-.09	-.18*	.11*	-.17*	-.28*	1			
11. <i>Localness</i>	-.13*	-.18*	-.12*	-.13*	-.01	.06	.12*	-.14*	-.12*	-.18*	1		
12. <i>Size</i>	-.05	-.24*	-.02	.17*	-.08	-.14*	.10	.06	.06	.14*	.013	1	
13. <i>Family</i>	.01	-.06	.05	.17*	-.04	-.15*	.13*	.05	.05	.12*	-.03	.54*	1
<i>Mean</i>	7.48	0.01	1.69	0.47	0.37	2.63	0.76	45.51	22.66	3.12	0.66	15.48	4.22
<i>SD</i>	15.56	0.80	5.63	0.18	0.48	2.50	0.43	10.50	11.43	0.73	0.47	21.90	9.13

* $p < .05$; $N = 350$; For space reasons, control variables related to the industry are omitted.

Source: our elaboration.

Given correlations and mean and standard deviation of the considered variables as in Tab. 2, we controlled for the matrix of correlation coefficients to be semidefinite positive. The presence of potential multi-collinearity conditions in used data was explored by inspecting the magnitude of inter-variables correlations, particularly in cases where the coefficient is greater than .7 (Mansfield and Helms, 1982). We also tested for the effect of potential non-normality data in our estimates by comparing the correlation coefficients in Tab. 2 with those obtained from the Spearman pairwise correlations. We observed that signs and significance levels of our correlation coefficients hold constant.

4.1. Main effects

The main effect was tested by running a regression of founders involvement in R&D on SMEs performance. To assess the potential effects of endogeneity in estimates, for SMEs performance we also run an instrumental regression, with founders involvement in R&D expressed as a function of firms location in a given province and in given industry (see Tab. 3).

Tab. 3: Impact of Founders involvement in R&D on SMEs performance

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)	Model (8)
<i>I_rd</i>	//	4.23** (2.41)	8.82** (9.23)	//	//	0.22* (2.48)	.17** (3.22)	//
<i>Blue collar</i>	//	//	//	1.10 (.31)	//	//		-.02 (-.09)
<i>Middle-level manager</i>	//	//	//	.13 (.05)	//	//		.12 (.98)
<i>Top manager</i>	//	//	//	-2.73 (-.56)	//	//		.27 (1.10)
<i>Founders</i>	//	//	//	4.21* (2.08)	//	//		.27** (2.65)
<i>Sex</i>	.53 (.27)	.95 (.49)	1.05† (1.67)	.91 (.46)	.02 (.21)	.04 (.43)	.03 (.65)	.03 (.36)
<i>Age</i>	.22 (1.38)	.95 (.49)	.05 (.71)	.21 (1.32)	.01 (.30)	.01 (.24)	.01 (.65)	.01 (.05)
<i>Tenure</i>	-.25† (-1.67)	-.24 (-1.61)	-.05 (-.78)	-.24 (.12)	.01 (.03)	.01 (.45)	.01 (.60)	.01 (.18)
<i>Education</i>	.77 (.61)	.92 (.73)	.73 (1.61)	.92 (.73)	.05 (.79)	.05 (.92)	.05 (1.42)	.05 (.87)
<i>Localness</i>	-3.67* (-2.02)	-3.69* (-2.05)	-2.58** (-3.24)	-3.71* (-2.04)	-.29** (-3.17)	-.29** (-3.21)	-.22** (-4.21)	-.29** (-3.18)
<i>Size</i>	-.05 (-1.09)	-.04 (-.89)	-.01 (-.82)	-.04 (-.89)	-.01 (-4.77)	-.01** (-4.58)	-.01** (-4.77)	-.01** (-4.65)
<i>Family</i>	.01 (.10)	.01 (.04)	.02 (.51)	-.01 (-.02)	.01 (.14)	.01 (1.41)	.01 (.60)	.01 (1.47)
<i>Constant</i>	.93 (.14)	-.81 (-1.12)	-.28 (-1.15)	-.99 (-1.15)	.03 (.91)	-.05 (-1.16)	-.19 (-1.18)	-.02 (-.06)
<i>Industry dummies</i>	YES	YES	YES	YES	YES	YES	YES	YES
R-squared (Wald chi2)	.08	.10	(5239.48**)	.10	.10	(287.91**)	.11	.13
N	350	350	350	350	350	350	350	350
Vif (Chi2 endogeneity test)	1.75	1.72	(2.19)	1.69	1.75	1.72	(.15)	1.69

† $p < .10$ * $p < .05$; ** $p < .01$; Dependent variable in models (1) to (4) is the share of new products on total sales at time $t+1$; dependent variable in models (5) to (8) is sales growth; t -tests in parenthesis for all models but models (3) and (7) in which z -scores are reported; coefficients are unstandardized betas; models (3) and (7) use instrumental variables (gmm) regression, with *I_rd* as a function of province, industry, and other control variables.

Source: our elaboration

Only considering direct effects, reported data show that founders involvement in R&D has a positive and significant effect on the share of sales of new products over total sales as well as on sales growth. Concerning both SMEs measures of performance, the significant effect of founders involvement in R&D holds positive and significant even if we use an instrumental variable (gmm) regression, with the resulting χ^2 endogeneity test between I_rd and SMEs performance that turns to be insignificant. For robustness, we also contrasted in models (4) and (6) founders vs others involvement in R&D and observed that the greatest significant effect on SMEs performance is observed when founders are involved in R&D activities. As a consequence, the analysis in Tab. 3 provides robust evidence that confirm our hypothesis 1. Thus, founders involvement in R&D matters also for low research-intensive SMEs.

4.2. Mediation effects

Mediation effects were tested by using SUR, where models from (1) to (4) are jointly estimated. Results are reported in Tab. 4.

Tab. 4: SUR of founders involvement in R&D and SMEs performance by considering mediators ($R\&D_i$ and $R\&D_o$) and a moderator variable (N_inv)

	Model (1)	Model (2)	Model (3)	Model (4)
I_rd	2.79** (3.90)	.07** (3.62)	2.34 (1.36)	.17 (1.93)
N_inv	-.09 (-.50)			
$N_inv \times I_rd$	-.49† (-1.74)			
$R\&d_i$.01** (2.34)	.19 (1.21)	.01 (.92)
$R\&d_o$			18.84** (4.09)	.44* (1.86)
Sex	-.23 (-.34)	.04† (1.89)	.40 (.22)	.03 (.31)
Age	.02 (.30)	-.01* (-1.90)	.27† (1.74)	.01 (.40)
$Tenure$	-.02 (-.47)	.01* (2.55)	-.31* (-2.16)	-.01 (-.11)
$Education$	1.25** (2.83)	.01 (.72)	.26 (.22)	.04 (.64)
$Localness$	-.96 (-1.51)	-.03† (-1.81)	-2.74 (-1.59)	-.27** (-3.02)
$Size$	-.02 (-1.12)	.01* (2.13)	-.06 (-1.32)	-.01** (-4.84)
$Family$.03 (.86)	.01 (.94)	.02 (-.17)	.01 (1.37)
$R\&D\ Dummy$		-.07** (-2.97)		
$Constant$	-2.19 (-.94)	.48** (6.16)	-7.57 (-1.12)	-.20 (-.59)
Industry dummies	YES	YES	YES	YES
R-squared	.09	.20	.15	.13
N	350	350	350	350
F-stat	3.46**	5.77**	3.93**	3.25**

† $p < .10$; * $p < .05$; ** $p < .01$; Dependent variable is $R\&D_i$ in model (1), $R\&D_o$ in model (2), Npd in model (3); sales_g in model (4); t -tests in parenthesis; coefficients are unstandardized betas. Endogeneity also examined by mean the Breusch-Pagan test of independence: $\chi^2(6) = 2.46$, $p = 0.87$.

Source: our elaboration

The significance of mediators in channeling the effects of founders involvement in R&D to SMEs performance is here analyzed by observing the magnitude of both the coefficients I_{rd} in models (3) and (4) and of the indirect effects represented by $R\&D_i$ and $R\&D_o$. On the one hand, while Tab. 3 offered empirical evidence of the significant, positive influence of founders involvement in R&D on SMEs performance, once controlled in models (3) and (4) for mediators, in particular R&D resources and outputs, such significance turns to vanish. On the other hand, the significance of the indirect effects depicted in Fig. 1 was assessed by the following equation: $(\beta_a \times \beta_b + \beta_c) \times \beta_d$, with the beta coefficients taken from Tab. 4. Concerning the share of sales from newly introduced products over total sales as a measure of SMEs performance, the total indirect effect calculated according to the delta method is equal to 1.61 (*Standard error* = .13, $p < .01$) and with bootstrap procedures is equal to 1.56 (*Standard error* = .62; $p < .01$). Considering sales growth as a dependent variable, the total indirect effect with delta method is equal to .064 (*Standard error* = .0055, $p < .01$) and with bootstrap is equal to .036 (*standard error* = .025; $p < .10$). The magnitude of the indirect effects over the total direct effect of founders involvement in R&D on SMEs performance was determined by means, the ratio of the indirect effect over the sum of indirect and direct effects. For the share of sales from newly introduced products over total sales the considered ratio is equal to 40,75% ($= 1.61 / (1.61 + 2.34)$); for sales growth, it is equal to 27.35% ($= .064 / (.064 + .17)$).

In our model is also possible within the indirect effect to try to separate the effect of structuring, from bundling and leveraging. In this vein, we calculated the indirect effect net of path c, which is the effect of founders involvement in R&D, via bundling capacities, of producing innovations out of R&D investments, holding constant such investments. For the share of sales from newly introduced products over total sales, the new total indirect effect calculated according to the delta method is equal to .32 (*Standard error* = .03, $p < .01$); and for sales growth is equal to .013 (*Standard error* = .0014, $p < .01$). Our results suggest that founders involvement in R&D not only increases the resources invested in R&D, but holding constant such a resource, the innovation outputs are increased compared to other firms in which such involvement is absent. This is an indication that founders bundling and leveraging matters and are to produce an increase on the indirect effect by 80% ($= (1.61 - .32) / 1.61$) for the share of sales from newly introduced products over total sales and of 79% ($= (.064 - .013) / .064$) for sales growth.

From our data, consistently with hypotheses 2, 3, and 4, we observed that founders involvement in R&D is likely to produce positive effects on R&D investments and, at the same time, that increased investments in inventive activities improve innovation outputs which, in turn, enhance SMEs performance. In addition, results offer evidence that founders involvement in R&D-SMEs performance is mediated by R&D resources and R&D outputs, as predicted by hypothesis 5.

4.3. Moderation effects

We tested the moderating effect of founders multiple involvements in functional areas different from R&D in SMEs. As expected, the interaction effect between I_{rd} and N_{inv} is negative and significant at the level of $p < .10$. To take into account the full effect of the moderating variable, we tested the joint significance levels of N_{inv} and $I_{rd} \times N_{inv}$, finding a value of $F(2, 1338)$ equal to 3.49 ($p < .03$). Our results provide evidence that founders involvement in multiple functional areas reduces his/her ability to structure resources in inventive activities. Therefore, hypothesis 6 is confirmed by data.

4.4. Robustness

The robustness of our results was checked by relying on two basic methods. On the one hand, following Altonji, Elder, and Taber (2005) we tested results robustness by inspecting whether moving from less to more restricted models significantly alters the coefficients of interests, specifically the I_{rd} - $R\&D_i$ association. Since it is at the starting point of the considered chains of

effects as in Fig. 1, it may be more affected by omitted variables. The *psac* procedure as available in STATA was used, observing that both controlled and uncontrolled beta coefficients associated with *I_rd* are positive and significant and that their difference is very limited ($= 0,17$). We also calculated the delta value which is equal to $.68$, well below the value of 1 . On the other hand, an identification strategy based on a Rajan and Zingales (1998) type was followed. We interacted *I_rd* with some sector-level factors, such as level competitiveness. As a result, the beta coefficient associated to *I_rd* remained positive (i.e., equal to 1.79) and highly significant (t -test = 2.91 , $p < 01$), while the interaction effect was insignificant ($p < .34$).

5. Conclusions

This study theoretically discusses the implications of founders initial and enduring involvement in R&D activities for SMEs performance. After developing six propositions, we found strong empirical evidence that founders involvement in R&D matters. Furthermore, the founders involvement in R&D-SMEs performance association is significantly channeled through inventive activities and the innovation outputs derived from such R&D investments. In addition, a founder with multiple involvements within the relevant SME tends to reduce his/her ability to orchestrate R&D resources.

Our analysis has important implications for academics and firms responsible and/or policy makers alike.

We contributed to the stream on orchestration theory by discussing and analyzing the pivotal role of founders for structuring, bundling, and leveraging inventive resources not only in high research-intensive firms (Haeussler, Hennicke *et al.*, 2019) but also in low research-intensive SMEs. We also addressed not only who and whose role is important for inventive resource orchestration (Chirico, Sirmon *et al.*, 2011; Haeussler, Hennicke *et al.*, 2019) but also “how” and “under what conditions” such a role is made relevant for SMEs performance. Concerning “how”, we add that founders involvement in R&D-SMEs performance relation is mediated by R&D resources and outcomes. Thus, within the debate on the founders role (Zuzul and Tripsas, 2020), whether founders exit (Willard, Krueger *et al.*, 1992) or stay in the firm (Haeussler, Hennicke *et al.*, 2019) is better for firm performance, we advanced that SMEs performance are enhanced if and only if founders involvement in R&D turns to increase both the R&D investments and the innovation outputs arising from such investments. If either R&D resources or R&D outputs or both were not enhanced, founders involvement in R&D would provide no systematic benefit to SMEs performance. Concerning “under what conditions”, recalling Wasserman (2012) discussion of founders dilemmas also in relation to the roles played in firms, we found that, on the one hand, founders involvement - far from being limited to top management positions, like CEO or CFO or CTO - should invest specific functional roles, specifically R&D. On the other hand, founders who tend to be like a king in their companies, controlling all activities and occupying directly various positions in the firm, attenuate the positive effects of their involvement in R&D activities on firms performance.

Our study is not without limitations. The dependent variable, i.e. SMEs performance, was operationalized and calculated by means of two measures, both revenue-based. Other studies could test the same variable by adopting multiple performance measures, even cost- and/or income-based. Moreover, the impact of founders involvement in R&D firstly on innovative performance and, then, on firm performance as a whole could be inquired. The considered propositions, here tested on manufacturing SMEs in Southern Italy, could be empirically analyzed in other geographic areas and/or in non-manufacturing SMEs. Instead of the cross-sectional design here employed, further studies could adopt a longitudinal design and, given the underlying theoretical background, test the suggested associations over longer periods. It would also be of interest to consider under what conditions the negative effect of founders multiple involvements in SMEs may turn to be positive because of synergies arising from the expertise gained in different functional areas of SMEs. At the

same time, it could be investigated the impact of R&D organizational configuration (e.g., centralization, standardization, formalization) on founders involvement in inventive activities.

As anticipated, our study has also some implications for practice. On the one hand, founders involved in R&D activities boost the performance of their firms: with their specific capabilities, founders offer an important contribution to structure, bundle, and leverage firms R&D resources, thus making the latter positively impact firms performance. SMEs founders should also be warned against being like a king involved in too many functional activities. On the other hand, policy makers should acknowledge such an important role of founders in SMEs and thus create incentives to stimulate founders of SMEs to be more involved in R&D. Lastly, our findings are important for financing and education/training programs: founders involvement in R&D should be carefully considered in funding firms operating in traditional industries and/or with a low research-intensity, as well as innovative entrepreneurship should be emphasized in a world dominated by SMEs.

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Does trust encourage social entrepreneurship?

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Abstract

Objectives. *In this study we propose an explorative empirical analysis that will investigate how the three dimensions of trust (personal, collective and institutional trust) can impact on social entrepreneurship.*

Methodology. *In this study we propose a factor analysis and a linear regression analysis, to test the effect of different dimensions of trust on social entrepreneurial intention.*

Findings. *This study contributes to the literature by showing which are the main aspects of trust that can be built, stimulated, encouraged, to promote social entrepreneurship. More concretely, this study shows how accompanying young people in volunteer experiences can be important to stimulate social entrepreneurial intention.*

Research limits. *The small size of the sample and its concentration in a single region does not allow us to be able to generalize our results on a large scale.*

Practical implications. *Voluntary activities should be promoted as they represent an effective tool for the development of a feeling of trust in the entrepreneurial and territorial reality, which highlights the opportunities offered by a territory and the willingness to contribute so that these opportunities become concrete projects.*

Originality of the study. *The present study focuses on voluntary activities, still poorly investigated in the literature, i.e. on the experience within voluntary associations understood as the Association of Italian Catholic Guides and Scouts or to a Catholic Action Group.*

Key words: *entrepreneurial trust; social entrepreneurship; volunteering experiences;*

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1. Introduction

Entrepreneurship plays a fundamental role in the socio-economic development because the presence of business activities creates value for its inhabitants and, therefore, supports the community well-being. Within the field of entrepreneurship, **social entrepreneurship (SE)** is becoming a very interesting topic among scientists and policy makers. It differs from conventional entrepreneurship insofar as it emphasizes social outcomes ahead of economic returns.

The literature is rich of contributes (Dees, 1998; Peredo and McLean, 2006; Zahra *et al.*, 2009; Dacin *et al.*, 2010; Short *et al.*, 2009). Some of them (Dees, 1998) argue that “*For social entrepreneurs, the social mission is explicit and central.... Mission-related impact becomes the central criterion, not wealth creation. Wealth is just a means to an end for social entrepreneurs [emphasis added]*” (1998: 3). The claim that any wealth generated is just a mean to the social end suggests that financial benefit to the entrepreneur has no place among the goals of the undertaking. Accordingly, a large body of literature (e.g. Dees, Emerson and Economy, 2002) locates the concept of social entrepreneurship in the world of non-for-profit (NFP) organizations.

For another branch of literature, social entrepreneurship necessarily involves “enterprise,” in the sense of some form of income-generating venture, determined, however, not on profit but on social benefits. Thus, NFPs taking this route are often described as “hybrids” (Davis, 1997) in recognition of the way that they combine nonprofit with for-profit organizational features.

According to Peredo and McLean (2006) social entrepreneurship is a NFP concept, and a range of opinion as to whether or to what extent they might or must be involved in some form of revenue-generating exchange. The authors, in fact have shown that a survey of the appearance of the term “social entrepreneurship” in scholarly and non-scholarly publications over a 15-year period, suggested that fully 83% of press references to “social entrepreneurship” referred to examples from the NFP sector. This paper considers that “*the social entrepreneur is overwhelmingly a nonprofit sector phenomenon*” (Taylor *et al.*, 2000: 6).

Social entrepreneurship literature acknowledges that social capital is vital to the success of social entrepreneurship efforts and trust is integral to the process of building social capital, and also the importance of trust, because it contributes to the process of building social capital to promote positive life and business experiences (Ayob 2018; Trigkas *et al.*, 2021).

Moreover, trust is a crucial factor that encourage *entrepreneurship* among young people, since it improves the desire to do something useful for their territory (Sheppard and Sherman 1998; Tack *et al.*, 2017). Social capital helps social entrepreneurs relieve social problems and enter the public sphere (Mair and Marti, 2006). Scheiber (2014) finds that social capital allows social entrepreneurs to develop a better understanding of complex social problems, which results in more effective social entrepreneurship initiatives. Entrepreneurship literature acknowledges that trust is integral to the process of building social capital (Bogren and von Friedrichs, 2016; Zhang and Hamilton, 2010). However, social entrepreneurship literature largely neglects the analysis of trust itself (Curtis *et al.*, 2010). Trust is unquestionably central in social entrepreneurship efforts. It facilitates cooperative behavior, decreases negative conflict, reduces transaction costs, promotes network relations, enables rapid team building, and encourages active responses to crises (Rousseau *et al.*, 1998); all of these are critical issues in social entrepreneurship efforts. Glaeser *et al.* (2000) show that when individuals are closer socially, trust rises.

However, there has been limited research on trust itself in social entrepreneurship literature. This article aims to begin filling this gap by investigate on trust as one of the main factors that can impact on social entrepreneurship efforts. The present paper attempt to offer a contribute to the literature by answering the following research question: *how volunteering experiences and trust impact on the entrepreneurial intention to became social entrepreneurs?*

In order to answer our research question, we focus on the experience within two religious voluntary associations still little investigated: Association of Italian Catholic Guides and Scouts (AGESCI)’s or to a Catholic Action Group (AC).

The paper is organized as follows: section one focuses on the role of trust on the social entrepreneurship. Then, it focuses on the three dimensions of trust entrepreneurship. Section three shows the methodology and empirical analysis. The results are discussed in the fourth section while in the last section we conclude with the limitations and future research.

2. Trust and Social Entrepreneurship

Social entrepreneurship has generated much interest in the private, public, and not-for-profit sectors. Although there are many definitions for this concept, social entrepreneurship can broadly be described as “*a process involving the innovative use and combination of resources to pursue opportunities to catalyze social change and/or address social needs*” (Mair and Marti, 2006, p. 37). Many variables impact on the social entrepreneurial intention. Trust is an essential component of social entrepreneurship success (Tack *et al.*, 2017) and it can be taken in three different forms: Personal trust, Collective trust and Institutional trust.

Although several studies have investigated the role of different forgetfulness, still few studies have focused on linking all dimensions of the Trust to the intention of creating a new company.

2.1 Personal trust (PF)

For personal trust “*a record of prior exchange, often obtained indirectly or by imputation from outcomes of prior exchange, provides data on the exchange process*” (Zucker, 1986, p. 60). The category of personal factors includes all the factors regarding individuals’ characteristics (personality traits and personal history). It can be measured through the honesty, the reliability, the person’s inclination to trust arising from their personal traits, their fear of unexpected and their ability to risk trusting an individual (Młokosiewicz and Misiak-Kwit, 2017; Welter and Smallbone, 2006) education (Elnadi *et al.*, 2020) and also Situational Attribution (McLeod, 2012). This means that trust is governed by norms, values, and codes of conduct inherent in a business environment (e.g., a business association) and/or a wider society (Welter and Smallbone, 2006).

2.2 Collective trust (CT)

Collective trust that concerns the trust born within a community that shares a goal, whether it is an ethnic group, a network, an association, or an industrial sector. Communities are made up of people, so it is almost obvious to emphasize how collective trust is influenced by personal trust and vice versa (Welter, 2012); also, the institutional component also assumes a certain relevance in the literature on Entrepreneurship. Collective trust that concerns the trust born within a community that shares a goal, whether it is an ethnic group, a network, an association, or an industrial sector. Belonging to a volunteer group can be a good experience to generate collective trust (Glaeser *et al.*, 2000).

Without education, every country is irreparably condemned to poverty and backwardness. It represents the foundation of a nation’s progress, showing people how to live together in a world characterized by diversity and pluralism. Education offers citizens the opportunity to develop their potential, to increase their knowledge and skills, to discover their talents and use them to contribute to the intellectual wealth of their territory (Astuti *et al.*, 2021).

Whereas formal education takes place almost exclusively in schools and universities, the so-called Informal Education draws from the multiplicity of experiences lived every day, assuming a primary role in strengthening the social and professional integration of the younger generations (Khasanzyanova, 2017). Indeed, for young people, associations are a training ground for life, for the development of skills that may prove useful in the work world. In this perspective, volunteering activities become an integral part of Informal Education, being beneficial for personal and professional development (Khasanzyanova, 2017). In this perspective *the educational dimension of*

volunteering should not be underestimated; in fact, it promotes autonomous learning, oriented to character formation rather than the acquisition of concepts and notions. (Khasanzyanova, 2017). Talking about informal education, it is necessary to recall the concept of lifelong Education, defined as: «*All learning activity undertaken throughout life, with the aim of improving knowledge, skills and competences within a personal, civic and/or employment-related perspective*» (Khasanzyanova, 2017). In globalized economies sociable, responsible and initiative-taking people are preferred to others (Khasanzyanova, 2017). The concept of social competence refers to those skills emerging thanks to cooperation; it is, therefore, a set of skills necessary for the individual to be integrated into a society (Khasanzyanova, 2017). Soft skills are nothing more than the social dimension of skills. They can be defined as: «*Attitudes and behaviors displayed in interactions among individuals that affect the outcomes of various interpersonal encounters*» (Khasanzyanova, 2017). The significant increase in the demand for soft skills to access almost all job positions is attributable to their transversality, to their ability to describe human nature. They represent, in fact, the answer to the triple need of twenty-first century companies: better management of interpersonal relationships, better understanding of the action scenario; worker's well-being (Khasanzyanova, 2017).

Thus, the intrinsically dynamic character of volunteer associations, naturally oriented to action, makes them fertile ground for the development of trust in new generations.

2.3 Institutional trust (IT)

Thus, Institutional trust embraces those bureaucratic and regulatory aspects that contribute to increasing citizen trust in territorial institutions (Welter, 2012). These are three conceptual levels in continuous dialogue, reinforcing or weakening each other.

Much of the debate on trust in the entrepreneurial world focuses on social capital and networks, within which trust improves the relational environment and favors the recognition and construction of opportunities, business and otherwise. Since trust creates lasting bonds, it appears fundamental for the stability of any 'network' relationship and for the development of social capital (Welter, 2012).

Institutional trust includes macro factors that are a less nourished strand of literature, because at the end of last century experts in the field started to believe that the Ecosystem a person belongs to, determine its choices as much as its family experience (Elnadi and Gheith, 2021). The entrepreneurial ecosystem, is defined as: «*An interconnected group of actors in a local geographic community committed to sustainable development through the support and facilitation of new sustainable ventures*» (Elnadi and Gheith, 2021). In other words, it can be said that an entrepreneurial ecosystem is closely linked to a geographical area, embraces political, social, economic and cultural elements, deals with promoting and encouraging entrepreneurship as a springboard for the development of the territory (Elnadi and Gheith, 2021). Within these factors, entrepreneurship education (formal) plays a fundamental role.

3. Methodology

3.1 Survey and Sample

We propose an explorative empirical analysis that will investigate how the three dimensions of trust (personal, collective and institutional trust) can impact on social entrepreneurial intention (SEI). A focus will be on the volunteers' experiences on the Institutional trusts among young people living in Calabria (a developing region in the south of Italy).

The data collected for the purpose of the analysis come from a sample composed of 133 individuals, young people from Calabria aged between 16 and 30 years, quite homogeneous as regards gender (50% males and 50% females) and spatial location within the regional territory.

The study adopts a quantitative approach; specifically, we used different validated scales to measure the different variables that impact on SEI. Thus, the questionnaire (Table 1) was structured into 3 macro sections:

- the first aimed at collecting general information on the volunteers and contains socio-demographic questions and others aimed at extracting data on the personal condition (gender, age, educational experiences, degree course, academic year, the place of residence and the province of residence).
- The second section concentrated on the measure of the construct of Social Entrepreneurial intention (SEI) (Hockerts, 2017). Specifically, we use a 5-point Likert-type response format ranging from 1, “strongly disagree” to 5, “strongly agree”.
- The third section investigated the main items that could influence SEI, specifically, we concentrated on:
 - Personal trust (Młokosiewicz and Misiak-Kwit, 2017). We used validated scales from the existing literature (Aasheim *et al.*, 2009; Zhang, 2012; Nga and Shamuganathan, 2010; Tiwari *et al.*, 2017 and also from Acedo-Carmona and Gomila, 2014). Specifically, we concentrated on a set of different items (Table 1).
 - Collective trust (Acedo-Carmona and Gomila, 2014). Belonging to a volunteer group can be a good experience to generate collective trust (Glaeser *et al.*, 2000). Then, stemming from Glaeser *et al.*, (2000), we focused on variables related to the volunteer activities and on the belonging of people to the Association of Italian Catholic Guides and Scouts (AGESCI)’s or to a Catholic Action Group (AC). It concerns the trust born within a community that shares a goal, whether it is an ethnic group, a network, an association, or an industrial sector.
 - There are questions that investigate on the Institutional trust (Urban, 2013). It will be associated with forms of economic encouragement, on the prevailing values, on the beliefs and on social habits. Questions refer to the infrastructures that can be used to develop social entrepreneurship but also on regulation, bureaucracy and external ecosystems.

Table 1
Items and questions of the questionnaire

Constructs	Items	Questions	Reference
Social Entrepreneurial Intention	SEI	I expect that at some point in the future I will be involved in launching an organization that aims to solve social problems. I have a preliminary idea for a social enterprise on which I plan to act in the future. I do not plan to start a social enterprise (Item is reverse coded)	Hockerts, 2017
Institutional trust	Social business opportunities	You believe that your territory offers social business opportunities	İrengün and Arıkboğa, 2015
Institutional trust	Infrastructures	You believe that road infrastructure is adequate to support social business activities	Urban, 2013
Institutional trust	Burocracy	You believe that it is easy to complete the bureaucratic procedures necessary to start a social business	Urban, 2013
Institutional trust	Regulation	You believe the current regulation favours the birth of social entrepreneurial realities	Urban, 2013
Institutional trust	Public funds	That you know it is possible to have access to public funding funds	Urban, 2013
Institutional trust	Entrepreneurial Ecosystem	Do you think that the external ecosystem can offer good opportunities to young people?	Cavallo <i>et al.</i> , 2019
Institutional trust	Entrepreneurial Ecosystem	Do you think that the external ecosystem can influence entrepreneurial decisions?	
Collective trust	Trust network	If a colleague is having difficulty, you help them without expecting anything in return	Acedo-Carmona and Gomila, 2013
Collective trust	Trust network	If, during group work, someone suggests a “shortcut” to make things easier, you discourage the action	Acedo-Carmona and Gomila, 2014
Collective trust	Voluntary group	Have you been part of a voluntary group (scout group)?	Glaeser <i>et al.</i> , 2000
Collective trust	Voluntary group	Have you been part of a voluntary group (Catholic Action Group)?	
Personal trust	Delegation of tasks	You can delegate important tasks	Acedo-Carmona and Gomila, 2014
Personal trust	Ability to work in teams	You help to create a climate of dialogue and exchange of ideas	Aasheim <i>et al.</i> , 2009; Nga and Shamuganathan 2010

Personal trust	Communication skills	You can present a project in a clear and exhaustive way	Aasheim <i>et al.</i> , 2009; Nga and Shamuganathan 2010
Personal trust	Communication skills	When you have to speak in public, you assess every possible contingency	Aasheim <i>et al.</i> , 2009; Nga and Shamuganathan 2010
Personal trust	Creative thinking	It happens you have ideas that no one had thought of before	Aasheim <i>et al.</i> , 2009; Nga and Shamuganathan 2010
Personal trust	Interpersonal skills	During group activities you are the first to speak	Chaker and Jarraya, 2021; Li <i>et al.</i> , 2021
Personal trust	Interpersonal skills	During group activities you express your opinion	Zhang, 2012
Personal trust	Interpersonal skills	During group activities you tend to make your idea prevail	Aasheim <i>et al.</i> , 2009; Nga and Shamuganathan 2010
Personal trust	Interpersonal skills	During group activities you listen to and respect others' opinion	Aasheim <i>et al.</i> , 2009; Nga and Shamuganathan 2010
Personal trust	Leadership (int skills)	You can make yourself understood when expressing your point of view	Tiwari <i>et al.</i> 2017; Zhang, 2012
Personal trust	Leadership skills	You can put together the opinions of the group	Tiwari <i>et al.</i> , 2017; Zhang, 2012
Personal trust	Opportunity identification	You are able to identify concrete opportunities	Tiwari <i>et al.</i> , 2017; Zhang, 2012
Personal trust	Organizational skills	You complete the tasks assigned to you	Aasheim <i>et al.</i> , 2009; Nga and Shamuganathan 2010
Personal trust	Problem solving	When a problem arises, you are able to come up with concrete solutions	Aasheim <i>et al.</i> , 2009;
Personal trust	Problem solving	You look at things from different perspectives and sometimes you find solutions to impossible problems	Zhang, 2012
Personal trust	Problem solving	You find concrete solutions to problems	Zhang, 2012
Personal trust	Project management skills	You take care of the division of tasks and / or the assignment of tasks	Zhang, 2012
Personal trust	Project management skills	If you do not have a fixed deadline you tend to postpone the work to be done	Zhang, 2012
Personal trust	Project management skills	You plan your work and commit to it	Aasheim <i>et al.</i> , 2009;
Personal trust	Project management skills	You know how to manage your days by taking into account the unexpected	Aasheim <i>et al.</i> , 2009;
Personal trust	Project management skills	The unexpected does not scare you; you are good at reprogramming	Aasheim <i>et al.</i> , 2009;
Personal trust	Resilience	When you face a challenge, you have no difficulty in overcoming the obstacles that arise	Tiwari <i>et al.</i> , 2017
Personal trust	Self- efficacy	You're not afraid to experiment even when you might fail	Tiwari <i>et al.</i> , 2017
Personal trust	Stress management	Working under pressure does not scare you	Zhang, 2012; Nga and Shamuganathan (2010)
Personal trust	Social Educational programs	Your studies are providing you with adequate skills to start a social business	Elnadi <i>et al.</i> , 2020;

3.2 Empirical analysis

The empirical analysis used IBM's Statistical Package for Social Science (SPSS) statistical program. First, the overall reliability of the model as well as the individual constructs was verified, making sure that the Cronbach Alpha was greater than 0.5. Out of a sample size of 133, only two cases were found to be invalid for the purposes of the analysis, guaranteeing a percentage of legitimacy of 98.5%. Overall, the model is reliable, with a Cronbach alpha of 0.850 out of 35 variables considered. The quantitative approach is already used by several authors to study the main factors that influence entrepreneurial intention. The empirical analysis was divided into several steps: from the creation of the questionnaire (explained earlier); To the Exploratory Factor Analysis used to achieve a reduction in data complexity. Once an acceptable solution of the factor model was reached, the factor scores were saved and used as input for multivariate linear regression. Finally, after analyzing the descriptive statistics, the results of the multivariate linear regression were

interpreted to analyze the effect of the independent variables (factors that emerged in the factor analysis and others) on social entrepreneurial intention.

3.2.1 Factor analysis

The size of the model was then reduced by factor analysis which received quantitative items on a 7-point metric scale as input. Several attempts were made until the ideal solution presented in this paragraph was reached. In particular, in the various attempts, the variables that saturated multiple factors, or that had coefficients lower than 0.4 on all factors, were eliminated. The solution obtained is shown below.

The first index that is taken into consideration is the KMO index, which is constructed by comparing the correlation coefficients with those of partial correlation. This ratio varies between 0 and 1 and the model obtained has a KMO index of 0.734.

The second value taken into consideration is the Bartlett Sphericity Test, which is used to test the hypothesis that the correlation matrix is an identity matrix. The significance of this test is <0.001, so we can conclude that the model is adequate.

Tab. 2: KMO & Bartlett's Test Factor Analysis

Kaiser-Meyer-Olkin measurement of sampling adequacy.		0,734
Bartlett sphericity test	Chi-square approximation	1589,172
	G.d.L.	406
	Significance	<0,001

Source: authors' elaboration

The extraction method chosen for the factor analysis is the main components one, based on the percentage of total variance explained, which selects the variables that will constitute the model's regressors. Keiser's rule defines the extraction of factors until the eigenvalues are greater than 1. From this extraction, 10 components were obtained, which explain almost 72% of the cumulative variance.

Since the extraction of factors is hierarchical, the first factor tends to show high coefficients on all indicators, making interpretation difficult. The axes are then rotated with the Varimax method (orthogonal rotation). The factorial analysis extracted 10 factors, which were assigned a name based on the items related to them and with which they are explained:

- Factor 1: **Education experience (EE)**. It summarizes all the items related to the student's educational background. These variables express the perceptions about the skills gained through entrepreneurial courses and activities.
- Factor 2: **Interpersonal skills (IS)**. It summarizes the variables that express the set of values of an individual to respect the needs of other persons.
- Factor 3: **Importance of ecosystem (IoE)**. It summarizes all the opinions declared regarding to the external ecosystem, in particular the importance that it has in the student's decisions.
- Factor 4: **Management of the emotions (ME)** It summarizes the set of variables that affect the personality; in particular, they express the degree of nervousness, anxiety and moodiness.
- Factor 5: **Difficulty Managing Stress (DMS)**. It summarizes the set of items that concern the organization, the hard work, the management of social problems.
- Factor 6: **Egoistic approach (EA)**. It summarizes the variables that express the subject's desire to satisfy only its own needs.
- Factor 7: **Extroversion (EX)**. It summarizes inside the variables that express both the trait of friendship, the level of understanding and courtesy and the extroversion.
- Factor 8: **Fair of unexpected (FE)**. It summarizes the variables that concern fair to deal with new experiences.
- Factor 9: **Self-efficacy (SE)**. It summarizes the variable that express the ability of an individual to rich a goal.

- Factor 10: **Situational Attribution (SA)**. It summarizes the statements concerning the attribution of a consequence to external and non-subjective causes.

3.2.2 Variables description

The dependent variable for the empirical analysis was Social Entrepreneurial Intention (SEI), that can be influenced by different regressors, that are: the components obtained from the factor analysis and the variables on the volunteer experiences. Thus, the outcome depended on the set of explanatory variables. To measure the independent variables, we used a set of variables rated by respondents on 5-point Likert scales; some of them used the semantic differential, while others, used the degree of agreement and disagreement with respect to certain statements. The independent variables came from the factorial analysis (output from F.A) and they were used along with a control variable in the econometric model (Age). Some variables were transformed, for the purpose of analysis, into dummy variables (Table 3):

Table 3
Description of variables

DEPENDENT VARIABLE		
	Label	Measure
1	SEI	Social Entrepreneurial Intention <i>(from 1, "strongly disagree" to 5, "strongly agree")</i>
INDEPENDENT VARIABLES		
	Label	Measure
1	AGE (Control variable)	<i>value 1 for all individuals over the age of 19, 0 otherwise.</i>
2	EE	Education experience <i>(Output F.A. based on 5-point Likert)</i>
3	IS	Interpersonal skills <i>(Output F.A. based on 5-point Likert)</i>
4	MoE	Management of the emotions <i>(Output F.A. based on 5-point Likert)</i>
5	DMS	Difficulty managing stress <i>(Output F.A. based on 5-point Likert)</i>
6	EA	Egoistic approach <i>(Output F.A. based on 5-point Likert)</i>
8	EX	Extroversion <i>(Output F.A. based on 5-point Likert)</i>
9	FoU	Fair of Unexpected <i>(Output F.A. based on 5-point Likert)</i>
10	ST	Self - Trust <i>(Output F.A. based on 5-point Likert)</i>
11	SA	Situational Attribution <i>(Output F.A. based on 5-point Likert)</i>
12	Sc-Ex	Scout Experience <i>1 for all individuals who are or have been part of a scout group, 0 otherwise</i>
13	AC-Ex	AC Experience <i>1 for all individuals who are or have been part of a Catholic Action Group, 0 otherwise</i>
14	IoE	Importance of Ecosystem <i>(Output F.A. based on 5-point Likert)</i>

"Output F.A." means that the variable comes from the Factor Analysis

3.2.3 Linear Regression Model

The variables listed in Table 3 were used to model multivariate linear regression. Age became the model selection variable; based on its value, the sample was divided into two groups and the model was applied to each of them. From the starting sample of 133 people, we selected people

over 19 (age>19); then, we used a final sample of 87 people. To verify the adaptation of the model to the data, it is sufficient to look at the adapted R-square, which in the specific case is sufficiently high (0.759). the model explains 79% of the variance of the dependent variable SEI. This analysis describes the relationship between all the factors and the SEI. The analysis starts from the observation of the R-squared.

Tab. 4: R-squared Linear Regression Model

Model	R	R-squared	Adjusted R-squared	Standard Error
1	,890a	,793	,759	,912

The ANOVA test allowed, instead, to verify the percentage of variance explained by the regression, which must exceed the one that remains unexplained, contained in the error term. It can also be noted that the model is significant at all levels.

Tab. 5: ANOVA - F test on coefficients

Model		Sum of squares	GdL	Quadratic mean	F	Sign.
1	Regression	235,361	12	19,613	23,604	<,001 ^c
	Residue	61,489	74	,831		
	Total	296,851	86			
a. Dependent variable: Social Entrepreneurial Intention						
b. Selection of only cases with the dummy Age = 1						
c. Predictors: (constant), Constant, Education experience, Interpersonal skills, Management emotions, Difficulty managing stress, Egoistic approach, Extroversion, Fair of Unexpected, Self -trust, Situational Attribution, Scout experience, Experience A.C., Importance of ecosystem						

From the analysis of the residues, it is possible to exclude the presence of heteroscedasticity, since mean is zero and variance is constant, at least in the group in which the variable 'age' takes value '1'. From the results of the regression and the values of VIF and Tolerance, very low multicollinearity occurs, which is acceptable for this particular model, given the relative closeness to the predicted values of 1.

Tab. 6: Coefficients - Linear Regression Model

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics		
		B	Std. Error	Beta			Tolerance	VIF	
Typology of trust	Constant	2,78	0,186		14,951	<,001			***
PT	Education experience	0,11	0,126	0,052	0,873	0,385	0,788	1,269	
PT	Interpersonal skills	0,653	0,122	0,34	5,344	<,001	0,692	1,445	***
PT	Management of the emotions	-0,112	0,115	-0,055	-0,975	0,332	0,873	1,146	
PT	Difficulty in managing stress	-0,202	0,11	-0,106	-1,841	0,07	0,849	1,178	***
PT	Egoistic approach	-0,251	0,103	-0,131	-2,435	0,017	0,96	1,041	**
PT	Extroversion.	-0,01	0,108	-0,006	-0,09	0,928	0,711	1,406	
PT	Fair of Unexpected	-0,981	0,143	-0,44	-6,87	<,001	0,682	1,466	***
PT	Self -trust	0,032	0,117	0,015	0,273	0,786	0,928	1,077	
PT	Situational Attribution	0,107	0,103	0,059	1,034	0,305	0,871	1,148	
CT	Scout experience	0,587	0,257	0,152	2,289	0,025	0,632	1,581	**
CT	Experience A.C.	0,638	0,249	0,169	2,562	0,012	0,641	1,559	**
IT	Importance of ecosystem	1,034	0,119	0,513	8,679	<,001	0,802	1,247	***
a. Dependent variable: Social Entrepreneurial Intention									
b. Selection of only cases for which Age = 1									

*** p-value < 0.01

** p-value < 0.05

* p-value < 0.1

4. Results

4.1 Descriptive statistics

The sample consists of 133 individuals, young Calabrian men between the ages of 16 and 30, fairly homogeneous in terms of gender (69 males and 64 females) and spatial location within the regional territory. As far as personal experiences are concerned, 56% have never been part of a scout group, 12% have been part of one in the past and 32% have been part of one. Moreover, as far as religious associations are concerned (Azione Cattolica), 52% have never been part of one, while the remaining part has been, in the past (28%) and currently (20%). We can see a clear prevalence of individuals who attended high school (105 individuals) rather than another institution of higher education, while about half of the sample had at least one experience abroad (68 yes vs. 65 no).

4.2 Results from the linear regression

The linear regression is valid and significant for the sample over 19 years old and it can be seen that there are some constructs that are not significant for the SEI; these variables are: educational experience, management of the emotions, extroversion, self-trust and Situational Attribution. However, all the other constructs are significant with a different effect on the SEI. Specifically, concerning the construct of Personal trust, the item Interpersonal skills is positive and significant at all levels with a positive effect on the SEI (0.653). Referring to Collective trust, Scout Experience and Experience in AC have also a positive and significant effect on SEI; in fact, the experience in these associations increases the SEI by 0.638 and 0.587 respectively, underlining the importance of being part of these groups for the development of social entrepreneurial ideas. By considering the Institutional trust, the Importance of Ecosystem turns out to be significant at all levels and with positive effect on SEI for 1.034.

On the contrary, we find a negative and significant effect for 3 variables related to Personal Traits; specifically, Difficulty managing stress, Egoistic Approach and Fair of Unexpected. People that has difficulty in managing stress, have less intention to develop social entrepreneurial intention to start a non-profit organization (-0.202). Also, people with an egoistic soul goes against the pursuit of socially valid activity (the variable has a negative effect of -0.251 on SEI). Finally, social entrepreneurs are daily treating with social problems that are characterized unexpected events. Thus, the impossibility of people to deal with unexpected states reduce the SEI (-0.981).

5. Discussion

This study contributes to the literature on social entrepreneurship by showing which are the main aspects of trust that can be built, stimulated, encouraged, to promote Social Entrepreneurial Intention (SEI). More concretely, this study shows how accompanying young people in volunteer experiences can be important to stimulate social entrepreneurial intention.

First, our results emphasize the importance of Interpersonal skills, to enhance the desire to generate positive social and environmental impact through a social venture. These are related to personal value that people build during their life. Thus, starting from the childhood, people should be oriented towards positive and altruistic life experience, that can enhance the desire to do something useful for society. Thus, the Collective trust dimension becomes an effective tool for creating a new awareness of institutions, the territory and its needs. Thus, belonging to voluntary activities, perhaps can develop a spirit of solidarity among young people, who will feel the institutions closest to their needs and those of people in difficulty. These elements can encourage social Entrepreneurial action oriented to the needs of society. Specifically, belonging to a the AGESCI or to the Italian Catholic Association (AC) could be a useful opportunity for personal growth and for educating free and responsible people (Astuti *et al.*, 2021). The associations

welcome young people and educators. The latter are men and women who freely choose to donate their time to the educational service in association, accompanying boys and girls in their personal growth path, unique and unrepeatable (AGESCI General Council, 1999). «The purpose of the association is to contribute, according to the principle of self-education, to children growth as significant and happy people» (AGESCI General Council, 1999). The principle of self-education, which is one of the eight founding elements of the scout method, allows the boy to be the protagonist of his own growth, although flanked by the educator who will offer him, based on age, opportunities for choice (AGESCI General Council, 1999). Finally, associationism arises above all from a need, a natural propensity of young people who choose to undertake the scout path, which will become for them a life gym, for the development of skills that will prove useful, if not indispensable, in the work world. A strong bond is established with the belonging territory, (AGESCI General Council, 1999). The method of AGESCI and AC is committed to accompanying people on his path of personal progression, which will lead him to become an adult capable of making his own choices, recognizing his own resources, and putting his talents at the service of others (AGESCI General Council, 1999). Scout experience, therefore, proposing stimulating, fun and healthy activities, lived in close contact with nature, contributes to form the character of the new generations, alongside school learning and family education, with a view to co-responsibility. It is believed that students who live or have lived in the past the scouting experience have developed those skills necessary to solve the problems of everyday life, more than others (Astuti *et al.*, 2021).

A proactive interaction with the ecosystem can improve the perception that people have of it; Ecosystem, in fact, has a strong impact on people's choices and it can stimulate entrepreneurial goals with social character.

6. Conclusions, main limitations and further researches

Looking at the work done, we can say that the goal set at the beginning has been achieved. The results of the empirical analysis confirm that volunteering activities generate a collective trust that can improve social Entrepreneurship, at least in the small sample examined, consisting of young and very young people scattered throughout Calabria.

Volunteering experiences should be promoted; they appear, as privileged spaces for person's formation, modelling his character and stimulating his skills. Volunteering activities can be an effective tool for the development of a trust feeling in the entrepreneurial and territorial reality, which makes clear the opportunities offered by a region and the desire to contribute to let these opportunities becoming concrete projects.

To succeed in something, you must mix two essential ingredients, talent, and passion. Well, future entrepreneurs need a third element without which the other two would be unusable, a good deal of trust in others and in their own land. The study offers useful implications for policy makers, and governments, to promote and support social volunteer activities that can help people to generate an entrepreneurial mindset. The educational dimension of volunteering should not be underestimated. It is a crucial point to develop an entrepreneurial ecosystem that can also improve the social environments.

Public policy should invest in projects oriented to solve social needs; they should support voluntary associations to implement social activities, especially in the regions with low levels of social capitals.

However, the analysis has limitations. We used a simple OLS on a small size of the sample belonging to a single region. This does not allow us to be able to generalize our results on a large scale. The experiences considered are limited to religious associations: dissimilar results could derive from the inclusion of other types of volunteers' activities. However, this could be an opportunity to develop future research on this research topic, by enlarging the sample and by using more complex models. Looking ahead, in fact, we could deepen research in this area, verifying the

impact of a variety of experiences on strengthening the Entrepreneurial Trust, not just volunteering. We can also will apply different empirical models. We will run Structural equation models, that could be useful to test relations also among the different dimensions of trust along with their impact on social entrepreneurship.

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Fintech and gender gap: an explorative study

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Abstract

Framing of the research. *Over the last years, academics, practitioners, and civil society have paid increasing attention to diversity and inclusion issues. In this regard, a particular interest has been devoted to issues related to gender equality. In parallel with the growing interest in social inclusion issues, technology has assumed a vital role in everyday life and corporate innovation across several industries. In particular, the financial industry has experienced significant technology integration into the financial product offering. Against this backdrop, drawing insights from the abovementioned trends, an emerging line of research has begun investigating the interactions between gender diversity and technology adoption in the financial services industry.*

Purpose of the paper. *Based on theoretical perspectives regarding gender and sex differences, the current paper intends to shed light on the interactions between gender diversity and the widespread technological innovation in the financial services industry.*

Methodology. *A semantic analysis was performed on 42 research articles from 2002 to 2022.*

Results. *The literature review shows an emerging line of research on gender and Fintech concerning three main lines of study, namely financial inclusion, technology acceptance, and women's financial behaviors. The current study also highlights the need to draw a framework to ensure gender equality in the Fintech industry.*

Research limitations. *The paper presents some limitations familiar to most similar qualitative studies. These limitations include excluding some residual keywords against which the bibliometric analysis was performed and issues linked to semantic analysis's potentially limited explanatory power.*

Practical implications. *The findings of the current paper are relevant for both academics and practitioners, as the analysis shows the hot issues regarding the connections between gender diversity and financial technologies. Shedding light on the women's behaviors and degree of acceptance of financial technology, the current study provides relevant insights to managers and businesses paying attention to the stakeholder reaction to Fintech products.*

Originality of the paper. *This is the first paper to provide a literature review exploring the interconnections between gender diversity and technological innovation in the financial services industry.*

Keywords: *gender gap; Fintech; financial inclusion; technology acceptance; financial behavior*

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1. Introduction

Women and STEM (Science, Technology, Engineering, and Mathematics) are a contentious binomial at the social and economic debate center.

On the one hand, there are indeed encouraging signs in the labor market regarding the increase in women's employment in the sectors of STEM. On the other hand, higher education, organizational position, and career prospects highlight the need for comprehensive interventions and actions, both at the institutional and corporate level, to overcome an accentuated gender gap.

In 2021, 66.3% of newly created positions for intellectual and specialized profiles will be held by women, an increase of 23% compared to 2019 (Fondazione Studi Consulenti del Lavoro), with an even greater dynamic for profiles characterized by a gender gap: + 40.2% female engineers and architects, + 33.6% professionals in the health, education, and research (+ 26.9%) and professionals in mathematics, computer science and chemical sciences professionals (+ 19.5%).

Today, even the company operating in a more traditional sector is, in one way or another, a technology company, a digital company. Companies are being called upon to redesign their activities and processes by taking advantage of technology, becoming the new linchpin and driving force of mathematical-informational knowledge, which is becoming the new language of business. JPMorgan and Goldman Sachs describe themselves as "technology groups" and count a percentage of technologists among their employees as over 20% (Accenture, 2020). Demand for IT, cybersecurity, and data science services is growing internationally, impacting business development and the job market. In contrast to this growth, data from a recent study shows that the overall gender gap in the technology industry is even more expansive today than it was in 1984 (Accenture and Girls who Code 2020). Only 21% of women in the study said they believe the technology industry is a place where they can advance and make a career (50% of women leave technology careers "by age 35, and women leave technology positions at a 45% higher rate than men). The gender gap thus seems to be particularly important in the high-tech sector, both from a social and cultural perspective and in terms of innovation performance (Canil *et al.*, 2021; Wikhamn and Wikhamn, 2020) and corporate sustainability (He and Jiang, 2019), which seem to be related to corporate behavior in terms of inclusion and respect for gender diversity.

Fintech is a sector where the gender gap may manifest naturally, as it relies on the combination of mathematical and IT skills with banking and financial knowledge, traditionally a prerogative of men. Prior literature recognizes that the glass ceiling phenomenon and barriers to career advancement are amplified both in the financial sector (Girardone *et al.*, 2021) and in industries that require high math, science, and technology skills (Reuben *et al.*, 2014).

According to a study led by Deloitte (2019), 369 Fintech startups worldwide were founded or co-founded by women, compared to the 2,600 based by men, representing only 12.2% of the total, while less than 30% of Fintech employees worldwide are women and only 5% hold leadership positions. This shows that action is needed to promote the inclusion of women in the Fintech world. To this end, research and studies are required to guide both policymakers and managers.

In light of these findings and the calls for inclusion contained in the 17 Sustainable Goals of the 2030 Agenda UN, the idea for this paper emerged. It aims to analyze the existing literature on Fintech and women to capture the knowledge on this topic dynamically. The review of the current contributions can identify the emerging trends and the area that needs to be deepened to improve the knowledge and practice on the topic of women in the Fintech industry. To achieve the research objective, we conduct a systematic literature review using a multidimensional text analysis method using Iramuteq.

The remainder of the paper is organized as follows. First, we provide an overview of gender studies and we discuss the literature related to the gender gap in the Fintech industry. Second, we describe the methodological design and procedures for developing a systematic review of the literature. We present and discuss our findings. We then highlight our contribution and outline a call for future research. A brief section on the limitations of the study concludes the paper.

2. Theoretical background

In this section, we discuss the theoretical background of the study. In particular, in subsection 2.1 we give a general overview of the development of gender studies. Instead, in Section 2.2, we discuss the previous literature on challenges and opportunities of gender diversity in the Fintech industry.

2.1 *Gender theorizing background*

The development of gender studies cannot be described linearly, and it takes place through debates strongly linked to the historical and social context. Understanding theoretical approaches involve uncovering how and why these debates took place over time (Calás and Smircich, 2014).

Over the years, feminist theorizing researchers have used a variety of epistemological approaches. While concerns closely related to gender, such as sex differences (Ely and Padavic, 2007); work and family issues (Runté and Mills, 2004), and emotions (Meyerson, 1998) continue to be relevant, some topics considered gender-neutral become more and more related to gendering (Calás and Smircich, 2014). Topics such as careers (Marshall, 1989), organization structure (Maier, 1999), collaboration (Gray, 1994), technology (Wajcman, 2004), organizational citizenship behavior (Karl and Waismel-Manor, 2005), and social networks (Benschop, 2009) acquired alternative conceptions.

Feminist theory can be seen as both a political and intellectual project, and it shows how social theory is arranged in gender issues in the academic field. Feminism is “an ongoing movement for social justice and equality” (Calás and Smircich, 2014). It is also a theory development project with a plurality of perspectives and different epistemological and methodological contours (Gerhard, 2004).

One way of understanding the mutations undergone by gendering is to analyze them in the context of contemporary social theory, as proposed by Calás and Smircich (2014). The authors propose to analyze the gendering background in two waves: the first, classical feminism, and the second wave, where gendering can be discussed according to five key contemporary feminist theoretical streams and their influence on the organizations.

First-wave feminism was influenced by universal suffrage and the abolitionist movement. The influence of liberal politics and reformist ideas are hallmarks of this first wave. During the 19th century, several women scholars made critical theoretical contributions to social theory. These contributions highlighted the absence of women as ‘social objects’ and the predominance of patriarchal relations of domination and subordination (Arni and Müller, 2004; Calás and Smircich, 2014).

The second wave started with recognizing earlier feminist contributions from the proposition of an epistemological, institutional, and emancipatory project. Four elements contributed to opening space for the debate on feminism: (i) the reassessment of Marxist and Freudian studies (ii) the impact of Kuhn’s sociology; (iii) the social construction of reality gaining ground in the philosophy of science; and (iv) the feminist movement in the 1960s and 1970s. Calás and Smircich (2014) discuss this second wave in 5 directions: liberal, radical, psychoanalytic, socialist, and post-structuralist. Each strand has a specific gender concept and a desirable social change. The liberal and radical strands represent the academy’s response to the social movements of the 1960s and 1970s.

With its roots in liberal political theory, the strand of liberal feminism has women’s rights, equality, and equity as its central themes. The debate has expanded beyond equality to include gender justice, which has led to the inclusion of the racial debate. Criticism of the liberal strand is directed toward the focus on the individual (sex/gender role) without considering the social structure and its historical, economic, and political implications (Scott, 1986).

As a direct result of this critique, the strand of radical feminism emerges. Radical feminism considers the subordination of women and patriarchal society as the main object of discussion. It

was called radical because it was women-centred, based on the interconnections between sexuality and power relations, and focused on building a new social order (Jaggar, 1983). This strand has been criticized for being naïve and for its expectations of social change through a separatist women's culture (Calás and Smircich, 2014).

The liberal and radical strands have left many influences on organizational studies. This approach was not straightforward, as liberal policies in management assume, by definition, that individuals are sex-neutral and have equal access to opportunities in a meritocratic logic. For this reason, gender theories have had difficulty being fully understood in organizations. The focus ended up being on the 'woman manager', ignoring the lower organizational levels and the organizational mechanisms (Shein, 2007).

The psychoanalytic and socialist strands of feminism have in common the shift in focus from equality, recognition, and women's rights to the discussion of social structure and the processes of gendering construction. The psychoanalytical strand conceptualizes the relationships between the individual's psychoanalytical processes and social structures, considering the criticisms directed at the last strands. This discussion gains strength through criticisms of biological determinism and Freudian theory (Dinnerstein, 1977).

Socialist feminist theorizing focuses on the reproduction processes of gender inequalities through patriarchy and capitalism. This strand received influences from Marxism and psychoanalytic feminism and highlighted hierarchical issues through a system of classes. Inspired by the separation between public and private expectations, this aspect proposes the debate on the gendered division of labor. In short, feminist socialists are concerned with the micro-practices of masculinity/femininity and their relationship to macro power structures (Scott, 1986).

The post-structuralist (also called postmodern) feminist approach emerged in the 1980s to promote a linguistic turn in the humanities and social sciences. This approach calls for the notion of experience, that is, of women's experience and women's standpoint, opening space for mobile subjectivities. In this sense, the post-structuralist strand is characterized by a miscellany of concepts and postmodern relativism. Gender issues are considered in the analysis of "a subject embedded in a power/knowledge matrix that normalizes categories of identification" (Calás and Smircich, 2014, p. 631).

Today, gendering, not just women's issues, has become the most addressed theoretical framing. The gendering phenomenon encompasses a complex and fuzzy set of social categorizations: class, race, sexuality, among others. The abundance of themes and their interrelationships brought the challenges of gendering institutionalizing while revealing the marginal position of feminist studies.

2.2 *Fintech industry and gender gap*

Over the last years, technological innovation and digitalization have assumed a critical role in several economic sectors, prompting companies to reformulate their business models and digitalize most of their processes and activities (Yuan *et al.*, 2021). In the financial industry, the digitalization process has been particularly intense (Ruddenklau, 2022). It has led to the diffusion of the terms "financial technology" or "Fintech" to identify the integration of technological innovation in traditional banking services or the offer of innovative digital financial services (Puschmann, 2017). According to Arner *et al.* (2015, p.1), Fintech appears as the process in which "finance and technology have evolved together".

The development of the Fintech industry renewed the debate on the role of finance and technological innovation in promoting social and financial inclusion (Demir *et al.*, 2022). In this regard, the relationship between Fintech and gender inequalities deserves special attention. Indeed, the discussion on the gender gap in the Fintech industry involves both the role of women in the financial industry and the relationship between women and technological innovation.

Despite the growing sensitivity toward the gender issues in finance (Adams and Kirkmaier, 2016) and the increasing number of policies promoting gender equality in the workplace (Hughes *et al.*, 2017), the financial industry is still far from closing the gap. In 2020, according to the European

Economic Governance Support Unit (2021), female executive directors of large banks represented only 26.4%. Some authors argue that the glass ceiling phenomenon duplicates in the financial sector, where the predominance of masculine cultural values augments the obstacles to women's career advancement (Girardone *et al.*, 2021). Indeed, male-dominated industries can exacerbate stereotypes and barriers to gender equality in workplaces. In this regard, von Hippel *et al.* (2015) observe that women are stereotyped as more focused on the family than on career progress and tend to be perceived as less appropriate for financial jobs.

The existing gender differences in the "traditional" financial industry may be further amplified in the Fintech ecosystem. The integration of technology into financial services requires strong mathematical and IT skills, which are generally considered a prerogative of men. From a cultural point of view, women are often perceived as more appropriate for humanistic subjects and to have less flair for math and science compared to men (Nosek *et al.*, 2002). This is reflected in the historical under-representation of women in STEM education and the labor force. Once again, sex-based stereotypes may help to explain this gap. For example, Reuben *et al.* (2014) suggest that stereotypes regarding the lower female attitude toward math may influence the women's decision to undertake education and careers in the science and technology field. The lower presence of women in STEM fields is likely to lead to a lower representation of women in apical positions and in starting a new business in technology-based industries. In addition to the STEM gap, prior literature also suggests that the predominance of "macho" cultural values and higher gender compensation differences may further contribute to limiting the presence of women in high-tech industries (Kuschel and Lepeley, 2016).

Even though these factors represent indisputable challenges to women's empowerment in workplaces, some recent encouraging signs feed the hopes that Fintech may contribute to closing the gender gap. In this regard, recent studies discuss gender diversity may contribute to a better approach to financial decision-making processes (Teodósio *et al.*, 2022). Scholars recognize that the presence of women in apical positions contributes to more prudent assessments of risks in financial decisions, helping to prevent financial difficulties and collapses (Palvia *et al.*, 2015). The attitude of women to mitigate the risks associated with decision-making processes may be crucial in the Fintech industry, where the high content of innovation can amplify the risks of "traditional" financial services. In a recent study, Giudici (2018) has pointed out that the risks connected to Fintech solutions may include the underestimation of creditworthiness, market risk non-compliance, fraud detection, or cyber-attacks.

At the same time, the development of Fintech solutions in the financial industry feeds market competition from both new intermediaries and innovative financial products (Arnaudo *et al.*, 2022). Against this backdrop, financial intermediaries need the appropriate skills and knowledge to face the high degree of competition. In this regard, prior studies have shown that gender diversity in workplaces can enrich decision-making processes, with higher problem-solving and original solution-generation capabilities than men (Balderson and Broderick, 1996). Indeed, authors also argue that gender heterogeneity represents a crucial source of knowledge that can contribute to business innovation processes (Abukhait *et al.*, 2018). From this angle, a wider presence of women may help Fintech companies do develop innovative financial solutions and to achieve a competitive advantage.

The recent initiatives aimed at increasing gender equality in tech-based industries (Blackburn, 2017) coupled with greater recognition of the contribution that women can lead in the workplace might create the conditions for Fintech to help close the gender gap. Against this backdrop, the current paper intends to map existing studies on the relationship between gender diversity and Fintech in order to trace the current state of knowledge and identify future lines of research on women's role in the Fintech ecosystem.

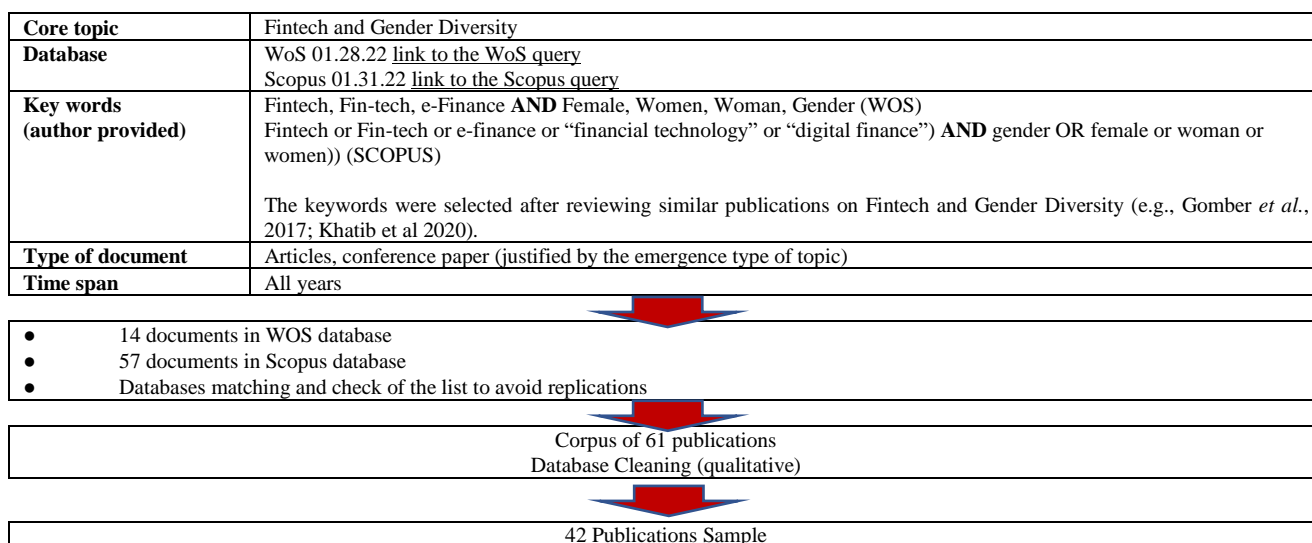
3. Method

The systematic review of the literature consists of a method for synthesizing a large volume of information, aiming to identify the main characteristics of a topic. This type of review also consists of a scientific investigation, which includes a comprehensive search for potentially relevant articles and the use of reproducible and explicit selection criteria (Tranfield *et al.*, 2003). The systematic literature review includes the collection, evaluation, and synthesis of the results of several studies and the identification of research gaps (Macke and Genari, 2019).

The systematic literature review is based on grounded theory. Grounded theory has its origins in symbolic interactionism and consists of a qualitative methodological approach whose objective is to understand phenomena and describe them according to the subject’s point of view (Glaser, 1998; Wolfswinkel *et al.*, 2013). The literature review was carried out to identify the main theoretical aspects of gendering and technological issues and to highlight the main characteristics of the publications. The literature review allowed researchers to identify gaps and propose a research agenda on the topic of the gender gap in the Fintech industry. The process was developed based on the study by Wolfswinkel *et al.* (2013) on the steps of a systematic literature review. The first refers to the definitions, from identifying the criteria for inclusion and exclusion of articles, areas of study, appropriate databases, and specific terms of research. Afterward, the effective search for studies and the selection of articles to be analyzed is done according to the objectives established for the research. Finally, the study sample must be analyzed, the main contents identified, and the results condensed and presented.

To conduct a comprehensive systematic literature review, we relied on the Scopus and Web of Science (WoS) databases. We searched for the following keywords: “Fintech”, “fin-tech”, “e-finance”, “financial technology”, “digital finance”, “gender”, “female”, “wom*n”. Keywords were selected after reviewing similar publications on Fintech and gender diversity (e.g., Gomber *et al.*, 2017; Khatib et al 2020). The lists of publications with the above keywords yield 14 and 57 research articles and conference papers from the Web of Science and Scopus databases, respectively. After matching the results from the two databases, we obtained an initial sample of 61 publications. We removed all articles that did not meet our research objectives. In particular, consistent with prior literature (e.g. Correia Loureiro *et al.*, 2021; Ciampi *et al.*, 2021; Turzo *et al.*, 2022), we cleaned the initial list by reading each of the 61 research items. We excluded the papers that only mentioned keywords included in our analysis but were non-consistent with the topic of the gender gap in the Fintech industry. This sample procedure led to a sample of 42 publications. Figure 1 shows the steps we followed in the review.

Fig. 1: Methodological Steps



Source: our elaboration

The abstracts of the 42 papers were prepared in a specific file to serve as a corpus of qualitative data analysis via Iramuteq software (Interface de R pour les Analyses Multidimensionnelles de Textes et de Questionnaires). We use version 0.7 alpha 2. Iramuteq is a graphical user interface of the statistical software R developed in Python (Souza *et al.*, 2018). It allows performing statistical analysis on text corpus and tables through semantic analysis ¹. In particular, Iramuteq investigates the distribution of vocabularies in written and oral text transcripts through lemmatization processes (reducing the word to its base form and grouping different forms of the same word). Semantic analysis is the study of the meaning of speech contents, studying how the structure of sounds, syllables, words, and utterances impacts on their meaning and understanding (Camargo and Justo, 2013).

As a methodology, it integrates advanced statistical methods through segmentation, hierarchical classification, and correspondence analysis, among other resources, configuring itself in a method of exploration and description (Azevedo, 2013). Among the methods, it uses the Descending Hierarchical Classification (DHC), which allows lexical analysis of texts and offers lexical classes characterized by specific vocabulary and textual segments of the same vocabulary, which interprets and analyzes more reliably (Camargo and Justo, 2013). Indeed DHC allows switching from Initial Context Unit to Text Segments that are the context of the words.

An essential advantage of using Iramuteq is that human bias is controlled, as the categories are considered a posteriori (inductive method): the researcher sees the results of the software and does not interfere in the construction of clusters. In other words, the researcher analyzes the results of the analysis in the light of the theoretical framework, based on the categories generated by (DHC), without the interference of the researcher (Illia, 2014).

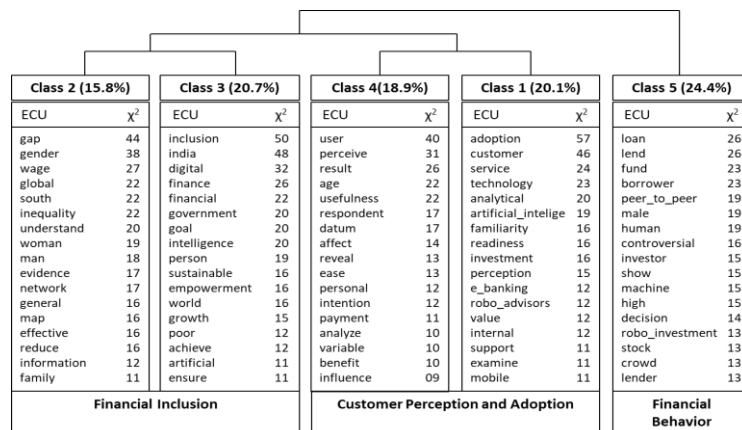
Iramuteq provided a dendrogram and a factorial map of similarities and differences that allowed researchers to define the main clusters. In parallel, we read all the articles corresponding to the abstracts that emerged from the qualitative analysis and grouped them further.

In this qualitative manual analysis, each article was classified according to the ABS ranking of the journal, the type of methodology, and the theoretical perspective it adopts. In addition, the review of the articles allowed the identification of the perspective with which the topic is approached: individual or organizational.

4. Results analysis and discussion

Within the corpus of 42 abstracts, Iramuteq classified 164 text segments (70%) out of the 235 that were created and generated five stable categories. The classes and the main words in each class are depicted in a dendrogram (distance tree) generated by that software (Fig. 2).

Fig. 2: Dendrogram



Source: present study from Iramuteq results (2022).

¹ <http://www.iramuteq.org/>

Financial Inclusion

The topic of financial inclusion has become very popular in recent years, as it is one of the pillars to promote gender equality proposed in ONU Agenda 2030 (Hendriks, 2019)

Knowledge of and use of financial tools can enable and empower women to make decisions about money and resource allocation in the family context (Karlan *et al.* 2016), for example, concerning savings and purchasing decisions for durable goods (Dupas and Robinson 2013). Some studies have shown that women's access to and use of digital financial services, such as mobile bank accounts and digital payment systems, can influence women's decisions about spending, saving, taking financial risks, and shaping their own financial futures. In short, Fintech tools can empower women and thus contribute positively to financial inclusion (Worldbank, 2018).

Consistent with the finding that the gender gap is wider in developing countries, the papers in Cluster 1 focus on the finance literacy (Vieria *et al.*, 2019) and on the role of Fintech tools (digital money, account ownership, etc.) in empowering women, with particular attention to some countries (Uganda, India). The theme is digital finance as a strategy to promote inclusion and create conditions for developing a better economy. The contributions are very recent (from 2019 to 2022, with two exceptions in 2002 and 2011), and they are all empirical works, giving preference to surveys, experiments, and case studies. They were published mainly (with a few exceptions) in journals not ranked by ABS.

Customer Perception and Adoption

"Fintech is a digital technology centered on Blockchain, Big Data, and intelligent investment advice, which is widely used in finance" (Hu *et al.*, 2019, p.). The value of the Fintech industry is increasing globally (Accenture 2020). The rapid growth of the sector is due to a combination of factors, including technological development, the need to contain costs, and, on the demand side, the need to meet market expectations and consumer trends and attitudes that are increasingly shifting toward digitalization (Gai *et al.*, 2018). Fintech is therefore considered one of the most important investments for most competitive financial firms (Wigglesworth, 2016).

For banking and finance companies, from a purely competitive perspective, the provision of digital financial services has the dual objective of increasing process efficiency and improving the user experience. Understanding the impact of the adoption of Fintech services on the demand side is extremely important. This explains the large number of empirical studies that characterize Cluster 2. Most of the papers focus on the technology acceptance model (TAM) and present surveys or case studies on women's attitudes towards Fintechs, mainly related to successful practices in specific territorial contexts (Malaysia, Bahrain, Pakistan). The qualitative analysis revealed that compared to Cluster 1, where women are the focus of interest because they catalyze the problem of financial inclusion and more generally the issue of gender equality, in Cluster 2 gender emerges in the context of defining a user profile, in a practical way related to the planning of the Fintech experience by banks and financial institutions. Women are thus seen as subjects, as users, to whom banks and financial companies address their Fintech offerings. The articles in Cluster 2 are mainly surveys that shed light on women's behavior and technology adoption of Fintech offerings and tools. Some studies from Cluster 2 highlight interesting implications related to women's empowerment through Fintech (Al Shehab *et al.*, 2020) and the role of Fintech tools and strategies in improving women's participation in the economy. The articles included in Cluster 2 are also relatively recent (2019-2021), but compared to Cluster 1, we found that half of the articles was published in journals ranked ABS.

Financial Behavior

The articles in Cluster 3 are quite different from those in Cluster 1 and Cluster 2: although they are based on empirical evidence (mainly case studies), they are anchored in a clear theoretical perspective. The preferred perspective is behavioral, and the focus on women is on investment decisions (Asandimitra *et al.*, 2019) and attitudes toward risk (Eckel *et al.*, 2002). As with Cluster 2, the analysis perspective in Cluster 3 does not relate to the gender gap in Fintech adoption or Fintech

carriers, but to the need to profile individuals (women) to understand and align their behavior and decisions. The contributions in cluster 3 are heterogeneous compared to the other two clusters.

5. Conclusion

This paper's semantic analysis was performed on articles related to Fintech and the gender gap, selected based on a bibliometric procedure. The mapping carried out has highlighted a corpus of scientific production consisting mainly of empirical research (surveys, case studies, experiments) aimed at analyzing a phenomenon in specific territorial contexts and has identified three main clusters defined in terms of the topics addressed and the breadth of the analytical perspective, all of which are highly recent (publications as of 2019). The first line of research, focusing on financial literacy and financial inclusion, seems to be particularly relevant, albeit with more policy and institutional than managerial implications. A second trend highlights the centrality of the technology adoption model to market segmentation and user profiling by banks and financial firms. A final trend, which shows less interaction between the terms, focuses on financial behavior, particularly risk-taking and investment decisions.

These results illustrate that interest in the issue of the gender gap in finance is still very recent and that the gender issue is, in fact, treated as an equality issue in only a portion of the papers in the corpus, which was selected based on the repetition of specific keywords.

The embryonic stage of the literature on the relationship between gender diversity and the Fintech industry also emerges from the dearth of research on the role of women from the perspective of business positions. Interestingly, our semantic analysis highlights the lack of a corpus of studies that examines the role of women as managers or entrepreneurs in the Fintech industry.

Although this is an exploratory study on the topic, the paper helps to draw attention to the problem of gender differences in finance and highlights the need for further research on the topic that addresses specific areas and goes beyond the scope associated with the studies. Behavior at a strategic planning level not only of the company but also of institutions and companies in line with the Sustainability Goals of the 2030 Agenda.

In particular, the authors' analysis, interpretation, and comparison led to a call for research in different directions that, in line with the postmodern approach (Calás and Smircich, 2014), make it possible to build a theory about women, finance, and technology.

First and foremost, the study should address the active and equal participation of women in business, including business performance and the presence of women in board and top industry positions. There have been studies and empirical research that analyze the problem of gender inequality in the Fintech industry mainly from the perspective of consumer behavior.

Our analysis, instead, points out that the entrepreneurial and managerial perspective is under-researched in the extant literature. This shows a need to develop further studies that focus on the role of women in apical positions in Fintech companies and startups. This would allow us to understand better the real opportunities and challenges that characterize the gender gap in Fintech workplaces.

We need a framework of skills, competencies, and knowledge for the development of a Fintech industry to ensure gender equality, both for the development of a new sustainable financial economy and for understanding how women's contribution to this industry can trigger the evolution toward a true Society 5.0 (Zengin *et al.*, 2021). Indeed, the gender gap in the Fintech industry, as in many other industries, is not just a matter of STEM degree or women's attitude toward risk but a cultural expression of an embedded tradition of dealing with money and business.

6. Main limitations

The study presented is essentially exploratory, as it aims to identify areas of interest where future research related to the gender gap and Fintech can be directed.

The main limitations of the study are therefore related to its nature. One limitation relates to selecting keywords against which the bibliometric analysis was conducted. In the current study, the field was very limited, and therefore, the dataset that emerged after the selection and cleaning of the articles is quite limited (42 articles). Another limitation concerns the chosen method of semantic analysis, which, although based on the analysis of lemmas, has limited explanatory potential due to the size of the corpus of reference articles.

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Websites

<http://www.societamanagement.it>
<http://www.sinergiejournal.it>
<http://www.iramuteq.org/>

Appendix

Table A1. This table reports an overview of the documents included in the literature review. In particular, columns 1, 2, 3, 4, and 5 report the authors' names, the publication year, the clusters, the methodological approach, and the journal, respectively. The column 6 (i.e. "ABS ranking"), instead, shows the classification ranking provided by Chartered ABS Journal Ranking (i.e. N=Not ranked; 1 = one star; 2= two stars; 3= three stars; 4=four stars). Finally, column 7 (i.e. "Theoretical Perspective") indicates the theoretical perspective adopted in the study.

Authors	Year	Cluster	Methodological approach	Journal	ABS Ranking	Theoretical Perspective	
Nurlaily F., Aini E.K., Asmoro P.S.	2021	1	Multivariate analysis	Business: Theory and Practice	N	Planned Behavior Theory (Perceived benefit and risk)	
Suzianti A., Haqqi F.R., Fathia S.N.	2021		Structural equation	Journal of Modelling in Management	1	Theory of reasoned action, the theory of planned behaviour and technology acceptance models	
Al Shehab N., Hamdan A.	2021		Case study	Applications of Artificial Intelligence in Business, Education and Healthcare	N	Literature review	
Museba T.J., Ranganai E., Gianfrate G.	2021		Survey	Journal of Enterprising Communities: People and Places in the Global Economy	N	Literature review	
Singh S., Sahni M.M., Kovid R.K.	2020		Survey	Management Decision	2	Technology acceptance model (TAM), unified theory of acceptance and use of technology (UTAUT)	
Bashir M.A., Ali M.H., Akther N., Wai L.M., Paiz N.A.M., Islam A.	2020		Survey	International Journal of Advanced Science and Technology	N	Literature review	
Lozano-Medina J.I., Hervert-Escobar L., Hernandez-Gress N.	2020		Principal component analysis	International Conference on Computational Science	N	Women - Risk management	
Belanche D., Casalo L.V., Flavián C.	2019		Survey	Industrial Management & Data Systems	2	Technology acceptance model	
Tran T.A., Han K.S., Yun S.Y.	2018		Survey	Asia Life Sciences	N	Technology acceptance model	
Li B; Hanna SD; Kim KT	2020		Multivariate analysis	Journal of Financial Counseling and Planning	N	Literature review	
Fan L	2021		Survey	International Journal of Bank Marketing	1	Technology acceptance model	
Flavian, C; Perez-Rueda, A; Belanche, D; Casalo, LV	2021		Post-hoc analysis	Journal of Service Management	2	Literature review	
Lee J.N., Morduch J., Ravindran S., Shonchoy A.S.	2022		2	Experiment	Journal of Economic Behavior & Organization	3	Behavioural economics
Frimpong Boamah E., Murshid N.S., Mozumder M.G.N.	2021			Case study	Applied Geography	N	"Systems effects approach" to examine the nonlinear and dynamic feedback processes through which socio-material factors engage to structure social problems
Guo Q., Chen S., Zeng X.	2021	Multivariate analysis		China & World Economy	1	The logic of entrepreneurial choice under liquidity constraints	
Setyawan I.R., Ramli I., Listyarti I.	2020	Structural equation		Materials Science and Engineering Conference Series	N	MODAF (Holistic Enterprises Architecture Frameworks)	
Mhlanga D.	2020	Conceptual and documentary analysis of peer-reviewed journals		International Journal of Financial Studies	N	Information Asymmetry	
Gupta A., Arya P.K.	2020	Manova		International Journal of Advanced Science and Technology	N	Literature review - no theories	
Varkey J.	2020	Decriptive stat		International Journal of Advanced Science and Technology	N	Literature review - no theories	
Ghosh C., Hom Chaudhury R.	2020	Multivariate analysis		Innovation and Development	N	Theories of information asymmetry and transaction cost	
Matthews B.H.	2019	Case study		Development in Practice	N	Behavioural economics	
Barik R., Sharma P.	2019	Survey		Journal of Public Affairs	1	Literature review - no theories	
Makhkamova G.M., Saidmurodov K.	2019	Survey		Advances in Business Related Scientific Research Journal	N	Literature review - no theories	
Ferrata L.	2019	Case study		Public Sector Economics	N	Literature review - no theories	
Smith A.D.	2011	Survey		International Journal of Electronic Finance	N	Customer Relationship Management	
Seibel H.D., Khadka S.	2002	Case study		Savings and Development	N	Literature review - no theories	
3	Fu R., Huang Y., Singh P.V.	2021	Machine learning	Information Systems Research	4	Behavioural economics	
	Niszczoła P., Kaszás D.	2020	Experiment	Plos one	N	Literature review - no theories	
	Gonzalez L.	2020	Survey	Managerial Finance	1	Behavioural Economics - Heuristics to simplify decisions	
	Fisch C., Meoli M., Vismara S.	2020	Case study	Economics of Innovation and New Technology	2	Democratization in entrepreneurial finance	
	Caglayan M., Talavera O., Xiong L., Zhang J.	2020	Case study	The European journal of finance	N	Theory of Discouraged Borrowers	
	Saputra A.D., Burnia I.J., Shihab M.R., Anggraini R.S.A., Purnomo P.H., Azzahro F.	2019	Case study	International Conference on Information Management and Technology	N	Literature review - no theories	
	Kelana B., Riskinanto A., Hilamawan D.R.	2018	Survey	International Conference on Sustainable Information Engineering and Technology	N	Technology Acceptance Model	
	Bradbury MAS; Hens T; Zeisberger S.	2019	Experiment	Journal of Banking & Finance	3	Risk taking approaches	

Disclosing green brand identity to shape the green image. A content analysis of the website's sustainability section of luxury hotels in Italy

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Abstract

Framing of the research. *In recent years, hospitality and tourism literature has devoted greater attention to the role of hotel green practices and green image in affecting guests' intention to return, recommend and spread positive word-of-mouth. However, disseminate on the website sustainability information is still a challenge for hoteliers due to both an elusive nature of the sustainability concept and a vague operationalization of the green brand image construct.*

Purpose of the paper. *This paper investigates how luxury hotels present and deliver information about their sustainability efforts on their website in order to identify best practices.*

Methodology. *This paper employs content analysis to extract the main topics from the sustainability information published by luxury hotels on their website. The luxury hotels chosen for the analysis were identified using the list of DUCO Italy 2021 participants.*

Results. *Only 37 percent of the sampled luxury hotels included a website section regarding their sustainability efforts. Sustainability discourse revolves around five subtopics: social and environmental commitment; energy efficiency, conservation and management; sustainability credentials on the web page; sustainability performance; and waste management priorities.*

Research limitations. *This study focuses only on the web sites of a list of 197 luxury hotels based in Italy. Some of these companies may have disseminated information about their sustainability effort on other channels, such as social media. Furthermore, this study is based on a text corpus collected in January 2022, web page information can be modified at any time.*

Managerial implications. *This study is important for luxury hotels managers because it shows the main subtopics employed by hoteliers to talk about their sustainability commitment.*

Originality of the paper. *There is not a specific research that analyses the sustainability disclosures published by luxury hotels on their websites; hence, this paper attempted to fill this gap.*

Keywords: *luxury hotels, web sites, sustainability information, social and environmental commitment, content analysis*

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1. Introduction

The environmental problems afflicting the world have increased the environmental concern and attitudes among consumers. Such concerns translate into a rising desire of integrating green practices into consumption behaviors for the benefit of the planet. Thus, eco-friendly behaviors motivate consumers to buy products that do not harm the environment. Same patterns may be observed with respect to the travel and hospitality industry. Also due to tourism and travel increases the nature is being wasted, tourist destinations suffer from high tourist flows and the life quality of local communities is also negatively affected. Therefore, the development of the tourism is worried about the sustainable aspects of preservation of cultural heritage and preservation of the natural environment (UNWTO, 2017). Many destinations are increasingly engaged in the reduction of the socio-cultural impacts as well as the impact on the environment. In the tourism sector, the hospitality industry is also characterized by high consumption of resources and waste production. Thus, sustainability becomes a necessary factor not only to preserve the environment and protect local areas, but also for maintaining a competitive advantage. For the hotel industry the design and achievement of sustainable practices help the organization to concretize the triple bottom line objectives, which encompass the three dimensions of sustainability, namely economic, environmental, and social. Environmental sustainability practices refer, among other things, to furnishing rooms with environmental-friendly materials, recycling materials, and implementing energy saving programs. Social sustainability practices include, among other things, investing in training and employee development, encouraging wellbeing in the workplace, supporting local communities, delivering high-quality services to guests and a safe environment. Economic sustainability practices, instead, are related to employment creation and value creation for both shareholders and customers (Sęrić and Sęrić, 2021; Pereira *et al.*, 2021). As already mentioned, the relevance of sustainability actions can also be read in the changes taking place on the demand side.

In fact, tourists are increasingly sensitive to environmental issues when travelling. A growing number of travelers prefer to stay at hotels that adopt environmental conservation and sustainability.

A 2021 survey carried out by Booking.com shows that 73% of travelers are more likely to choose accommodation that has implemented sustainability practices over those that have not (Booking.com, 2021). Moreover, the Operto's white paper (2021) states that hotel guests are willing to pay up to 75% more per night for an eco-friendly stay. With environmental issues becoming a significant matter of concern for the society and, subsequently, for travelers, hotels have begun to develop a variety of environmental programs in their daily operations.

For examples, hotels are devoting a lot of efforts towards energy and water conservation. However, in recent years, there has been a parallel increase of efforts to communicate their "green" commitment. Exploiting the power of digitalization, hotel use their official websites and social networks to spread information to stakeholders and clients about their products, services, history, but these digital channels also promote environmentally sustainable management goals (Kraft, 2017). Sustainability communication aims to improve transparency and inspire an interactive dialogue with stakeholders based on company's actions. Hence, sustainability communication becomes part of a wider sustainability marketing strategy and contributes to the emergence of green image (Gao *et al.*, 2016; Aragon-Correa *et al.*, 2015; Chan, 2013). A green image can be defined as the set of beliefs held by consumers about the environmental protection commitment of the hotel (Assaker *et al.*, 2020). This dimension has become an important driver in appealing more environmentally concerned travelers, enriching their experience, and consequently stimulating their loyalty in terms of willingness to return and recommend (Yusof *et al.*, 2017). This development has encouraged companies to go beyond a focus on profit and rapidly explore ways to formulate new ideas and strategies for positioning their brand as a green brand in consumers' minds.

Given the above considerations, recent hospitality and tourism literature has devoted greater attention to the role of hotel green practices and green image in affecting guests' intention to return, recommend and spread positive word-of-mouth (Merli *et al.*, 2019; Martínez *et al.*, 2018; Han and Yoon, 2015). However, communicating sustainability is still a challenge due to both an elusive

nature of the sustainability concept (Tölkes, 2018) and a vague operationalization of the green brand image construct (Topcuoglu *et al.*, 2021; Chen, 2010; Cretu and Brodie, 2007). Specifically, the absence of a valid and reliable scale for the measurement of the green image in a hospitality context has undermined the development of studies focused on the role of green image as a new dimension of the overall image. Thus, given the current inclination and necessity of many hotels to implement more complex sustainable projects in a green transition perspective also projecting a green image no more solely based on an abstract communication, there is merit in extending the investigation of the constituent components of green brand identity. In fact, despite the relevance of effective sustainable communication for the tourism industry, past studies have devoted a very limited attention to the green brand identity adopted by hotels (Coles *et al.*, 2013), which represents the intent behind a company designs a specific brand to cultivate a certain image in consumers' minds.

To address the afore-mentioned lacuna within the existing literature, this study adopts the perspective of marketing analysis to develop an initial systematization of the green brand identity in a hospitality context, understood as “a specific set of brand attributes and benefits related to the reduced environmental impact of the brand and its perception as being environmentally sound” (Hartmann *et al.*, 2005: 10). Specifically, after a brief review of the main evidence provided by the literature on green branding, the results of a content analysis of the web communication related to sustainability adopted by luxury hotels located in Italy are presented. We opted for the content analysis technique due to the explorative nature of the current study. Hence, we did not use a predetermined set of codes, but with the help of InfraNodus software we allowed themes to emerge from the data.

Luxury hospitality represents the third-largest market share in the global luxury industry (D'Arpizio and Levato, 2021). Luxury hotels can be defined as hotels providing a unique and excellent service quality to their guests. Luxury travelers are in search of travel experiences connotated by a high symbolic value. However, recent trends also confirm that about 80% of luxury travelers believe it is fundamental that their favored luxury hotel implements environmentally sustainable practices (Fairmont Luxury Report, 2019). Therefore, based on these arguments, the decision to investigate the communication of luxury hotels stems from the fact that the luxury sector represents an ideal investigative space for observing the process whereby a contemporary green identity is created (Melewar and Karaosmanoglu, 2008). Finally, the choice of Italy, as country under investigation, is motivated by the international value of its cultural heritage, being the country with the largest number of sites included in the World Heritage list (58 sites) (UNESCO, 2022). Moreover, according to the 2021 edition of the Anholt-Ipsos Nation Brands Index (Ipsos, 2020), Italy ranks 1st out of 60 countries on both the “heritage & culture” and “tourism” dimension. This result stems primarily from the extraordinary mix of heritage, cultural and natural attractions that make Italy an undisputed world leader in terms of concentration of tourist attractions.

2. Theoretical background

Sustainability is becoming an emerging issue in tourism and hospitality sector. Many serious environmental deteriorations are rooted in tourism activities. Travelers are integrating their green concern into travel choices. They also show a willingness to pay higher prices for products and services that do not hurt the planet. This trend has encouraged companies, on the one hand, to invest more intensively in concrete “green” actions and, on the other hand, to identify new projects and strategies for positioning their brand as a green brand in the clients' minds. Because of this rapid change, the green brand image has become a focal strategy for hospitality market too. The green brand image can be interpreted as the set of beliefs towards a brand held by consumers and associated with environmental concern and commitments (Chen, 2010).

Past studies have confirmed that hotel's perceived green brand image affects expectations related to green hotels (Lin *et al.*, 2017). Existing literature often approaches green brand image as an

antecedent of relevant outcomes such as green brand preferences (Mourad and Ahmed, 2012), trust (Martinez, 2015), loyalty (Lin *et al.*, 2017), corporate image (Yadav *et al.*, 2016), and willingness to pay a price premium (Anselmsson *et al.*, 2014). In hospitality research green brand image has been also interpreted as preceded by functional and emotional benefits acting as antecedents. Functional benefits are related to product or service features that meet expected requirements such as respect for environment, prevention of global warming, water conservation, etc. Emotional benefits, instead, refer to attributes that satisfy consumer self-esteem (Bashir *et al.*, 2020). A worthy green image may represent a clear signal of a firm's green commitment towards its key stakeholders and embodies an effective tool to improve not only environmental differentiation but also profitability (Heikkurinen, 2010).

Hospitality companies promote their green image to show their actual commitment towards sustainable issues, demonstrating to stakeholders their achievements oriented to environment protection. However, recent tourism and hospitality literature shows discordant results in terms of influences exerted by green practices, eco-certifications and sustainable communication on customer satisfaction (Gasbarro and Bonera, 2021; Topcuoglu *et al.*, 2021; Bruns-Smith *et al.*, 2015). Such mixed results can be traced back to the absence of measurement scales for green brand image that embed dimensions able to intercept the current evaluation criteria used by consumers to judge the green commitment of hospitality structures.

While studies within the marketing literature have devoted great importance to investigating issues related to firm image (Kuo and Hsiao, 2008; Wan *et al.*, 2007), only a few research have been found to address this variable in the tourism and hospitality literature and with respect to sustainable communication. Specifically, past tourism studies (Assaker *et al.*, 2020; Wang *et al.*, 2018; Bashir *et al.*, 2020; Yadav *et al.*, 2016) have adapted a measurement scale of green brand image proposed by Chen (2010) regarding electronic product purchasing experience in Taiwan. The study by Chen (2010), one of the most cited in the hospitality literature, proposes a measurement of the green brand image based on five items: 1. Environmental commitment; 2. Environmental reputation; 3. Environmental performance; 4. Environmental concern; 5. Environmental promises. It should be noted that the above definition shows evident theoretical limits - in addition to the fact to have been validated in a different sector - since the five dimensions proposed for describing green image are not fully discriminated and they do not allow stakeholders to have a clear idea of the aspects under investigation. Furthermore, this measure adopts a too abstract and general interpretative perspective of sustainable communication, which does not reflect the current evolution of environmental commitments and actions on the part of businesses (Topcuoglu *et al.*, 2021).

Moreover, this gap has also compromised progress in sustainable communication studies for the tourism industry in terms of theoretical foundations, influences and outcomes (Wehrli *et al.*, 2017). The growing complexity of intangible features of tourism products and the increased uncertainty and perceived risk associated with green travel choices, requires a deepening comprehension of the constituent components of the sustainable communication that incorporate contemporary challenges. Therefore, there is a need to identify a measurement scale for green image that goes beyond these limits. To do this, however, it is essential to start from a deeper analysis of the current green brand identity designed and projected by hospitality companies.

Following this line of enquiry, the objective of this study is to conduct an empirical in-depth analysis on the sustainable web communication of luxury hotels. The aim is to compare the conceptual categories of the green brand image with the communicative codes used by luxury companies to disclose and transfer the value of their sustainable commitment.

3. Methodology

3.1 Data collection

To fulfil the objectives of understanding how luxury hotels present and deliver information about their sustainability efforts to key stakeholders, we examined textual disclosures published on their own hotel property website. For many accommodation firms, official websites are the first point of contact with guests, delivering information regarding their facilities and services. The sophistication of the website and the type of contents available affects the image formation and the buying decision (Tiago *et al.*, 2021).

The luxury hotels chosen for the analysis were identified using the list of DUCO Italy 2021 participants. DUCO Travel Summit is an invitation-only event held annually in Florence and reserved to high-profile hotels (and travel advisors and suppliers) located in Italy that are characterized by high standards of excellence and bespoke experiences. As already mentioned, a luxury hotel is “unique and superior in quality and that provides excellent service, symbolizing the wealth and status of its patrons” (Peng & Chen, 2019a, 2019b, p. 1375). Four- or five-stars hotels that provide services beyond basic needs (accommodation and food) are considered luxury (Peng and Chen, 2019; Becker, 2009; Forbes Travel Guide, 2021). The selection of hotels followed by DUCO fully reflects this perspective comprising 197 luxury hotels (four-stars, five-stars and five-stars superior).

Data collection was performed through January 2022. For each hotel of the list of DUCO Italy 2021 we reviewed the website and reported on the presence/absence (1 or 0) of sustainability information by using a Microsoft Excel spreadsheet. During this phase, if a website section about the commitments of the hotel towards sustainability was found, we proceeded to copy and paste the text in a specific cell of the row corresponding to the name of the hotel. Of the 197 sampled luxury hotels, 73 (37%) had a website section dedicated to sustainability information and sustainability policy. The majority of them were rated five-stars ($n = 69$), only four were rated four-stars. 64 were chain-affiliated hotels, the main international groups to which they belong were Relais & Châteaux ($n = 16$), Marriott International Inc ($n = 14$), Belmond Hotels ($n = 7$), Rocco Forte Hotels ($n = 6$), and Starshotel Collection ($n = 4$). 9 hotels were independent, that is, non-chain affiliated. A list of the 73 luxury hotels selected for the content analysis of the textual material retrieved from their websites is depicted in the *Tab. A1* in the Appendix A.

3.2 Content analysis

Content analysis is a set of methods to investigate the correlation between texts and possible themes or concepts (Weber, 1985). It has been applied in a variety of studies about sustainability and the hotel industry (e.g., Hsieh, 2012; Joseph *et al.*, 2014; Khatter *et al.*, 2019; Ruffolo, 2015). However, there is not specific research about luxury hotels market; hence, this paper attempted to fill this gap.

Content analysis can be performed manually or using computer software (Ignatow and Mihalcea, 2016). To extract information from the text corpus we employed InfraNodus. This software, which is available as a cloud-based version at the following URL <http://www.infranodus.com>, is designed to represent the text as a network graph. Specifically, words become the nodes and the edges are their co-occurrences (Paranyushkin, 2019).

Once imported the original text corpus into InfraNodus, the software converts all the words into their lemmas to reduce redundancy. For example, “bottles” become “bottle”, “certifications” become “certification”, and “locally” becomes “local”. This process is called normalization. The software also deletes from the text all the stop words (e.g., “is”, “are”, “a”, “the”, etc.).

To extract the most relevant words in the text, the software utilizes the betweenness centrality, namely, “the number of times a node needs a given node to reach another node. Stated otherwise, it is the number of shortest paths that pass-through a given node” (Otte and Rousseau, 2002, p. 443).

As can be seen in *Fig. 1*, the most influential elements of the text network, since they link different subtopics together, are “hotel”, “environmental”, “impact”, “reduce”, “energy”, and “sustainability”. These nodes are shown bigger on the graph.

Colours in *Fig. 1* indicate the distinct topical groups, which are communities of words that are closely related. The text network consists of five communities. Each one denotes a specific aspect of the hotel sustainability discourse. Specifically, as depicted in *Tab. 1*, the discourse about sustainability efforts focuses on the following subtopics: social and environmental commitment; energy efficiency, conservation, and management; sustainability credentials on the web page; sustainability performance; and waste management priorities.

Tab. 1: Most influential communities of words in sustainability discourse.

Topical Cluster	Colours used in <i>Fig. 1</i>	Percentage of nodes	Label assigned to the topical cluster (Category)	Words in the context
1	Spring green	30%	Social and environmental commitment	Environment; guest; community; local; heritage; culture; support; business; natural; commitment; practice; people; legislative; future; employee
2	Yellow green	21%	Energy efficiency, conservation and management	Energy; water; reduce; waste; carbon; low; effort
3	Orange	32%	Sustainability credentials on the web page	Hotel; sustainable; green; product; certification; ISO; design
4	Fuchsia	10%	Sustainability performance	Environmental; impact; protection; policy; operation; standard; positive; reducing
5	Mint	7%	Waste management priorities	Plastic; organic; material; bottle; plastic; single; eliminate

Source: our elaboration

The main topical group concerns those words regarding the sustainability credentials on the web page. The objective of the hotel is to provide strong evidence to both consumers and stakeholders that their operations are truly sustainable rather than the result of a greenwashing strategy, that is, the making of misleading environmental claim.

To create a positive image of their hotel and reduce consumer scepticism, hoteliers tend to adopt the following bigrams (a sequence of two adjacent words) in their sustainability discourse: “sustainability certification” (weight = 31), “sustainable design” (weight = 16), “ISO process” (weight = 12), “obtain ISO” (weight = 12), and “certified hotel” (weight = 11).

Having certifications by independent and credible agencies and communicating the messages to customers and other stakeholders is a way to appear more credible. Some of the luxury hotels sampled adopt ISO - International Organization for Standardization certification, as the following excerpts illustrate:

[...] we are one of the first companies to have obtained the ISO 9001 process certification and the UNI EN 14065 product’s hygienic quality, for the treatment of all of Due Torri’s textiles. (Due Torri Hotel)

Lefay intended to implement a Quality and Environmental Management System certified according to ISO 14001 and 9001 standards since 2008, for the “design and development of architectural solutions for innovative and environmentally friendly accommodation facilities” and for the management and development processes of hospitality and wellness companies. In the construction of the first Resort, great attention was paid to respect for the surrounding environment through an architectural project fully integrated in the existing landscape, the implementation of cutting-edge technologies that reduce the consumption of energy and water, and the use of clean and renewable energy. These principles have also been the basics of the second Resort project (Lefay Resort & SPA Dolomiti), which obtained the ISO 9001 e 14001 certifications in December 2019 and the prestigious ClimaHotel® certification, attesting green hospitality and tourism. (Lefay Resort & SPA Dolomiti)

We have certified that our energy and emissions management system comply with our Environmental Policy, our energy commitments and the standards required by ISO 50001. (Me Milan Il Duca)

Another certification introduced to help the credibility of golf facilities is the GEO Certified label, as illustrated below:

The GEO Certified® Golf Club and our agricultural production, which is totally organic, are the frame of our daily commitment towards sustainability. (Toscana Resort Castelfalfi)

The Green Globe is another certification that measures the sustainability performance of travel and tourism businesses and their suppliers, as in the following:

Starhotels E.c.h.o. has obtained the Green Globe certification for sustainability of travel and tourism with the 90% of conformity to sustainability Green Globe's criteria. (Hotel d'Inghilterra Roma)

The second topical group by order of relevance concerns social and environmental commitment, that is, "the corporate efforts to manage social issues and environmental issues, respectively" (Bansal *et al.*, 2014, p. 950). To efficiently communicate the strategies and actions adopted to contribute to the solution of environmental, economic and social problems, hoteliers utilize the following bigrams: "environmental protection" (weight = 24), "natural environment" (weight = 24), "social responsibility" (weight = 23), "cultural heritage" (weight = 21), "support local" (weight = 19), "green project" (weight = 18), "conserve natural" (weight = 12), "environmental commitment" (weight = 11), "support community" (weight = 7). The most adopted verbs employed to express the commitment of the hotel towards environmental issues are "minimize" and "aim", as illustrated below:

Each hotel [...] seeks to minimize the environmental impact of its operations, including those relating to energy consumption, water use, waste minimization and management, product procurement and use, and the selection of materials in refurbishment and new build projects. (Hotel Principe Di Savoia)

At the Hotel Splendide Royal a program has been developed to minimize the ecological footprint that the property has on the planet, preserving natural resources. (Hotel Splendide Royal)

We aim to reduce the negative environmental and social impact of our business activities by focusing on sustainable, responsible and local sourcing. (Cristallo, A Luxury Collection Resort & Spa)

We aim to reduce the negative impact of our business on the planet, enhance our ability to deliver the value our customers expect and protect valuable natural resources for future generations. (Palazzo Montemartini, Rome - A Radisson Collection)

One of the pillars of sustainable tourism regards the residents' satisfaction and the economic wellbeing of host communities (Mihalič *et al.*, 2016). Therefore, several hoteliers adopt in their sustainability disclosures the rhetoric of "support local communities", as the following excerpts illustrate:

Mandarin Oriental is committed to contributing to the communities in which we operate and responsibly managing our environmental impacts and social commitments. (Mandarin Oriental, Lago Di Como; Mandarin Oriental, Milan)

Integrating our hotel operations into the life of the local community and society of our host countries is highly rewarding for Kempinski and our employees. We believe that the local economic and social impact of our hotels can be managed positively and responsibly. (San Clemente Palace Kempinski)

Indigenous traditions, craftsmanship, rehabilitation of lost traditions: all hotels support local artisans through purchasing and encourage guests to do the same. Education, orphanage support, female empowerment and entrepreneurship: support to programs tackling issues for women, children, against poverty and hunger. All properties support local school programs and orphanages, support for female led businesses to create economic independence. [...] Local farmers, local vendors: employment priority to locals, support of local agriculture in culinary art, purchase of local products; fair trade and using only cage free- and free-range products. (Aman Venice)

Most of the food used in the kitchens comes from local farms and fisheries, while inside the resort there is a vegetable garden to guarantee guests always have the freshest high-quality products. (Forte Village Resort)

To improve the hotel commitment towards social and environmental issues, companies adopt training programs for employees and customers to encourage environmental protection, as illustrated below:

We promote training and raising the awareness of our customers and employees through programmes focused on respect for the environment and biodiversity. (Me Milan Il Duca)

All employees are given an operational manual illustrating both customer service and environmental procedures and standards. The observance of these standards is verified every day by department heads and periodically during inspections conducted by specially-trained employees or external consultants. [...] The actions taken to reduce this consumption concern raising awareness among Guests and Staff (for example, changing Guests' linen only when they make a specific request. (Lefay Resort & SPA Dolomiti)

The third topical group by order of relevance concerns the energy efficiency, conservation, and management. Hotels operate 24 hours a day. It follows that they are one of the most energy-intensive types of business activity (Huang *et al.* 2015). To communicate their sustainable effort hoteliers share on their websites information about resource conservation (e.g. water and materials), energy efficiency (e.g. use energy-efficient lighting such as LED and renewable energy), and carbon emissions, as the following excerpts illustrate:

Addressing the challenge of managing global water resources and providing everyone with access to clean drinking water is important to Radisson Hotel Group. With a special focus on water stressed areas, participating hotels focus on minimizing water consumption by installing water saving technology and engaging guests and employees in water saving activities. (Palazzo Montemartini)

To dramatically reduce water consumption from the mains water supply, the water supply system has been calibrated and designed in minute detail. All toilet flushing systems and bath taps regulate the water quantity in output through devices that help save water consumption by 50% compared with standard facilities. (Lefay Resort & SPA Dolomiti)

[...] using low-impact generators to reduce CO₂ emissions and energy consumption, as well as low consumption LED lighting and high efficiency heating systems. (Helvetia & Bristol Firenze)

Focusing on the words, the most frequently used bigrams by hoteliers to introduce the energy management topic are “energy consumption” (weight = 46), “reduce energy” (weight = 41), “natural resource” (weight = 39), “renewable energy” (weight = 32), “water consumption” (weight = 19), “energy efficiency” (weight = 18), “reduce consumption” (weight = 17), “water conservation” (weight = 15), and “energy saving” (weight = 13).

The fourth topical group by order of relevance concerns the sustainability performance. Communicate and promote the corporate sustainability performance on the website is a way to build a strong reputation and enhance market position. In this context, reporting information about environmental awards and recognition received by hotels can be used as a criterion to evaluate the performance in the hotel sector, as illustrated below:

Verdura Resort also implemented a no-car policy to protect the natural landscape and ecosystem. For its superlative design and ecological practices, Verdura Resort was awarded the EHMA Sustainability Award shortly after its completion. [...] This exclusive award is dedicated to General Managers who succeeded in implementing and promoting sustainable hospitality actions by means of environmental protection and preservation. (Verdura Resort)

Borgo Pignano is pleased to announce to have been awarded the Condé Nast Johansens Excellence Award 2019 as “Best hotel for sustainability” in Europe and the Mediterranean. (Borgo Pignano)

Talk about specific operations and projects is another way to provide information on the hotel sustainability performance, such as in the following excerpts:

Lefay Resorts is the first Italian company in the tourism sector to sign an agreement with the Ministry of the Environment for projects aimed at neutralisation of CO₂ emissions. This is achieved through the purchase of CERs credits (in accordance with the Kyoto Protocol), intended to reduce emissions in Italy and in developing countries. (Lefay Resort & Spa Lago Di Garda)

[...] we are part of the Global Reporting Initiative and we have signed the UN Global Compact Compliance and the UN CEO Water Mandate. (Palazzo Montemartini)

The hotel sustainability performance can be also documented in periodical reports published on the website, as illustrated below:

We invite you to learn more about our activities by downloading our latest Sustainability Report. (Mandarin Oriental, Lago Di Como)

Sustainability reports are considered a more transparent manner for informing all stakeholders, including customers, about the sustainability performance of the hotel, such as in the following:

Lefay Resorts communicates its commitment to its stakeholders in Italy and abroad in a transparent manner. The resort's results and objectives are summarised in a Sustainability Report, which is an effective tool for managing and reporting environmental, social and economic sustainability. (Lefay Resort & Spa Lago Di Garda)

From our analysis emerged that only eight of the sampled luxury hotels included on their website a link to download the sustainability performance of the hotel.

The final topical group deals about waste management priorities. According to Demirbas (2011, p. 1281), the waste management system regards “the whole set of activities related to handling, treating, disposing or recycling the waste materials”.

The main bigrams utilized to give information on the waste management are “single plastic” (weight = 24), “waste management” (weight = 19), “eliminate plastic” (weight = 19), “reduce, recycle” (weight = 15), “reuse, recycle” (weight = 14), and “plastic bottle” (weight = 12).

According to the above-mentioned bigrams, hoteliers' attention is prevalently focused on the need to reduce single-use plastic products, as highlighted in the excerpts below:

In 2019, Starhotels also launched the Plastic-free project, a commitment to lowering its environmental impact and banishing single-use plastic products in favour of 100% recycled and biodegradable products. (Terme di Saturnia Natural Spa & Golf Resort)

[...] a commitment from all hotels eliminating single use plastic. (Hotel De Russie)

We also set ourselves an ambitious goal of eliminating all single-use plastic from our hotels by the end of March 2021. (Mandarin Oriental, Lago Di Como; Mandarin Oriental, Milan)

Furthermore, hoteliers in their sustainability disclosures utilize sequences of words such as “reduce”, “reuse”, “replace” and “recycle”, as in the following:

Radisson Hotel Group works to reduce, reuse, replace and recycle and share best practices in this area. We work with suppliers to reduce waste and increase recycling. Other key waste management priorities include food waste management and the elimination of single-use plastics wherever possible. (Hotel de la Ville)

5. Discussion

Most of the luxury hotels sampled in Italy continue to use property websites primarily as a marketing tool for promoting and selling their services. Only 37 % of the sampled hotels included a website section regarding their sustainability efforts with headings such as “Sustainability”, “Our

Sustainability Approach”, “Corporate responsibility”, “Environmental sensitivity”, “Eco | Nonprofit projects”, or “A responsible philosophy”.

In the case of chain-affiliated hotels, sustainability information is at the corporate level. For example, the British group Rocco Forte Hotels utilizes the same text for all the affiliated hotels. This may represent a limitation, because stakeholders may prefer to know the specific sustainability operations done by the hotel management on the territorial dimension. Independent hotels, such as Borgo Pignano, Due Torri Hotel, Forte Village Resort and Alpina Dolomites, present a different approach since their sustainability information reflects the characteristics of the territory.

Focusing on the rhetoric employed by hoteliers, it is worth to note that the definition of sustainability shared on the hotels’ websites pays attention to all the three pillars of sustainability, namely, social, environmental, and economic (Purvis *et al.*, 2019). This is a positive thing because companies generally concentrate their effort just towards the environmental dimension (Murillo-Avalos *et al.*, 2021). The findings also suggest that the sustainability discourse revolves around five subtopics: social and environmental commitment; energy efficiency, conservation, and management; sustainability credentials on the web page; sustainability performance; and waste management priorities.

Social and environmental commitment concerns the description of the set of activities planned by luxury hotels to improve the social welfare of all stakeholders (e.g., customers, local communities, and employees) and the quality of the environment, for example by offering products and services that do not harm the natural resources. Introducing a section about the hotel’s commitment is of paramount importance because the hotel presents its model of ethical behavior in business. Furthermore, luxury hotels by communicating their strategies for building a better world could engage with those consumers who are more ethical and environmentally conscious.

The sustainability information reported by hotels on their websites also tends to emphasize two specific area of intervention, that is, energy efficiency, conservation and management and waste management priorities. According to the findings, hoteliers describe on their websites the technologies (e.g., replacing light sources with low consumption LED bulbs, high-efficiency heating systems, and solar power plant) and the practices that can be adopted by customers and employees to reduce energy consumption. Specifically, the majority of the sampled luxury hotels focus on how to minimize water usage. About waste management priorities, the discourse is prevalently centered on how reduce/recycle plastic water bottles.

To demonstrate to customers, regulators, and other stakeholders their social and environmental commitment, the sampled luxury hotels communicate on their website the sustainability performance. In this context, hoteliers include on their website’s information about environmental awards and recognitions. They can also illustrate operations and projects, such as the Plastic-free project created by Starhotels to lowering its environmental impact and banishing single-use plastic products in favor of 100% recycled and biodegradable products. Finally, hotels can furnish on their website reports and documentations that describe the sustainability operations performed in a specific period. Generally, sustainable reports are published annually on the website (Hsieh, 2012). Unfortunately, according to our findings, only eight of the sampled luxury hotels included on their website a link to download the sustainability report. Hence, the publication of sustainability reports and documents seems to be a praxis of world’s largest luxury hotel chains, such as Marriott International, A Radisson Collection, Hyatt Hotels Corporation, Lefay Resorts, Mandarin Oriental Hotel Group, Meliá Hotels International, and TUI Group.

At the core of the sustainability discourse, there is a group of words used to display the luxury hotel’s sustainability credentials, that is, the authenticity of their social and environmental commitment. Specifically, to establish their credibility, hoteliers are used to inform their audience about the achievement of certifications, such as ISO.

Sustainability credentials can help to enhance stakeholders’ trust (Sadiq *et al.*, 2022). Furthermore, consumers are willing to pay more if the services or products are certified (Bernard & Nicolau, 2022; Boronat-Navarro & Pérez-Aranda, 2020; Nelson *et al.*, 2021).

5.1 Theoretical implications

Less attention has been paid to sustainability communication in luxury hospitality sector. This research tried to fill this gap by proposing a content analysis of sustainability disclosures published on the websites of a list of luxury hotels located in Italy. Findings contribute to the extant literature by showing the main subtopics that characterize the sustainability discourse, which in turn represents an effective marketing tool to develop the green brand identity of the luxury hotel. The results of the statistical-lexical analysis of the contents of the institutional communication of the selected hotels showed results of significant interest, both with respect to the variety of the components of and, more generally, with respect to the degree of complexity and progress of the communication strategies concerning sustainability. With reference to the first aspect, the comparison of the evidence emerged from the empirical analysis brought to light new elements not contemplated so far in the literature on green brand identity. For example, we are thinking of the social and environmental commitment, and of energy and waste management. Regarding the second aspect, instead, this study demonstrates the theoretical limits of the measurement scale proposed by Chen (2010) to estimate the green brand image in hospitality sector. From the empirical findings emerges that hoteliers communicate their sustainability efforts in a more concrete and less abstract way by furnishing examples of their activities, strategies, and projects. In addition, it is worth to note that the communication code used by luxury hotels aims to enhance the brand credibly, since hotels furnish information about the possession of specific green certifications.

Such an analysis may contribute to an advancement on green brand identity studies. Specifically, the identification and mapping of semantic structures unveils the contemporary green brand identity in a hospitality context and lays the foundation for investigating and proposing a new measurement scale for the green brand image.

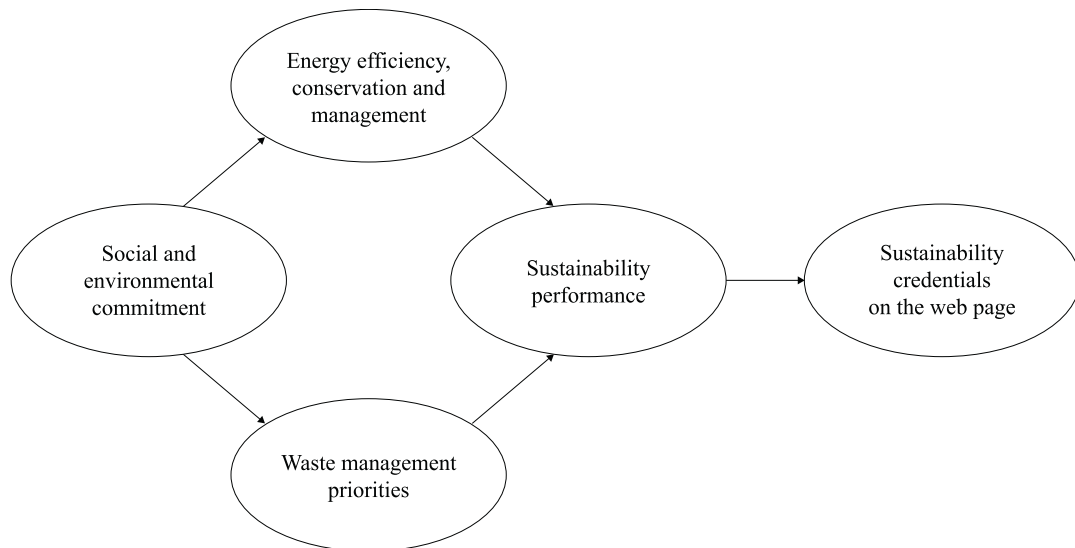
To sum, the results of this explorative research give a more realistic picture of the sustainability information furnished by luxury hotels on their websites, and thus can help researchers to identify a more adequate measurement scale for green image.

5.2 Managerial implications

In recent times luxury hotel managers have been responsive to environmental concerns undertaking concrete actions toward sustainability and emphasizing such efforts on official websites and communication channels. However, luxury hotels still seem skeptical to focus on sustainability in their marketing communications. Indeed, they usually promote their offerings by stressing the high level of service rather than their sustainability actions. However, high-end hoteliers are increasingly looking for effective communication strategies to deploy sustainability within both marketing messages and the customer experience. By showing the main subtopics employed by some of the best luxury hotels to show their sustainability commitment, the results of study provide a framework of guidance for building an ideal website section concerning the luxury hotel's sustainability disclosures. Hence, the framework in *Fig. 2* serves as a guideline for luxury hotels that would like to communicate their sustainability commitment. Specifically, according to *Fig. 2*, the first step that hoteliers should make to build a good website section dedicated to sustainability consists in introducing statements about their social and environmental commitment. Second, specific paragraphs concerning areas of sustainability interventions such as energy efficiency and waste management should be presented. Third, to give more credibility to the sustainability discourse hoteliers should present their sustainability performance and credentials.

How emerged from the analysis, only a small number of luxury hotels based in Italy seems to be inclined to use their website to disseminate information on their sustainability effort. Including explicit statements regarding the social and environmental commitment of the luxury hotels can offer advantages. For example, a website section about sustainability can help to develop the green image of the luxury hotel and attract new segments of travellers.

Fig. 2: A framework of guidance for building a good sustainability discourse.



Source: our elaboration.

6. Conclusion, limitations and future research

This study investigated luxury hotels. Particularly, the attention is focused on the analysis of the website section used by hoteliers to communicate information about their sustainability efforts. The research revealed that the major focus areas for the luxury hotel sampled were social and environmental commitment; energy efficiency, conservation and management; sustainability credentials on the web page; sustainability performance; and waste management priorities.

The research found that only a small group of luxury hotels based in Italy utilizes its own website to disseminate environmental-related information. Hence, several luxury hotels miss the opportunity to give relevance to their green brand image and consequently do not engage with those customers who have a high environmental awareness.

This study has some limitations. First, it focuses only on the web sites of a list of 197 luxury hotels based in Italy. Some of these companies may have disseminated information about their sustainability effort on other channels, such as social media. Furthermore, this study is based on a text corpus collected in January 2022, generally web page information can be modified at any time. Finally, we analyzed only the text material, we did not consider pictures, video and external link published in the section dedicated to sustainability. Thus, future research can analyze also multimodal texts, that is, contents that combine two or more communication modes, for example, visual image and written language (Baldry & Thibault, 2006).

Future research should also consider expanding the sample size, for example an international analysis can be made to find cultural differences and similarities in the way luxury hotels communicate their sustainability efforts.

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Websites

<https://www.ducotravelsummit.com>

<https://infranodus.com/>

Appendix A

Tab. A1: List of the 73 luxury hotels selected for the content analysis.

Hotel names	Star ratings	Type of hotel	Hotels group	Headquarter
Palazzo Montemartini, Rome - A Radisson Collection	5 stars	Chain-affiliated hotels	A Radisson Collection	United States of America
Aman Venice	5 stars	Chain-affiliated hotels	Aman Resorts International	Switzerland
Rosa Alpina Hotel & SPA	5 stars	Chain-affiliated hotels	Aman Resorts International	Switzerland
Belmond Grand Hotel Timeo	5 stars Superior Luxury	Chain-affiliated hotels	Belmond Hotels	Hamilton City, Bermuda
Belmond Hotel Caruso	5 stars	Chain-affiliated hotels	Belmond Hotels	Hamilton City, Bermuda
Belmond Hotel Cipriani	5 stars	Chain-affiliated hotels	Belmond Hotels	Hamilton City, Bermuda
Belmond Hotel Splendido	5 stars	Chain-affiliated hotels	Belmond Hotels	Hamilton City, Bermuda
Belmond Splendido Mare	5 stars	Chain-affiliated hotels	Belmond Hotels	Hamilton City, Bermuda
Belmond Villa Sant' Andrea	5 stars	Chain-affiliated hotels	Belmond Hotels	Hamilton City, Bermuda
Belmond Villa San Michele	5 stars	Chain-affiliated hotels	Belmond Hotels	Hamilton City, Bermuda
COMO Castello del Nero	5 stars Superior Luxury	Chain-affiliated hotels	Como Hotels and Reports	London, UK
Hotel Eden	5 stars	Chain-affiliated hotels	Dorchester Collection	London, UK
Hotel Principe Di Savoia	5 stars	Chain-affiliated hotels	Dorchester Collection	London, UK
Park Hyatt Milano	5 stars	Chain-affiliated hotels	Hyatt Hotels Corporation	United States of America
Capri Palace Jumeirah	5 stars Superior Luxury	Chain-affiliated hotels	Jumeirah Hotels Resorts	Dubai, United Arab Emirates
San Clemente Palace Kempinski	5 stars Superior Luxury	Chain-affiliated hotels	Kempinski Hotels	Switzerland; Germany
Lefay Resort & Spa Lago Di Garda	5 stars	Chain-affiliated hotels	Lefay Resorts	Italy
Lefay Resort & SPA Dolomiti	5 stars	Chain-affiliated hotels	Lefay Resorts	Italy
Mandarin Oriental, Lago Di Como	5 stars	Chain-affiliated hotels	Mandarin Oriental Hotel Group	Causeway Bay, Hong Kong
Mandarin Oriental, Milan	5 stars	Chain-affiliated hotels	Mandarin Oriental Hotel Group	Causeway Bay, Hong Kong
Cristallo, A Luxury Collection Resort & Spa	5 stars	Chain-affiliated hotels	Marriott International, Inc	United States of America
Excelsior Hotel Gallia, a Luxury Collection Hotel	5 stars	Chain-affiliated hotels	Marriott International, Inc	United States of America
Hotel Cala di Volpe, a Luxury Collection Hotel	5 stars	Chain-affiliated hotels	Marriott International, Inc	United States of America
Hotel Danieli, a Luxury Collection Hotel	5 stars	Chain-affiliated hotels	Marriott International, Inc	United States of America
Hotel Pitrizza, a Luxury Collection Hotel	5 stars	Chain-affiliated hotels	Marriott International, Inc	United States of America
Hotel Romazzino, a Luxury Collection Hotel	5 stars	Chain-affiliated hotels	Marriott International, Inc	United States of America
Hotel VIU Milan	5 stars	Chain-affiliated hotels	Marriott International, Inc	United States of America
Jw Marriott Venice Resort & Spa	5 stars	Chain-affiliated hotels	Marriott International, Inc	United States of America

The Gritti Palace	5 stars	Chain-affiliated hotels	Marriott International, Inc	United States of America
The St. Regis Rome	5 stars	Chain-affiliated hotels	Marriott International, Inc	United States of America
The St. Regis Venice	5 stars	Chain-affiliated hotels	Marriott International, Inc	United States of America
The Westin Excelsior, Rome	5 stars	Chain-affiliated hotels	Marriott International, Inc	United States of America
ME Milan Il Duca	5 stars	Chain-affiliated hotels	Meliá Hotels International	Spain
Castello Di Guarene	5 stars	Chain-affiliated hotels	Relais & Chateaux	Paris, France
Capofaro Locanda & Malvasia	5 stars	Chain-affiliated hotels	Relais & Châteaux	Paris, France
Castello Banfi - Il Borgo	5 stars	Chain-affiliated hotels	Relais & Châteaux	Paris, France
Château Monfort	5 stars	Chain-affiliated hotels	Relais & Châteaux	Paris, France
Hotel Caesar Augustus Relais & Châteaux	5 stars	Chain-affiliated hotels	Relais & Châteaux	Paris, France
Hotel Londra Palace	5 stars	Chain-affiliated hotels	Relais & Châteaux	Paris, France
Il Borro	5 stars	Chain-affiliated hotels	Relais & Châteaux	Paris, France
Il San Pietro Di Positano	5 stars	Chain-affiliated hotels	Relais & Châteaux	Paris, France
L'albereta	5 stars	Chain-affiliated hotels	Relais & Châteaux	Paris, France
Locanda Don Serafino Relais & Châteaux	4 stars, Boutique hotel	Chain-affiliated hotels	Relais & Châteaux	Paris, France
Monaci Delle Terre Nere	5 stars, Boutique hotel	Chain-affiliated hotels	Relais & Châteaux	Paris, France
Palazzo Seneca	4 stars First Class Superior	Chain-affiliated hotels	Relais & Châteaux	Paris, France
Petra Segreta Resort & Spa	5 stars, Boutique hotel	Chain-affiliated hotels	Relais & Châteaux	Paris, France
Relais & Châteaux Villa Cordevigo Wine Relais	5 stars Superior Luxury	Chain-affiliated hotels	Relais & Châteaux	Paris, France
Relais & Châteaux Villa Franceschi	5 stars	Chain-affiliated hotels	Relais & Châteaux	Paris, France
Villa Della Pergola	5 stars	Chain-affiliated hotels	Relais & Châteaux	Paris, France
Hotel Splendide Royal	5 stars	Chain-affiliated hotels	Roberto Naldi Collection	Italy; Switzweland
Hotel de la Ville	5 stars	Chain-affiliated hotels	Rocco Forte hotel	London, UK
Hotel De Russie	5 stars	Chain-affiliated hotels	Rocco Forte hotel	London, UK
Hotel Savoy	5 stars	Chain-affiliated hotels	Rocco Forte Hotel	London, UK
Masseria Torre Maizza	5 stars	Chain-affiliated hotels	Rocco Forte Hotels	London, UK
Verdura Resort	5 stars	Chain-affiliated hotels	Rocco Forte Hotels	London, UK
Villa Igiea	5 stars Superior Luxury	Chain-affiliated hotels	Rocco Forte Hotels	London, UK
Rosewood Castiglion del Bosco	5 stars	Chain-affiliated hotels	Rosewood Hotels & Resorts	United States of America
Hotel d'Inghilterra Roma - Starhotels Collezione	5 stars	Chain-affiliated hotels	Starshotel Collection	Italy
Grand Hotel Continental Siena - Starhotels Collection	5 stars	Chain-affiliated hotels	Starshotel Collection	Italy
Helvetia & Bristol Firenze - Starshotel Collection	5 stars	Chain-affiliated hotels	Starshotel Collection	Italy
Terme di Saturnia Natural Spa & Golf Resort	5 stars	Chain-affiliated hotels	Starshotel Collection	Italy
The St. Regis Florence	5 stars	Chain-affiliated hotels	Starwood Hotels & Resorts	United States of America

The Westin Excelsior Florence	5 stars	Chain-affiliated hotels	Starwood Hotels & Resorts	United States of America
Toscana Resort Castelfalfi	5 stars	Chain-affiliated hotels	TUI Group	Germany
Capri Tiberio Palace	5 stars	Independent hotels	--	Italy
Grand Hotel Majestic Già Baglioni	5 stars Superior Luxury	Independent hotels	--	Italy
Palazzo Manfredi	5 stars Superior Luxury	Independent hotels	--	Italy
Straf Hotel & Bar	4 stars	Independent hotels	--	Italy
Masseria Montenapoleone	5 stars	Independent hotels	--	Italy
Forte Village Resort	4 stars	Independent hotels	--	Italy
Borgo Pignano	5 stars	Independent hotels	--	Italy
Alpina Dolomites	5 stars	Independent hotels	--	Italy
Due Torri Hotel	5 stars	Independent hotels	--	Italy

Firm performance and contribution of female training

OKSANA TOKARCHUK* ROBERTO GABRIELE*

Framing of the research. *The present research contributes to the field of studying effect of gender diversity and management training on firm performance.*

Purpose of the paper. *The present study investigates the impact of training of senior managers on firm efficiency. In doing so, our focus is on understanding whether female involvement in training improves this relationship.*

Methodology. *This empirical study is based on archival data of training activities undertaken by 6,403 Italian firms out of 123,117 firms enrolled in Fondirigenti from 2000 to 2018. We implement a multi-stage methodology for econometric estimation. First, total factor productivity is estimated for all firms in the sample. Next, training and female involvement are assessed following the Heckman selection model (Heckman, 1976).*

Results. *We find a positive effect of senior management training on firm productivity. This effect is enlarged if female managers are involved in training activities. Participation in training activities helps women unleash their potential and provide additional benefits to the firm.*

Research limitations. *Due to data availability, it was not possible to distinguish between general and firm-specific training.*

Managerial implications. *Our results indicate that carefully crafted training activities help female managers to unleash their potential and fully contribute to the performance of their firms, as upper echelons theory predicts. Firms should promote more female leaders and provide them with training opportunities to increase their contribution.*

Originality of the paper. *Most of the existing evidence on the effect of the female presence in leadership positions relates to a very narrow context of top management and board of directors of large publicly traded companies. The present investigation addresses a novel context of senior managers that undergo management training in a sample of Italian firms that adhere to Fondirigenti. The sample includes small, medium, and large firms.*

Keywords: *female managers; managerial training; firm performance; TFP; senior managers; gender diversity*

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1. Introduction

There are still few women in top corporate management positions. Although the situation significantly improved in the last years, with rising female C-suite members from 17 per cent in 2015 to 21 per cent in 2020, the crisis generated by COVID-19 threatens the progress made (Thomas *et al.*, 2020; Crotti *et al.*, 2021). Therefore, companies urge to be presented with a “business case” to continue to invest in this issue (Deloitte, 2011; OECD, 2012).

Existing literature offers considerable evidence supporting increasing female representation at the top level (i.e., Post and Byron, 2015; Jeong and Harrison, 2017). However, the evidence is mixed. Several meta-analyses conducted on the results of four decades of research on the topic find a positive relationship between female presence in the top team with long-term financial performance (i.e., Post and Byron, 2015; Jeong and Harrison, 2017). However, markets’ reactions to the nomination of female CEO are context-dependent. For instance, the effect of female board representation is positive in countries with greater gender parity (Post and Byron, 2015; Hoobler *et al.*, 2018). On the other hand, female representation in top management teams is negatively related to short-term stock market returns (Jeong and Harrison, 2017). The presence of female leaders in corporate suites reduces the gender pay gap (Elkinawy and Stater, 2011), increase the presence of women in top management (Stainback *et al.*, 2016), boosts innovation and creativity (Dezsö and Ross, 2012), solve critical situations (Glass, 2016).

However, most of the existing evidence on the effect of the female presence in leadership positions relates to a very narrow context. These studies primarily represent US large publicly traded companies, either mentioned in the Fortune list or included in the S&P index (Post and Byron, 2015; Jeong and Harrison, 2017). Evidence on firms outside the US is scant. Most of the studies conducted on firms outside the US also focus their investigation on the largest publicly traded firms (Post and Byron, 2015; Jeong and Harrison, 2017). While it is important to learn best practices from the best world companies, there is a need to create a “business case” that will appeal to a “regular” firm.

From a theoretical point of view, the role of management in shaping corporate performance can be established once we rely on the resource-based view of the firms (Wernerfeldt, 1984) and its extension of the dynamic capabilities view (Teece *et al.*, 1990, 1997; Teece and Pisano, 1994; Teece, 1996). Using the words of Helfat *et al.* (2007), the dynamic capability is “the capacity of an organization to purposefully extend, create, or modify its resource base.” (Helfat *et al.*, 2007:4). In this definition, he emphasizes the intentionality element present in capabilities. The reference to this purposefulness in the firm motivates and explains the important role that management plays in selecting and/or developing routines -skills of the organization-, making investment choices, and orchestrating nontradable assets to achieve efficiencies and appropriate returns from innovation (Dosi 1988, Teece 1984, March 1994). The essence is that competitive success arises from the continuous development, alignment, and reconfiguration of firm-specific assets (Augier and Teece 2006, Teece and Pisano 1994, Teece *et al.* 1997). Following this perspective, more diversity enriches the set of possible recipes and strategies that a firm can experiment within the market to create distinctive competencies. Thus, enrolling and training women managers properly can enrich decision-making skills and the organizational processes to sense and seize opportunities (Augier and Teece, 2009) and boost firm performance (Christiansen *et al.*, 2016).

The present study investigates the impact of training of senior managers on firm efficiency. In doing so, our focus is on understanding whether female involvement in training improves this relationship. The investigation addresses a novel context for the research on gender diversity. We analyze senior managers that undergo management training in a sample of Italian firms that adhere to Fondirigenti. The sample includes small, medium, and large firms.

Italy represents an interesting case study because the context allows us to test the theories (which we collapse into our working hypotheses) in extreme conditions: the low intensity of the training provided by Italian firms. In other words, it could be interesting to see if and how much training for senior managers not accompanied by high-intensity worker training eventually generates an impact

on total factor productivity (TFP). Moreover, in this context, we can investigate the role of female managers in mediating this relationship.

Our study contributes to the literature on gender diversity by underlying the role of female senior managers for firm efficiency. At the same time, we contribute to the literature on the impact of training on firm performance by investigating the effect of firm investment in senior manager training. Moreover, the present analysis turns attention to the context that has been neglected in the previous research by addressing non-US firms of different sizes. The rest of the paper is organized as follows: Section 2 presents the relevant literature. Section 3 put forward research hypotheses. The methodology is presented in Section 4. Section 5 is devoted to data presentation. Results are the focus of Section 6. Section 7 discusses the results. Finally, Section 8 concludes the paper.

2. Literature

2.1 Gender diversity

Mixed evidence exists concerning the effect of female presence on the top management team, and advisory board has on firm performance (i.e., Post and Byron, 2015; Jeong and Harrison, 2017). Several meta-analyses conducted on the results of four decades of research on the topic find that there is a positive relationship between female presence in the top team and long-term financial performance (i.e., Post and Byron, 2015; Jeong and Harrison, 2017). However, markets' reactions to the nomination of female CEO are context-dependent. For instance, female board representation is positive in countries with greater gender parity (Post and Byron, 2015; Hoobler *et al.*, 2018). Female representation in top management teams is negatively related to short-term stock market returns (Jeong and Harrison, 2017).

The presence of women on the advisory board reduces the probability of securities fraud (Cumming *et al.*, 2015). Women are more likely than men to be considered for promotion to positions associated with a state of crisis or high stake of risk (Ryan and Haslam, 2005; Glass, 2016). Female leadership is related to higher innovation within a company (e.g., Dezsö and Ross, 2012) and improved corporate reputation (Bear *et al.*, 2010). Female presence in the high echelon helps to reduce the gender pay gap (Elkinawy and Stater, 2011). Appointment of women on the advisory board has a positive spillover effect on the executive team and below (Matsa and Miller, 2011; Skaggs *et al.*, 2012; Stainback *et al.*, 2016).

Despite a relatively large literature focusing on gender diversity and its impact on firm performance, research attention concentrated on investigating top management teams or members of boards of directors (e.g., Post and Byron, 2015; Jeong and Harrison, 2017). Little is known about gender diversity at lower levels of management (Kirsh, 2018).

This research has been repeatedly conducted on samples of large publicly traded firms. A typical study would include a sample of firms, included Standard and Poor's index (i.e., Adams and Ferreira, 2009; Carter *et al.*, 2010; Hoskisson *et al.*, 2002; Dezsö and Ross, 2012) or Fortune Most Admired Companies of the year list (Bear *et al.*, 2010; Cook and Glass, 2014; Cook and Glass, 2015; Glass and Cook, 2016). A few studies conducted on different samples rely on subsets of the largest national publicly traded firms (e.g., Kang *et al.*, 2007; Rose, 2007; Campbell and Míñiguez-Vera, 2008).

This excessive focus on large companies and top teams may be due to the difficulty in acquiring information on the gender composition of management teams. Companies traded on the stock exchange have obligations to disclose certain information that otherwise is very difficult to obtain. Moreover, it is possible for these companies to calculate the measure of financial performance by Tobin's q (Tobin 1969). This measure corresponds to a ratio of the market value of a firm's assets to their replacement value. This value is considered to include the future market valuation of the firm implicitly and thus reflect its overall strategic competitive advantage (i.e., Post and Byron, 2015).

The question of the effect of gender diversity at lower levels of management as well as in the context of smaller and less successful companies remains open. The present study aims to close this gap by analyzing gender diversity in senior management teams in a sample of small, medium, and large Italian companies.

2.2 Training

Literature on training and its importance is available widely, but there is a substantial lack of literature on the theoretical link between training and organizational performance. Interest in this topic has increased constantly. A growing number of studies have been trying to capture the effect of employer-provided training on productivity by using firm-level data from several sectors of the economy. Protogerou, Caloghirou, and Spyros (2012) observed that the learning capability is one of the factors underlying dynamic capabilities because the former can be conceived as “a principal means of attaining strategic renewal” (Protogerou, Caloghirou, and Spyros 2012: 619). Learning allows individuals to resolve specific problems better and quicker through experimentation and repetition.

Furthermore, learning involves individuals and organizations at the same time: Indeed, learning processes are at an individual level, but individual knowledge is shared at the organizational level; thus, insight and innovative ideas “become institutionalized as organizational artefacts” (Protogerou, Caloghirou, and Spyros 2012: 619). Then, the impact of training on firm performance can be seen as a part of the more general impact of dynamic capabilities on performance. Eisenhardt and Martin (2000), Winter (2003), Zott (2003), and Protogerou, Caloghirou, and Spyros (2012) advanced the indirect link between dynamic capabilities and performance by considering the mediating role of functional competencies. Training activities also enhance firms to invest in their absorptive capacity directly by boosting their ability to recognize the value of new, external information, assimilate it, and apply it to commercial ends (Cohen and Levinthal 1990).

Thang, Quang, and Buyens (2010: 29) observed that “the theoretical framework for the relationship between training and firm performance has been subject to considerable debate.” There are numerous difficulties in measuring the returns on training investment for firms. One major problem is the availability of data on training activities. In addition, unobserved training heterogeneity and endogeneity are likely to affect the econometric estimation of the impact of training on firm productivity. In this respect, the change in the research horizon from cross-sectional to longitudinal allows researchers to properly address the two econometric biases. The study of the impact of training on productivity is a developing research field, thanks to both increasing interest from employers in terms of understanding the return on investment of training activities and the availability of firm-level data.

The empirical investigation of the topic has yielded mixed results. Bartel (1994) estimated the effect of training programs on net sales. No impact of formal training on productivity in the same year was found, and this result was not affected by the inclusion of the variables for measuring three other human resource policies (a formal job design program, a formal performance appraisal system, or an employee involvement or quality circle program). Secondly, Bartel (1994) addressed the endogeneity problem by implementing a model of the determinants of 1983 labor productivity and calculating the residual. For businesses that did not have any training programs as of 1983, a Logit model was estimated. The dependent variable was the probability of implementing a training program after 1983, and the independent one was the value of the residual from the 1983 labor productivity equation. Results indicate that firms that invest in training programs experience faster productivity growth. Furthermore, businesses operating below their expected labor productivity levels in 1983 are more likely to implement a formal training program and experience more significant increases in labor productivity growth in the three following years. Only new training programs, but no formal training, positively affect firm sales.

Black and Lynch (1996) showed that training (defined as the number of workers trained between 1990 and 1993) did not affect firm performance. Still, the proportion of time spent in formal off-

the-job training, i.e., outside working hours, had a positive effect on the performance of manufacturing sector firms. Computer training had a positive impact on the performance of nonmanufacturing- sector firms. However, this cross-sectional study was prone to an unobserved heterogeneity bias, and the authors considered training as an exogenous variable in their regression as opposed to endogenous. Black and Lynch (2001) showed that the positive relationship between training and productivity observed in the cross-sectional analysis disappeared once one correctly considered endogeneity. Nonetheless, Turcotte and Rennison (2004) showed that an increase of 10 percentage points in the proportion of employees that received technological training is linked with a 4.5 percent increase in productivity.

Ballot, Fakhfakh, and Taymaz (2006) showed that returns on training could be shared between the firm and its employees, but returns remained higher for the firm itself. They found that the returns on training accumulation were higher for firms than for their employees. Employees shared the returns of physical capital investments, R&D, and training with their employers. Dearden, Reed, and Van Reenen (2006) found that an increase of 10 percent in the proportion of trained employees led to a proliferation of 3 percent and 6 percent in wages and value-added per worker, respectively. Barrett and O'Connell (2001) found that general training positively impacted productivity growth for Irish firms, whereas specific training had no effect.

Starting from individual-level data on training and firm-level data on productivity and wages for 1996-1999, Conti (2005) empirically analyzed an industry panel including all sectors of the Italian economy. Colombo and Stanca (2014) examined the impact of workers' training on productivity and wages by using a database representative of the population of Italian firms, formed by merging firm-level information on training and company account data between 2002 and 2005. The contributions training was demonstrated to have a positive and enormously significant effect on productivity, although to a different extent. Conti (2005) suggested that raising the stock of trained workers in an industry by one percentage point led to a 0.4 percent increase in productivity, and Colombo and Stanca (2014) found that a 1 percent increase in training was associated with an increase in value-added per worker of about 0.07 percent.

The vast majority of empirical literature demonstrates a positive and significant relationship between training activity and firm performance. Nonetheless, the results are not always coherent in estimating the magnitude of that relationship (i.e., Ballot, Fakhfakh, and Taymaz 2006; Barrett and O'Connell 2001; Colombo and Stanca 2014; Zwick 2006).

3. Research hypotheses

Many studies confirm that individuals profit from training because it can positively influence their performance and produce better paid, more stable, and more satisfaction-providing jobs (Bloom and Van Reenen 2007; Zwick 2005). In the past two decades, research interest has shifted from the individual to the organizational level. The debate has increasingly opened to studying firms' potential returns on training investments. A critical result in the literature is the presence of two causal nexuses between the impact of training on firm performance (Van Reenen 2006). More competitive firms tend to train more simply because they recognize more benefits from this costly activity.

Hence, we put forward the following hypothesis:

Hypothesis 1: More productive firms train their managers more.

Although it is difficult to assess and isolate the impact of training on firm performance, several empirical results demonstrate that training has a significant positive effect (e.g., Bartel 1994, 2000; Dearden, Reed, and Van Reenen 2006) and suggest that it directly enhances firm performance by raising the general level of skills. At the national level, the evidence is less clear. Still, it suggests

that investment in human capital positively affects productivity growth, the propensity to innovate, and success in research and development (R&D) (Gospel 2005).

From a theoretical point of view, training is seen by human capital theory as an investment that can improve employees' productivity and lead to better economic performance (Becker, 1964). The literature agrees that firm-specific training creates value for the firm (Coff, 1997). According to the resource-based view, this training is hard to imitate by competitors while it generates complex and tacit knowledge that can be a source of sustainable competitive advantage (Rumelt, 1984). Existing empirical evidence confirms this view (i.e., Bidwell, 2011; Campbell *et al.*, 2014).

On the other hand, general training is seen as a firm's investment that employees can apply at any other firm and thus does not lead to the generation of economic value for the company. However, empirical research finds a positive relationship between general training and a firm's financial performance (i.e., Georgiadis and Pitelis, 2014; Riley *et al.*, 2017; Feltrinelli *et al.*, 2017) competitive advantage can be seized.

This logic leads to the first hypothesis:

Hypothesis 2: Investment in training for senior management, regardless of it being generic or firm-specific, leads to significant gains in the firm's productivity

The present study evaluates the participation of female senior managers in training. Upper echelons theory suggests that managers' cognitive frames and decisions depend on their characteristics and previous experiences (Hambrick and Mason, 1984). Female managers are considered to have different life and work experiences, view the world from another point, and represent other consumer markets (Post and Byron, 2015). Therefore, the promotion of women to senior positions should improve organizational performance. However, existing research suggests that there are still few women on the top, and it is hard for them to make their voices be heard in a still male-dominated world, especially if they are not in the position of the leader. Women tend to be less aggressive in sustaining their views, making it challenging to consider their opinions, and reducing the potential positive contribution women can make as senior leaders. Moreover, women tend to be more risk-averse than men and thus be less inclined to voice innovative ideas in regular working meetings.

During the informal situation created during the off-the-job training, where the trainer is responsible for creating a safe space for learning and experimentation and building a peer-support community, women can gain their voice and be seen and reconsidered by colleagues (Ely *et al.*, 2011). Consequently, this helps them overcome confidence bias and contribute their opinions and views as predicted by the high echelons' theory.

Additionally, women tend to rely more on formal education. Female leaders tend to have more university degrees and are more likely to hold advanced degrees (Carter *et al.*, 2010; Hillman *et al.*, 2002). As a result, they can take more seriously training opportunities and learn from them for learning (Severiens and TenDam, 1994), which may translate to higher returns from their participation. On the opposite, men are more interested in a course for their qualifications. This reasoning leads to the following hypothesis:

Hypothesis 3: Involvement of female managers in training has a positive effect on firm performance

4. Methodology

4.1 Regression Models

We employ a multi-stage methodology. First, we estimate the TFP. Secondly, we estimate the probability of doing training for the individual firm. Finally, we estimate the effects of training and

female manager training using a regression that includes a correction term for accounting for self-selection.

TFP estimation is implemented using the Levinsohn and Petrin (2003) method¹, which can tackle a vital issue in estimating production function: the correlation between unobservable productivity shocks and input levels. Indeed, firms respond to positive productivity shocks by expanding output, which requires additional inputs. Conversely, adverse shocks lead firms to contract production, thus decreasing their inputs. Levinsohn and Petrin have suggested using an intermediate input as a proxy for investments to avoid the simultaneity bias related to inputs level².

The production technology is assumed to be Cobb-Douglas (Levinshon and Petrin 2003)

$$y_t = \beta_0 + \beta_l l_t + \beta_k k_t + \beta_m m_t + w_t + \eta_t, \quad [1]$$

where y_t is the logarithm of the firm's output measured as value-added; l_t and m_t are the logarithms of the freely variable inputs labor and the intermediate input, and k_t is the logarithm of the state variable capital. The error has two components: the transmitted productivity component given as w_t and an uncorrelated error term with input choices.

We then investigated the determinants of TFP, implementing the Heckman selection model. The two-step estimation framework helps control selection bias (Heckman 1976), while we consider the issue of endogeneity using instrumental variables in the second step regression model.

In general, the two estimated models take the following form:

In the first step, we model the probability of giving training for each firm using a Probit specification:

$$prob(training_{i,t} = 1) = probit\{\beta_0 + \beta_1 TFP_{i,t-1} + \beta_2 X_{i,t} + \tau_t + \varepsilon_{i,t}\} \quad [2]$$

Where the probability of using training is regressed against the past level of TFP to correct for potential endogeneity in the use of training related to the productivity level of firms, a series of control variables: age, unit labor cost, cost of external services, sector of activity, a time trend, in the second step, we regress the estimated TFP - through [1] - against a series of variables on the set of firms that provide training. In particular, we add the training variable:

$$\ln(TFP_{i,t}) = \beta_0 + \beta_1 \ln(TrPC_{i,t-1}) + \beta_2 WomPerTrain_{i,t-1} + \beta_3 X_{i,t-1} + IMR_{i,t-1} + \tau_t + \varepsilon_{i,t} \quad [3]$$

In both equations, the subscript i refers to firm and t to year. $TFP_{i,t}$ represents the total factor productivity of firm i in year t . In the formula, we use a logarithmic transformation of the variable.

The variable $TrPC$ represents the overall number of training hours used by firm i in year t per overall number of senior managers in the firm; $X_{i,t}$ a vector of independent covariates, namely, size, age, sector of activity (SIC 2-digit level) and the geographical area of activity at NUTS 1 level. The term τ_t is a time dummy for controlling the business cycle effect. The term $IMR_{i,t}$ represents the inverse Mills ratio which has been calculated from the regression (Equation [2]) and added to the instrumental variable regression model [Equation [3]) as an independent variable to correct for selection bias.

All independent variables are lagged one period concerning the dependent variables to avoid simultaneity bias. The estimation of Equation [3] is performed using the IV- technique, which allows for coping with the endogeneity of training variables: more productive firms can conduct more training because they have more resources to devote to this activity or because they understand better the value they can derive from middle manager training. If this is the situation, a

¹ We do this for the general model and separately for each size group and training method.

² See Levinsohn and Petrin (2003) and Olley and Pakes (1996) for a discussion about the issues arising in estimating a production function and the related econometric solutions.

regression analysis without further corrections could signal a correlation between training and productivity that could be wrongly interpreted as the causal effect of training on productivity. Hence, the endogeneity of the training variable can bias the estimations and needs to be addressed.

Moreover, to get rid of heteroskedasticity, we estimated robust standard errors.

4.2 Choice of Instrument

A vital aspect of the present models is using an instrument to cope with potential endogeneity issues that seem to mimic the theoretical instrument's characteristics. In the context of our study, endogeneity arises from the fact that we intend to single out the impact of manager training on firm TFP. Nonetheless, we cannot exclude ex-ante the fact that past TFP influences the level of training activity in a firm. Under this condition, "standard" regression coefficients are biased (Wooldridge, 2002).

We, then, use an external instrument, i.e., the yearly amount of money that Fondirigenti put together to be used by each firm for training activity, the so-called "conto formazione" (amount of money saved annually for financing senior manager training).

This money is generated via administrative legislation related to the Fondirigenti membership. In particular, Fondirigenti saves a percentage of the annual fee due from the firms-0.30% from the overall amount of senior managers' wages paid each year by a firm-in a reserved fund that is accessible to the firms only to finance training for senior managers. After three years, the fund "expires," meaning that the firm cannot use it anymore, and Fondirigenti reallocates the money for other purposes.

This variable is significantly correlated with the number of hours spent in training yearly and the amount of money spent on training each year. At the same time, the correlations of this variable with the performance indicators used are not significant and are close to zero. Hence, the number of hours and the amount of money spent in training are contingent on the annual training budget available to each firm, which ex-ante is correlated with the number of hours of training but not with firm performance.

5. Data

5.1 Dataset

The empirical analysis is based on an original 9-year panel created by merging two different complementary datasets. The two data sources are Fondirigenti and the Italian section of Bureau van Dijk.

Fondirigenti is an Italian Inter-professional Fund founded in 2004 and promoted by Confindustria and Federmanager. Its main objective is to fund senior managers' training in the joined Italian firms. Firms that join Fondirigenti can recover 0,30 percent of employer contribution paid to the National Institute for Social Security (INPS) for all managers employed with the "dirigente"³. The recovered amounts are accumulated in the firm's account at the fund and can be invested by the firm at any moment for training for this type of manager. Fondirigenti is the largest Italian fund that offers this service.

The dataset from Fondirigenti contains detailed information about Italian firms' senior management training activity. It is an individual-level dataset that includes the number of managers in training, the number of days spent on training, the overall number of hours, and the overall

³ According to Italian labor law "dirigente" is a subordinate worker who is vested with the power of disposal, coordination and control, which extends to the entire company or part of it. This professional figure enjoys the autonomy with respect to the employer, so that the latter does not immediately supervise her. In medium-large firms, these managers can often have other managers on top of them (obviously, the latter have more relevant and top role). In small to medium firms, "dirigente" typically reports to a member of board of directors or directly to the owner. As such "dirigente" supervises middle managers and reports to top management. For these reasons we refer to these managers as senior managers.

amount of money spent on training. Furthermore, this information has been used to classify those firms which spend just a portion or over the credit balance (“active” firms) and those which do not use the credit (“inactive” firms). This suggests that the availability of money is not a binding constraint in our sample.

From the second data source, we collected all accounting data of firms for the corresponding years. It allowed us to build a series of firm-level indicators and variables such as the sector of activity, sales; value-added, the stock value of fixed capital; the number of employees; cost of labour, and other variables regarding balance sheets, strong demographics, and employment. As a result of the matching, we obtain a firm-level panel dataset containing firms’ economic characteristics and training practices covering nine years from 2010 to 2018.

The sample size is remarkable in the light of previous studies on training, which often considered only a few hundred observations. This sample size is also comparable to earlier studies on gender diversity. The final clean dataset counts 12,234 firms, and training information about senior management is profound and reliable⁴.

5.2 Descriptive statistics

Table 1 lists the descriptive statistics of the variables used in the analysis. “Active” firms (i.e., those firms which have spent a portion or over the credit balance in training activities between 2010 and 2018) represent about 30 percent of the sample. Small firms (i.e., fewer than fifty employees) make up 48 percent of the total sample, with about 91 percent of firms using training services being medium and large (more than fifty employees). Most of the firms are located in the North of Italy (about 77 percent) and have been in business for more than 14 years (about 78 percent). Most of the firms in the sample are firms operating in manufacturing sectors (almost 70 percent), while companies providing services account for only 30 percent.

⁴ That is true for several reasons. First, it is pretty unusual to have in the same dataset different measures of training activity such as number of hours, number of days, number of participants, number of training activities per manager, and training costs and methods of training. Second, the training variables available are strong indicators. Indeed, according to the most influential studies in the related academic literature, the preferred training measures are the length of training (either the number of training hours or days or weeks) and training expenditure. Third, as opposed to the vast majority of academic studies in training, training information is not collected from a survey; the firm itself generated the dataset once the provision of training activity has been planned. Joining Fondirigenti, a company can submit its training plans at any time of year. The firm must record all the details concerning the training activities and subsequently confirm them by the organization that provides training. Consequently, all the information collected is triple-checked: once by those responsible for the training project within the firm, once by the training provider, and once by Fondirigenti. Measurement errors are not likely to occur, and data’s reliability and completeness are ensured. It is also true that utilizing a company database avoids the biases that generally result when individuals cannot accurately recall the amount of training they received and when definitions of training vary across diverse firms. With a few rare exceptions (e.g., Barron, Black, and Loewenstein 1989; Bartel 1994), in the academic literature, training information is usually reported by the individual employee, raising questions about the accuracy of an individual’s response duration or costs of training. Fourth, data is collected in real-time. As soon as the training activity is over, all the data are generated. This is much better than having employee- or employer-reported information about past training activities and ensuring thorough, complete on-the-job training. Fifth, the dataset is fully representative of the managers in the firm. Once the firm decides to join Fondirigenti, the registration involves all the senior managers working in the firm. This means that Fondirigenti records training activities for every manager in the firm, although this record is done at the aggregate firm level.

Tab. 1: Descriptive statistics.

Variables:	Firms that activated training					Firms that did not active training				
	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
TFP	6,403	205	212	0-49	5.416	116,714	159	568	0.01	90810
Total Employees	6,403	801	3.718	3	139433	116,714	177	1,236	1	148,126
Firm Age	6,403	33.31	21.08	1	152	116,714	27.52	18.5	1	156
Cost of labor per employee (unit labor cost)	6,403	62	36	0.07	1.040	116,711	58	299	3	65476
Credit (Yearly amount of money available for training activity)	6,403	52,115	339,607	0.32	1.02e+07	116,711	1,363	1,708	500	31,124
Percentage of training hours dedicated to female managers (only in firms that involve female managers in training)	5,441	38%	31	0.07%	100%					
Firms that involve at least one female manager in training	1,959	36%								
Total number of training hours	5,441	166	633	2	28499					
Total number of senior managers in training	5,441	28	88	1	1569					
Hours of training per manager involved in training	5,441	20.35	2.00	1.00	231.73					
Training hours per total managers	5,441	1.88	2.47	0.07	154.00					

Source: our elaboration

Only 36 per cent of the “active” firms involve at least one female manager in training. In those firms, 38 per cent of total training hours are allocated to women. On average, firms involve 28 managers in training, offering around 20 hours of training per manager. Male and female managers receive the same number of training hours.

Managers involved in training have an average age of 50.29 years. Female managers are slightly younger registering an average age of 48.8 years; male managers’ average age is 50.59 years.

6. Results

Table 2 reports the Probit regression results that measure the probability for a firm to activate training. Significant predictors of training activity are the firm dimension (0.404) and its age (0.108): bigger and older firms use more training very likely to upgrade their capabilities. The coefficient related to the past TFP score is positive (0.258) and significant. Hence, more efficient firms are more inclined to invest in managerial training, lending support to Hp.1. These firms recognize opportunities created by training to boost competitive advantage and invest in it to maintain their efficiency. The probability of initiating a training program increases with firm age and its dimension. The nature of the fund partly explains this. Firms need to accumulate a considerable amount of money on the account to activate training programs. This goal can be reached faster by larger firms and by older firms.

Tab. 2: Determinants of training. Probit model. Dependent variable: the probability of using the training at the time (t) ($prob(training=1)$).

Independent variables:	
Ln[Total Factor Productivity at time (t-1)]	0.2578*** (0.011)
Ln[Employees at time (t-1)]	0.4037*** (0.006)
Age at time (t)	0.1076*** (0.009)
Unit Labor Cost at time (t-1)	0.0000*** (0.000)
Services (t-1)	0.0001 (0.000)
Year controls	yes
Sector controls	yes
Region controls	yes
Constant	-5.3682*** (0.074)
Chi2 test	8905
Prob. Chi2	0.000
Pseudo-R2	0.180
Observations	107,583

Notes: sectors controls consider ATECO 2-digit sectors. Geographic controls for regions

Standard errors in parentheses.

*** p<0.01. ** p<0.05. * p<0.1

Source: our elaboration

Table 3 summarizes the effect of training and female managers' involvement in training on TFP. Table 3 column (1) represents a benchmark model of training impact. Column (2) also includes the variable of interest related to the proportion of training hours dedicated to female managers. Results are very similar. Hence we refer to column (2) in presenting and commenting on them. First, the Inverse Mills Ratio (IMR) is negative and significant, indicating self-selection in the sample -see the discussion about Hp.1- and justifying the two-step procedure applied. The estimate of the impact of training on TFP (ln of) is positive (1.615) and significant. Raising the training hours per senior manager by 1 per cent increases TFP by around 1,62 per cent. This supports our Hp.2.

Tab. 3: The effect of training intensity and women training on the TFP. Dependent variable: $Ln[TFP(t)]$

Independent variables:	(1)	(2)
Training hours per manager at time (t-1)	1.6594*** (0.642)	1.6151*** (0.610)
Proportion of training hours dedicated to female managers		0.0027** (0.001)
Ln[Employees at time (t-1)]	-0.8399*** (0.094)	-0.8356*** (0.093)
Age(t)	-0.3453*** (0.043)	-0.3429*** (0.041)
IMR	-3.9662*** (0.291)	-3.9273*** (0.272)
Year controls	yes	yes
Sector controls	yes	yes
Region controls	yes	yes
Constant	15.2854*** (1.151)	15.2429*** (1.134)
Chi2 test	596.5	628.1
Prob. Chi2	0.000	0.000
Observations	5,441	5,441

Notes: sectors controls consider ATECO 2-digit sectors. Geographic controls for regions

Standard errors in parentheses

*** p<0.01. ** p<0.05. * p<0.1

Source: our elaboration

The effect of female managers' presence in training registers a positive and significant coefficient (0.003). Firms that involve female managers in training receive an additional boost to their TFP. This result lets us conclude in favor of Hp.3. These firms gain an advantage from enhancing the managerial capabilities of their managers through training. They enlarge the benefit given by training through further stimulating diversity. The higher the proportion of female managers involved in training, the larger the effect. This coefficient is economically significant. Dedicating managerial training entirely to female managers would augment TFP by 27 percent. If

gender parity is reached among managers who undergo training, the TFP would increase by 13,5 percent compared to companies that reserve training only to male managers.

To facilitate understanding the economic significance of this value, Table 4 provides a hypothetical example. Suppose a firm placed within 10 percent of the less productive firms wish to improve its performance. By increasing its training intensity by 25 percent, it could reach firms' productivity within 25 percent of less productive firms. A firm within 50 percent of the most effective firms that would like to boost its productivity further could do it by increasing its training intensity by 34 percent. This would allow it to reach the top 75 percent of firms.

Based on the example in Table 4, a hypothetical firm with the value of TFP within 25 percent of the less productive firms with only male managers in training could reach the 33rd percentile by reserving half of the places in training activity for female managers. It could get the 40th percentile if all managers in training were women. To reach a similar improvement without diversity, the firm with only male managers in training would need to increase training intensity by 16 percent. It can be achieved without spending extra budget by increasing managerial diversity.

The two effects, the impact of training and the involvement of women, are cumulative. Firms that involve female managers in training reach higher efficiency levels than other firms in the sample.

Tab. 4: A hypothetical example of the impact of training on the TFP of the overall sample

TFP starting value		% increase in training intensity needed to reach the intended	TFP to be reached	
percentile	value		percentile	value
p10	98	25%	p25	138
p25	138	25%	p50	189
p50	189	34%	p75	292
p75	292	30%	p90	432

Source: our elaboration

7. Discussion

The results of the present study confirm that investment in managerial training improves firm performance. This means that firms that activate executive training, involve more managers, and dedicate more hours to training experience improved productivity in the subsequent year. Feltrinelli *et al.* (2017) conducted in a similar context found a too-much-of-a-good-thing effect. According to this effect, increasing investment in training offers incremental results only until a particular optimum is reached. After that point, additional training will result in lower returns in terms of productivity growth. We find a positive linear relationship between training hours and TFP improvements in our setting. It indicates that the more the firm invests in training, the better its productivity growth is. Feltrinelli *et al.* (2017) analysed the period from 2006 to 2011. In the present study, a period from 2010 to 2019 is considered. Higher uncertainty and fast changes faced by firms characterises the latter period. Increasing tension may require firms to turn their attention to training to purposefully acquire necessary capabilities that help compete in the turbulent marketplace (Helfat *et al.*, 2009). These results are in line with dynamic capability model (Tece *et al.*, 1990, 1997).

The most prominent result of the present study is that the impact of training on productivity is enlarged if female managers are involved in the activity. This result provides additional proof of the importance of promoting diversity at different layers of management by showing that investment in the training of female managers gives additional benefits to firm productivity. Promoting gender diversity among managers involved in training allows companies to improve efficiency without extra financial investment.

Our results demonstrate that training helps unleash female leaders' potential to contribute to firm performance fully. Given the critical productivity boost that accompanies the involvement of female managers in training, more attention should be dedicated to exploring what drives this result.

Finally, we observe that more productive firms are more inclined to invest in training. The measurement of the impact of training in the present study is not affected by this finding due to the econometric procedure adopted by the study. However, this result suggests that more productive firms investing in managerial training increase their productivity. This may lead to a growing disparity among firms in terms of productivity. This observation needs to be explored in future studies.

8. Conclusions

The present study empirically examines the relationship between firm investment in human capital, gender diversity, and performance. It is the first study that investigates the impact of diversity.

It offers several contributions to the literature. First, the paper contributes to the literature on the impact of management training on firm performance. Previous literature examined the effect of comprehensive training (Riley *et al.*, 2017), employee training, and middle managers' training (Feltrinelli *et al.*, 2017). Our results confirm that investment in senior management human capital, either general or firm-specific, constitutes the source of competitive advantage (Morris, 2017).

Previous literature demonstrated the importance of female presence in top management teams and the board of advisors. The present study helps to indicate how this contribution can be improved. Participation in training activities seems to help women unleash their potential and provide additional benefits to the firm. We claim that a skillfully created training program, in addition to building skills and transferring the knowledge, the main reason it is organized, creates firm-specific human capital given by the generation of a unique safe space that allows for learning and experimentation. This space is the cornerstone for successfully applying high echelon theory in practice. Moreover, our results suggest that the more women are involved, the more diversity goes through the training, and the higher the advantage to the firm.

The present study sheds light on the under-researched category of management which is senior management. This group is less studied in the literature but is essential for the strategy definition and implementation. Given that the Italian context is characterized by scant investment in employee training, the investment in senior management supported by the national law can be seen as a source of firms' competitive advantage.

Finally, previous studies concentrated on investigating the stars of business, the largest and most performing companies. The present inquiry extends the earlier results to the context of "regular" firms. It confirms that also, in the context of smaller firms, gender diversity matters and brings competitive advantage.

8.1 Managerial implications.

Human capital matters in upgrading a firm's dynamic capabilities. Our results suggest that firms need to invest in the overall training and give more space to female leaders as this boosts companies' competitive advantage. However, the fact that 60% of firms activate training programs without involving a single woman suggests that there are probably no senior-level women who could be involved in the first place.

Our research suggests an action plan for firms willing to improve their efficiency. They need to embrace diversity within their organization, individuate personalities with high potential, and invest in their development (Ely *et al.*, 2011). Firms that do have women but do not provide them with the opportunity for growth should do this, as training helps women unleash their potential and improve the firm's performance.

Our results also suggest that firms' development activities should be carefully planned to involve more diversity in training and create an atmosphere that helps to unleash their inherent capacity.

Our evidence demonstrates considerable differences between firms that invest in training and those that do not. Moreover, this difference is growing as more efficient firms tend to re-invest in the training and development of their human capital. This gives them an additional advantage in attracting a better workforce, particularly female managers.

8.2 Limitations

There is no study without limitations, and the present one is not an exception. Although the investigation relies on a rich dataset providing

The strength of the dataset constitutes its weakness. The focus on training activities prevents the collection of data on the firm itself. While the gender composition of managers who underwent training is registered in archives, there is no information on the composition of the gender mix of managers not involved in training. For instance, it is impossible to understand if firms addressed training activities only to male participants because the training was specific for the positions occupied by male managers or if the lack of involvement of female managers is due to the absence of female senior managers in the firm.

From the information at our disposal, it is impossible to infer if the training was generic or firm-specific. While firm-specific and generic human capitals constitute value at the senior management level, as demonstrated by the present study results, a better distinction between the two types would have helped test the theory.

Our result related to gender diversity may be driven by the fact that only a few women can make it to the top. These managers are probably better prepared, have a richer experience, and invest in their human capital provides higher returns (Dezsö and Ross, 2012). Our data do not allow us to investigate this alternative hypothesis. Future research should address this point.

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Dual leadership in “rosa”: una verifica empirica in Europa

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Abstract

Inquadramento della ricerca. All'interno della letteratura sulla corporate governance, un filone di ricerca riguarda la CEO Duality. In tale contesto, viene indagato il ruolo delle donne che ricoprono questa doppia posizione nelle imprese.

Obiettivo del paper. Indagare il ruolo delle donne nella CEO duality e il conseguente impatto sulle performance aziendali.

Metodologia. Questo lavoro si concentra su un panel cross-country di imprese europee quotate e non quotate, tenendo conto della potenziale endogeneità mediante l'uso della tecnica del 2SLS con variabili strumentali.

Risultati. La ricerca rileva, in linea con la letteratura principale, un effetto negativo della CEO Duality sulle performance aziendali. Mentre nel considerare la female CEO Duality tale effetto diventa positivo.

Limiti della ricerca. Nonostante vengano fornite indicazioni per la ricerca futura al fine di migliorare la comprensione della CEO duality nell'ambito della diversità di genere, sarebbe auspicabile utilizzare un periodo di analisi più ampio, testando anche l'effetto in contesti diversi dall'Europa.

Implicazioni manageriali. Il presente lavoro mette in evidenza il contributo positivo che può essere fornito dallo stile/comportamento di leadership femminile, suggerendo di valorizzarne il ruolo per rilanciare il business in modo efficace. La diversità di genere rappresenta una dimensione molto importante nella vita come negli affari. In particolare, il management femminile ha importanti potenziali implicazioni in termini di etica e minimizzazione dell'opportunismo.

Originalità del paper. I risultati evidenziano il “lato positivo” della governance femminile. Viene studiata per la prima volta la female CEO Duality, che potrebbe migliorare la gestione delle risorse e contribuire in modo più efficace a potenziare le performance dell'impresa.

Parole chiave: female CEO duality; diversità di genere; governance femminile; performance d'impresa.

Framing of the research. Inside the corporate governance literature, a stream of research concerns the CEO duality. In this context, we investigate the role of female having this double position.

Purpose of the paper. Investigate the role of women in CEO duality and the impact on firm performance.

Methodology. Focusing on a cross-country data set of listed and unlisted European companies, our research takes into account the potential endogeneity through the use of 2SLS with instrumental variable techniques.

Results. In line with the main literature, a negative effect of the duality of the CEO on company performance emerges. While considering the female CEO duality this effect becomes positive.

Research limitations. Although indications are provided for future research to improve the understanding of CEO duality in the context of gender diversity, it would be desirable to use a longer period of analysis, testing the effect in contexts other than the EU.

Managerial implications. This work highlights the positive contribution that can be provided by the female leadership style / behavior, enhancing its role to relaunch the business effectively. Gender diversity is a very important dimension in life as well as in business.

Originality of the paper. The results highlight the “positive side” of female governance. Female CEO duality, studied for the first time, could improve resource management, and contribute more effectively to enhancing firm performance.

Keywords: female CEO duality; gender diversity; female governance; firm performance.

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1. Introduzione

A partire dagli anni Novanta, la letteratura (Rapporto Cadbury, 1992; Rechner e Dalton, 1991; Finkelstein e D'Aveni, 1994) ha mostrato grande interesse per i potenziali effetti della c.d. CEO duality, legata alla sovrapposizione in una stessa persona del ruolo di *Chief Executive Officer* (CEO), ossia Amministratore Delegato, e Presidente del Consiglio di Amministrazione (CdA). La maggior parte degli studi ha rilevato che quando un CEO funge anche da presidente del CdA, è più probabile che ciò peggiori le performance dell'impresa (Fama e Jensen, 1983). Pertanto, è stato raccomandato di separare queste due posizioni, auspicando la necessità di avere un presidente indipendente per promuovere più elevati standard di corporate governance all'interno del consiglio e dell'impresa (Krause *et al.*, 2014; Mohammadi *et al.*, 2015). Tuttavia, esistono diverse prospettive che rendono l'effetto della CEO duality controverso. Infatti, alcuni studi (Baliga *et al.*, 1996; Brickley *et al.*, 1997; Yan Lam e Kam Lee, 2008) non hanno riscontrato alcun effetto statisticamente significativo della CEO duality sulle performance aziendali, mentre un diverso filone di ricerca (Anderson e Anthony, 1986; Stoeberl e Sherony, 1985) ha sottolineato che conferire le due posizioni a uno stesso individuo fornisce una leadership forte e inequivocabile, che offre una chiara focalizzazione sugli obiettivi dell'impresa, aumentando l'efficienza aziendale. Tali risultati contrastanti suggeriscono che l'effetto della *CEO duality* possa derivare dalla mancanza di considerazione di caratteristiche e tratti personali del CEO. È importante che le imprese nominino la persona più adatta a ricoprire tale posizione e, nel fare ciò, un aspetto cruciale potrebbe essere il sesso del candidato. Alla luce di ciò, il presente lavoro intende approfondire come le performance aziendali possano essere influenzate dalla struttura della leadership aziendale nella prospettiva della *gender diversity*. Al riguardo, si intende verificare empiricamente se l'effetto positivo delle caratteristiche femminili sulla performance di un'impresa (Adams e Ferreira, 2009; Carter *et al.*, 2010; Low *et al.*, 2015; Dezso e Ross, 2012), che rappresenta un tema caldo e attuale nella letteratura manageriale (Tyrowicz *et al.*, 2020; Zhang, 2020; Whelan e Humphries, 2020), fornisce vantaggi al business anche nel caso di *CEO duality*. L'effetto negativo della *CEO duality* sulle performance aziendali potrebbe essere controbilanciato dai benefici legati all'atteggiamento e alle caratteristiche intrinseche delle donne. In effetti, alcuni aspetti caratteristici delle donne, che verranno successivamente descritti, possono essere al centro dei vantaggi di una leadership femminile nella *CEO duality*, d'ora in poi chiamata *female CEO duality*. La letteratura prevalente (Ferrell e Skinner, 1988; Ruegger e King, 1992; Bernardi e Arnold, 1997; Duckworth e Seligman, 2006; Croson e Gneezy, 2009; Yesser e Al Mamun 2015) suggerisce che le donne sono più avverse al rischio, sono socialmente più responsabili prestando maggiore attenzione ad aspetti etici e sono meno orientate all'opportunismo. È la prima volta che si utilizza questo termine, non rinvenibile in nessun paper di ricerca, ed è la prima volta che viene approfondito il tema della *CEO duality* con una declinazione sul ruolo della *gender diversity* per verificarne l'effetto sulle performance d'impresa. Si riscontra una precedente analisi di Tullio e Chen (2017) che riscontra una maggiore propensione verso la corruzione quando il doppio ruolo della *CEO duality* è occupato da maschi rispetto a donne.

La presente analisi empirica riscontra superiori performance generate da una *female CEO duality*, in grado di amplificare gli effetti di una leadership forte e fornire un monitoraggio efficace del governo aziendale. Quando una donna detiene sia il ruolo di CEO che quello di presidente del CdA le imprese sono in grado di operare in modo più efficace mitigando le conseguenze negative derivanti da possibili problemi di opportunismo e radicamento del CEO. L'atteggiamento etico e la maggiore attenzione sociale delle donne possono limitare l'interesse e la propensione a trarre vantaggio dal proprio potere e posizione a spese degli altri (proprietari e altri stakeholder).

Pertanto, con il presente lavoro di ricerca si incrocia la letteratura di governance inerente la *CEO duality* con la letteratura della *gender diversity*, studiando l'effetto unico di un CEO-presidente donna sulle performance aziendali. Il riscontro empirico fornisce un supporto per l'effetto positivo derivante da una presenza femminile sulle performance delle imprese. Non solo si

aggiunge conoscenza sulla controversa letteratura inerente la leadership duale, ma si offre anche un contributo alla letteratura sul governo societario, la gestione e la finanza aziendale.

Dai risultati emergono implicazioni per imprese, manager e per la futura ricerca. Le imprese dovrebbero promuovere la *CEO duality* femminile per sostenere virtuosi processi di sviluppo delle performance. La *female CEO duality* rappresenta un driver per migliorare le performance aziendali e la futura ricerca dovrebbe meglio approfondire quali effetti di moderazione a livello istituzione (*country-based*) oppure a livello micro (*firm-specific*), potrebbero amplificare o limitare tale effetto.

L'articolo si articola in base alla seguente struttura. La sezione 2 propone una rassegna della letteratura per arrivare alla formulazione dell'ipotesi di ricerca. La sezione 3 descrive dati, modello empirico e variabili. La sezione 4 riporta i risultati empirici. L'articolo si conclude con una discussione dei risultati in modo da trarne implicazioni manageriali e per la futura ricerca.

2. Rassegna della letteratura e ipotesi di ricerca paragrafo

È ben noto in letteratura che le differenze di genere riflettono differenze nei comportamenti e nei processi decisionali non solo nella vita personale, ma anche nelle attività professionali e imprenditoriali (Croson e Gneezy, 2009). Numerose evidenze empiriche suggeriscono che le donne si mostrano più eticamente corrette degli uomini (Ferrell e Skinner, 1988; Ruegger e King, 1992; Ford e Richardson, 1994). In tale direzione di ricerca, si evidenzia che le donne manager hanno un livello più alto di valori morali (Bernardi e Arnold, 1997), sono più sensibili a comportamenti non etici (Stedham *et al.*, 2007), sono considerate più disciplinate (Duckworth e Seligman, 2006), tendono a promuovere meglio la responsabilità sociale (Williams, 2003) e sono meno orientate al potere e all'opportunismo rispetto alle loro controparti maschili (Whipple & Swords, 1992; Schubert, *et al.*, 1999; Croson & Gneezy, 2009).

Pertanto, è possibile che il loro comportamento etico, i valori morali e la natura premurosa rendano le donne più affidabili e impegnate.

2.1 Dualità del CEO femminile e performance aziendali

Nella letteratura di corporate governance, la leadership aziendale è stata considerata come uno degli aspetti più cruciali e visibili della struttura aziendale. Il termine “struttura di leadership” si riferisce ai due ruoli chiave del comando nell'impresa, ossia il ruolo del CEO e quello di presidente del CdA dell'impresa. In generale, l'espressione “*CEO duality*” ovvero “dualità del CEO” fa riferimento alla struttura di leadership in cui una persona ricopre due ruoli contemporaneamente: quello di CEO dell'impresa e, allo stesso tempo, quello di presidente del CdA (Rechner e Dalton, 1991; Boyd, 1995; Resick *et al.* 2009). Al contrario, la leadership indipendente definisce il caso in cui due persone diverse e indipendenti si trovano ad occupare le posizioni di CEO e presidente del CdA dell'impresa.

Nella letteratura sulla leadership aziendale il tema della *CEO duality* rappresenta un argomento molto dibattuto nell'ambito della corporate governance e della gestione strategica, con un vasto *corpus* di ricerche dedicato alla domanda se sia opportuno che una persona ricopra contemporaneamente entrambe le posizioni di CEO e presidente del CdA o se sia preferibile avere due distinti individui in tali ruoli. La prospettiva della *Stewardship Theory* e quella dell'Agenzia offrono dei framework teorici differenti. Da un lato, il primo approccio suggerisce che la *CEO duality* possa supportare una logica di leadership forte e inequivocabile, mentre il secondo evidenzia come a causa di opportunismo e un carente monitoraggio tale situazione possa complessivamente minare l'efficienza dell'impresa.

I sostenitori della *Stewardship Theory* ritengono che i manager sappiamo gestire in modo competente le risorse aziendali (Donaldson e Davis, 1991), e quindi la *CEO duality* possa creare vantaggi nella gestione di un'impresa, consentendo la piena comprensione delle scelte e delle situazioni aziendali in una visione di lungo periodo (Krause and Semadeni 2013). Alcuni studi

empirici (Donaldson e Davis, 1991; Mallette e Fowler, 1992; Boyd, 1995; Peng *et al.*, 2007) evidenziano potenziali vantaggi legati alla *CEO duality*, derivanti da una leadership univoca: facilita la generazione di efficienze interne dovute all'unità di comando, elimina potenziali conflitti tra due capi (CEO e presidente), riduce i costi di informazione (Brickley *et al.*, 1997) e, infine, evita ambiguità nell'avere due portavoci per rivolgersi agli *stakeholder* dell'impresa. Donaldson (1990) sostiene che nella *CEO duality* non vi sia alcun problema di "gioco di colpa" tra il management e il CdA perché il CEO, responsabile delle decisioni aziendali, non può incolpare nessun altro per gli eventuali risultati scarsi. Chen *et al.* (2008) evidenziano che combinare in un'unica persona il ruolo di CEO e presidente del CdA genera risparmi di tempo e di risorse. Pertanto, la *CEO duality* conduce a un governo efficace ed efficiente e, quindi, a superiori performance finanziarie.

D'altra parte, in linea con la prospettiva della Teoria dell'Agenzia, si sostiene che la sovrapposizione dei ruoli di CEO e presidente del CdA possa generare una situazione negativa in cui l'amministratore delegato valuta il proprio lavoro (Brickley *et al.*, 1997). Sin dal rapporto Cadbury (1992), è stato suggerito che i due titoli di CEO e presidente del CdA dovrebbero essere separati per avere un governo efficace di un'impresa, al fine di evitare una forte concentrazione di potere. Infatti, secondo la teoria dell'agenzia, esistono conflitti di interesse tra manager e azionisti (proprietari) e il CdA ha un ruolo centrale di controllo (Jensen e Meckling, 1976; Fama e Jensen, 1983). Al fine di garantire l'efficace funzionamento del monitoraggio, è essenziale separare la gestione delle decisioni dal controllo/monitoraggio. In particolare, secondo Fama e Jensen (1983), la *CEO duality* "segnala l'assenza di separazione tra gestione delle decisioni e controllo delle decisioni" e il CdA perde di efficacia nel monitorare e controllare le attività del CEO e del top management team. Di conseguenza, la leadership duale aumenta il radicamento dell'amministratore delegato che, a sua volta, andrà a ledere l'indipendenza e oggettività del controllo nel CdA (Finkelstein e D'Aveni, 1994). Pertanto, la *CEO duality* avrà un impatto negativo sulle performance d'impresa (Berg e Smith, 1978; Rechner e Dalton, 1991; Pi e Timme, 1993; Fosberg e Nelson, 1999; Chen *et al.*, 2005).

Sebbene la maggior parte della letteratura riveli un effetto negativo della *CEO duality* sulle performance aziendali (Krause *et al.*, 2014; Mohammadi *et al.*, 2015), alcuni studi empirici presentano risultati contrastanti e controversi (Yasser e Mamun 2015). Rispetto ai contributi che hanno riscontrato un effetto negativo della *CEO duality* sulle performance aziendali (per esempio, Berg e Smith, 1978; Rechner e Dalton, 1991; Pi e Timme, 1993; Fosberg e Nelson, 1999; Chen *et al.*, 2005), alcuni studi hanno evidenziato la mancanza di qualsiasi relazione statisticamente significativa (Baliga *et al.*, 1996; Brickley *et al.*, 1997; Yan Lam e Kam Lee, 2008) e solo una relativamente piccola parte della letteratura ha riportato effetti positivi (Donaldson e Davis, 1991; Mallette e Fowler, 1992; Boyd, 1995; Peng *et al.*, 2007).

Tali ambigui riscontri empirici suscitano interesse di ricerca sulla relazione tra la *CEO duality* e le performance dell'impresa, suggerendo un potenziale potere esplicativo nel considerare il ruolo moderatore di alcuni fattori (Boyd, 1995; Yang e Zhao, 2014). A tale riguardo, uno dei filoni di ricerca più promettenti riguarda il ruolo delle caratteristiche personali del CEO. In particolare, tra i fattori che potrebbero influenzare tale relazione, la *gender diversity* potrebbe rivestire un ruolo chiave. La diversità di genere ha stimolato grande attenzione da parte dei ricercatori in termini di studi sul CdA e sul top management e potrebbe rappresentare una variabile chiave per spiegare il ruolo della *CEO duality*. Un focus sulla dimensione di genere della *CEO duality* (ossia *female CEO duality* ovvero *CEO duality* "in rosa") potrebbe generare una potenziale area di indagine sulla relazione tra *CEO duality* e performance aziendali. Sebbene tale aspetto non sia stato ancora esplorato, potrebbe fornire spunti significativi. Per esempio, potrebbe fornire ulteriori prove a sostegno dei potenziali benefici delle donne manager per l'impresa.

Sulla base dell'evidenza esistente sulle differenze di genere (Barber e Odean, 2001; Bliss e Potter, 2002; Yasser *et al.*, 2014), si attendono atteggiamenti più etici e morali nelle donne rispetto alle loro controparti maschili, tali da renderle più responsabili e rispettose dei loro ruoli (doveri), generando motivazioni e influenze virtuose sul comportamento degli altri. Essere più altruista, degna di fiducia e meno orientata al potere per natura può motivare un CEO-presidente donna ad

avere maggiori probabilità di lavorare in modo socialmente responsabile. Si può assumere che una donna che detenga il ruolo sia di CEO che di presidente del CdA possa agire in modo più efficace riducendo l’opportunismo manageriale e il radicamento del CEO, poiché atteggiamenti etici, elevati principi morali e una maggiore preoccupazione sociale potrebbero limitare comportamenti personalistici a danno di altri stakeholder (Schubert *et al.* 2000; Wei 2007). Il “lato oscuro” della *CEO duality*, in termini di forte concentrazione di potere, radicamento del CEO e dominanza manageriale, diventa meno rilevante nel caso di un CEO-presidente donna, a causa degli atteggiamenti e della natura intrinseca delle donne. La prospettiva della teoria della *Stewardship*, evidenzia il “lato positivo” della *CEO duality*, ovvero che un’impresa con una leadership duale femminile potrebbe avere maggiori probabilità di godere dei classici vantaggi della leadership combinata fornendo unità di direzione e di comando, oltre a minori asimmetrie informative (Brickley *et al.*, 1997). Alla luce di atteggiamenti socialmente più responsabili, una minore incidenza di opportunismo e maggiore efficacia decisionale, tale prospettiva giustifica un potenziale effetto positivo della *female CEO duality* sulle performance economiche aziendali.

Osservando alcune casistiche nella comunità imprenditoriale, è possibile notare come Indra Nooyi (PepsiCo), Mary T. Barra (General Motors), Nancy McKinstry (Wolters Kluwer) e Angeliki Frangou (Navios Maritime Holdings) rappresentino alcuni esempi famosi di donne con doppie posizioni di CEO e presidente del CdA, dimostrando una forte leadership ma allo stesso tempo un comportamento etico e socialmente rilevante nelle decisioni aziendali.

Pertanto, sulla base delle argomentazioni teoriche sopra menzionate, con riferimento alla capacità delle donne nel doppio ruolo di CEO e presidente del CdA di minimizzare problemi di opportunismo, migliorare l’efficienza aziendale e portare una leadership forte e inequivocabile all’impresa si assume che la *female CEO duality* possa avere un effetto positivo sulle performance economiche aziendali. La seguente ipotesi di ricerca verrà testata empiricamente:

H.1: la female CEO duality ha un effetto positivo sulle performance economiche dell’impresa.

3. Design della ricerca

3.1 Dati

Molteplici fonti sono state utilizzate. Le variabili specifiche dell’impresa sono raccolte da Amadeus, banca dati di Bureau Van Dijk (BVD), uno dei principali data-base elettronici su informazioni e di governance aziendali in Europa. I dati sul PIL sono stati tratti dal sito web della Banca Mondiale.

L’ampio set di dati cross-country, che interesse tutti i paesi dell’area geografica orientale e occidentale dell’Europa, offre un contributo importante alla letteratura esistente sul legame tra diversità di genere e performance aziendali. Il campione transnazionale di imprese, includendo imprese operanti in contesti istituzionali diversificati, consente un’ampia generalizzazione dei risultati (Terjesen *et al.*, 2015). Solo pochi studi sono basati su set di dati europei transnazionali (per esempio, Christiansen *et al.*, 2016).

Il campione d’analisi comprende imprese europee quotate e non quotate che rispettano i seguenti criteri. In primo luogo, sono state escluse le imprese appartenenti ai settori dell’istruzione, finanziario e sociale, poiché in tali settori la gestione aziendale tende a essere influenzata da differenti aspetti normativi e molteplici altre specificità. In secondo luogo, sono state escluse anche settori che interessano la pubblica amministrazione e le organizzazioni senza scopo di lucro. Per evitare ogni tipo di errore umano nella rendicontazione delle informazioni, sono state escluse le imprese per le quali esistevano informazioni inattendibili (come quelle che con valori negativi di prestiti, debiti a lungo termine o immobilizzazioni materiali). Inoltre, sono state escluse le imprese per le quali mancavano informazioni per una qualsiasi delle variabili utilizzate nel modello di stima di regressione. Il campione finale comprende 128899 osservazioni nel periodo dal 2014 al 2016 per

25 paesi europei. Tutte le variabili contabili sono winsorizzate al 1° e al 99° percentile in modo da minimizzare l'impatto di eventuali valori anomali ed errori di codifica dei dati.

3.2 Modelli e variabili

Da un punto di vista econometrico, in primo luogo è stato utilizzato un modello generale sulla *CEO duality* [modello 1], indipendentemente dal genere, e poi è stato applicato un modello specifico sulla *female CEO duality* [modello 2].

Di seguito si riporta il modello generale di base, avente l'obiettivo di testare l'effetto complessivo della *CEO duality* sulle performance.

$$\text{Performance aziendali} = f(\text{CEO duality, variabili di controllo}) \quad [1]$$

Il secondo modello applicato è il *main model* dell'analisi, che riguarda lo studio dell'effetto della *female CEO duality* sulle performance aziendali.

$$\text{Performance aziendali} = f(\text{Female CEO duality, variabili di controllo}) \quad [2]$$

Da un punto di vista econometrico, la presenza di problemi di endogeneity, in cui una variabile esplicativa è correlata con il termine di errore, è stata testata attraverso l'Hausman specification test determinando una violazione delle assunzioni del modello OLS che, pertanto, non può essere usato. L'endogeneità rappresenta, quindi, un problema durante l'esame della relazione tra *female CEO duality* e performance poiché, in particolare, la diversità di genere potrebbe essere una variabile endogena (Hermalin e Weisbach, 2001; Carter *et al.*, 2003). Per esempio, la probabilità di riscontrare una donna nel doppio ruolo di CEO e presidente del Consiglio di Amministrazione potrebbe essere influenzata da alcuni fattori non osservabili che interessano il termine di errore.

Data la presenza di endogeneity, viene applicata la tecnica di econometrica dei minimi quadrati a due stadi (2SLS), come usando il comando stata `xtivreg2`. Vengono utilizzate due variabili strumentali (IV instrumental variables), correlate con la *CEO duality* e la *female CEO duality*, alternativamente, ma senza alcun impatto diretto sulla variabile dipendente (performance dell'impresa). Negli studi di governance è generalmente difficile trovare variabili strumentali valide, in quanto i fattori probabilmente più legati alla variabile endogena sono altre caratteristiche di governance, spesso già incluse nelle regressioni come variabili di controllo (Adams e Ferreira, 2009). Per il modello [1] si utilizzano come variabili strumenti il valore della frequenza con cui si presentano situazioni di *CEO duality* a livello di settore, unitamente all'età media dei membri del CdA. Per il modello [2] vengono usate come variabili strumentali il valore della frequenza con cui si presentano situazioni di *female CEO duality* a livello di settore, unitamente all'età media dei membri del CdA. Per quanto riguarda la frequenza della *CEO duality* a livello di settore di appartenenza, questa è calcolata come rapporto fra il totale delle imprese che hanno situazioni di *dual leadership* (stessa persona nella posizione di CEO e Chairman) in un settore rispetto al numero complessivo di imprese nello stesso settore, ed è correlata alla probabilità di avere dualità in ciascuna impresa affiliata a un settore specifico. Allo stesso modo viene calcolata la frequenza percentuale della *female CEO duality* in un settore, che si mostra strettamente correlata alla probabilità di avere *female CEO duality* in ciascuna impresa affiliata a un settore specifico. L'età media dei membri del CdA viene usato come strumento in base al presupposto che l'anzianità di servizio e la maggiore esperienza tendano ad aumentare la probabilità che una persona possa ottenere il doppio incarico di CEO e Chairman del CdA data la maggiore esperienza (Wang *et al.*, 2019). In altri termini, se l'età media dei membri del CdA è maggiore si presuppone che parimenti sia maggiore l'età della persona che assumerà il doppio incarico.

Le variabili utilizzate nel modello empirico sono illustrate nella Tabella 1. È stato scelto di usare una misura economico-contabile come proxy delle performance aziendali considerando la presenza di imprese non quotate nel campione che, di conseguenza, non permette di usare misure di

mercato oppure miste. La variabile dipendente è il Return on Assets (ROA) dell’impresa proxy tradizionalmente usata negli studi come indicatore di performance (Zona *et al.*, 2015). Il ROA è definito come il rapporto tra l’utile netto e il totale delle attività dell’impresa ed è la misura più comunemente utilizzata della performance dell’impresa (Adams e Ferreira, 2009; Easterwood *et al.*, 2012).

Tab. 1: Definizioni delle variabili e fonti dei dati

Variabili	Descrizione
Misure di performance	
Return on Assets (ROA)	Rapporto tra utile netto e totale attivo
Variabili di duality	
CEO Duality	Dummy uguale a 1 se il CEO e il presidente del CdA sono la stessa persona e 0 altrimenti
Female CEO Duality	Dummy uguale a 1 se il CEO e il presidente del CdA sono la stessa persona ed è una donna, e 0 altrimenti
Variabili di controllo	
Percentage of Female Executives	Percentuale di dirigenti donne rispetto al totale dei dirigenti nelle imprese
Percentage of Foreigner Board Members	Percentuale di consiglieri esteri rispetto al totale dei consiglieri esteri e nazionali nell’impresa
Firm Age	Logaritmo naturale dell’età dell’impresa dove l’età dell’impresa è calcolata dalla data di costituzione
Firm Size	Logaritmo naturale del totale attivo
Financial Leverage	Rapporto tra indebitamento finanziario e totale attivo
Cash Holdings	Cassa, banca c/c e liquidità rispetto al totale attivo
Firm Growth	Variazione del totale attivo rispetto al periodo precedente rispetto al valore del totale attivo del periodo precedente
Ownership Concentration	Percentuale di proprietà diretta e indiretta del primo maggiore azionista
GDP Growth	Tasso di crescita percentuale annuo del PIL

Note: Tutte le variabili sono tratte dal database Amadeus. Mentre i dati sul PIL sono stati raccolti dal sito web della Banca Mondiale

Fonte: ns. elaborazioni.

Le principali variabili esplicative sono *CEO duality*, una dummy uguale a 1 se CEO e presidente dell’impresa sono la stessa persona e 0 altrimenti, e *female CEO duality*, una dummy uguale a 1 se l’amministratore delegato e presidente dell’impresa è la stessa persona ed è donna, e 0 altrimenti.

Per evitare stimatori distorti, sono stati utilizzati diversi fattori specifici dell’impresa, specifici della gestione, della governance e di altro tipo come variabili di controllo in relazione alla letteratura precedente. La percentuale di dirigenti donne di tutti i livelli dirigenziali (di livello superiore, di livello medio e di livello più basso) è una variabile calcolata come il numero totale di dirigenti donne diviso per il numero totale di dirigenti in un’impresa (Dwyer *et al.*, 2003; Carter *et al.*, 2010; Dezsö e Ross, 2012). La proporzione di dirigenti stranieri è calcolata come il numero totale di dirigenti stranieri diviso per il numero totale di dirigenti nell’impresa di ciascun paese (García-Meca *et al.*, 2015). Età dell’impresa è definita come il logaritmo naturale del numero di anni dall’anno di fondazione (Low *et al.*, 2015). Includiamo la dimensione aziendale (Firm Size), misurata dal logaritmo naturale delle attività totali (Campbell e Mínguez-Vera, 2008). La l’indebitamento (*Financial leverage*) è misurato come il rapporto tra il debito finanziario totale e il totale delle attività (Campbell e Mínguez-Vera, 2008). Cash Holdings è calcolato come il rapporto fra disponibilità liquide e mezzi equivalenti rispetto al totale attivo. La crescita aziendale (*Firm Growth*) è misurata come variazione percentuale del totale delle attività dall’anno t-1 all’anno t. La concentrazione della proprietà è definita come percentuale di azioni, proprietà diretta e indiretta, del principale azionista di riferimento. La crescita del PIL è definita come il tasso di crescita percentuale annuo del prodotto interno lordo (PIL).

4. Risultati empirici

4.1 Statistiche descrittive

La tabella 2 riporta le statistiche descrittive per tutte le variabili del modello.

Tab. 2: Statistiche descrittive

	Mean	Median	SD	Min	Quartile 1	Quartile 3	Max
ROA	0.056	0.059	0.120	-1.698	0.027	0.097	1.304
CEO-Duality	0.010	0.000	0.103	0.000	0.000	0.000	1.000
Female CEO-Duality	0.003	0.000	0.057	0.000	0.000	0.000	1.000
Percentage of Female Executives	0.153	0.000	0.245	0.000	0.000	0.247	1.000
Percentage of Foreign Executives	0.084	0.000	0.217	0.000	0.000	0.000	1.000
Firm Age	3.622	3.526	0.832	0.693	2.996	4.248	5.892
Debt	0.209	0.143	0.224	0.000	0.039	0.263	0.912
Firm Size	10.757	9.781	1.776	5.042	9.239	10.147	15.831
Cash Holdings	0.116	0.081	0.120	0.000	0.039	0.144	0.928
Firm Growth	0.149	0.060	0.349	-0.974	-0.007	0.258	1.000
Ownership Concentration	0.822	1.000	0.284	0.000	0.570	1.000	1.000
GDP Growth	1.241	1.367	1.488	-0.404	-0.457	2.987	4.134
<i>N. Observations</i>	128899						

Fonte: ns. elaborazioni.

Il ROA (Return on Assets) è in media di 0,056. Su 1230 situazioni di *CEO duality*, in 386 casi viene segnalata una *CEO duality* femminile. Le variabili di natura contabile mostrano valori in linea con precedenti analisi empiriche sulle determinanti delle performance.

Tab. 3: Matrice delle correlazioni

	1	2	3	4	5	6	7	8	9	10	11	VIF
1 ROA	1.000											
2 CEO-Duality	-0.025	1.000										1.65
3 Female CEO-Duality	0.003	0.207	1.000									1.25
4 Percentage of Female Executives	0.021	-0.013	0.047	1.000								1.42
5 Percentage of Foreign Executives	-0.004	0.050	0.008	-0.045	1.000							1.36
6 Firm Age	0.026	0.009	0.017	0.077	-0.072	1.000						1.95
7 Debt	-0.321	-0.011	-0.016	-0.019	0.109	-0.099	1.000					1.12
8 Firm Size	-0.124	0.044	0.011	-0.036	0.090	0.081	0.205	1.000				2.01
9 Cash Holdings	0.127	0.033	0.002	0.001	0.088	0.039	-0.067	0.330	1.000			1.20
10 Firm Growth	0.111	-0.002	-0.004	-0.016	0.044	-0.18	0.032	0.015	0.029	1.000		1.38
11 Ownership Concentration	0.007	-0.002	0.004	-0.042	0.140	-0.078	0.030	0.192	0.065	0.022	1.000	1.11
12 GDP Growth	0.174	0.003	0.001	-0.006	0.242	-0.069	0.173	0.018	0.127	0.087	0.227	1.21

Fonte: ns. elaborazioni

La matrice delle correlazioni (tabella 3) mostra l'assenza di problemi di multicollinearità; l'entità della correlazione tra variabili esplicative non è molto elevata, indicando che è improbabile che la multicollinearità vada a distorcere i coefficienti di stima. Il test VIF segnala che l'analisi non è minacciata da questo tipo di problema (il VIF massimo è 1,25, al di sotto della soglia generalmente accettata di 5).

4.2 Risultati della regressione

L'analisi di regressione è stata sviluppata implementando come tecniche econometrica il 2-stage least-squares (2SLS) basato sulle variabili strutturali. La tabella 4 riporta l'esito del secondo

step del modello 2SLS in cui le variabili esplicative *CEO duality* e *female CEO duality* sono i valori “strumentati” ottenuti con il primo step di regressione. Il test F degli strumenti, in relazione al primo stage di regressioni, mostra che gli strumenti sono statisticamente significativi, superando il criterio della rilevanza. Il test Hansen-J Statistic è non statisticamente significativo, identificando gli strumenti come validi.

Nella tabella 4, le colonne (1-2), vengono presentati i risultati della regressione 2SLS. Il coefficiente della variabile *CEO duality* nella colonna 1 è negativo e statisticamente significativo a livello di quasi il 5%. Il coefficiente della variabile *female CEO duality* nella colonna 2 è positivo e statisticamente significativo all'1%. I risultati della tabella 4 sono coerenti con l'idea che la presenza delle donne nella doppia carica di CEO e presidente del CdA migliori le performance aziendali.

È ampiamente riconosciuto che la *CEO duality* tenda a ridurre le performance dell'impresa a causa della presenza di conflitti di agenzia. Questo perché, in assenza di separazione tra proprietà e controllo, un amministratore delegato che sia anche presidente del CdA potrebbe iniziare a divergere dagli interessi degli azionisti e manipolare l'informazione del consiglio. Pertanto, nel caso di *CEO duality*, il consiglio aziendale perde la sua indipendenza, la sua capacità di monitoraggio e disciplina gestionale e diventa incapace di governare l'impresa in modo efficace.

Ma la *female CEO duality* può avere un impatto opposto sulla governance e sulle performance dell'impresa, coerentemente con il fatto che le donne più etiche, altruiste e collaborative si sentirebbero più reattive in termini di doveri nei confronti dell'impresa e sarebbero meno propense a essere opportuniste. Pertanto, una donna che ricopre le cariche sia di amministratore delegato che di presidente dell'impresa si sentirebbe ancora più responsabile e fortemente obbligata a svolgere efficacemente i propri compiti, soprattutto in posizioni che generalmente sono considerate una tipica situazione di opportunismo.

Si può assumere, dato il presente risultato empirico, che una donna con posizioni sia di CEO che di presidente del CdA, dato il più elevato livello di eticità, valori morali e altruismo, possa svolgere i suoi doveri in modo più efficace senza alcun egoismo, ben motivando il management e guidando la direzione e il team del consiglio verso il raggiungimento di obiettivi ambiziosi.

Tab. 4: *Impatto della CEO duality femminile sulle performance finanziarie dell'impresa*

La tabella mostra i risultati della regressione 2SLS con il ROA come variabile dipendente. La colonna 1 mostra i risultati per *CEO duality* e la colonna 2 i risultati per *female CEO duality*. Alla fine della tabella vengono riportate le seguenti statistiche: Hansen J Statistic è il test della condizione di sovraidentificazione per la validità congiunta degli strumenti esclusi; e la statistica Kleibergen-Paap rk LM e la statistica Kleibergen-Paap Wald rk F sono i test di pertinenza e debolezza degli strumenti. Si veda la tabella 1 per le definizioni delle variabili esplicative. I numeri tra parentesi rappresentano i p-value. Livelli di significatività: 10% (*), 5% (**) o 1% (***)

Variabili esplicative	ROA	
	Metodo del 2SLS (Variabili strumentali)	
	(1)	(2)
CEO-Duality	-0.174** (0.023)	
Female CEO-Duality		1.016*** (0.002)
Percentage of Female Executives	0.003 (0.425)	-0.005 (0.255)
Percentage of Foreign Executives	-0.003 (0.128)	-0.011 (0.120)
Firm Age	0.004** (0.014)	0.001 (0.545)
Debt	-0.227*** (0.000)	-0.202*** (0.000)
Firm Size	-0.010*** (0.000)	-0.013*** (0.000)
Cash Holdings	0.014*** (0.000)	0.021*** (0.000)
Firm Growth	0.028*** (0.000)	0.033** (0.000)
Ownership Concentration	-0.009* (0.089)	-0.005* (0.055)
GDP Growth	0.005** (0.020)	0.016** (0.047)
Hansen J Statistic (p-value)	0.354 (0.451)	0.295 (0.465)
Kleibergen-Paap rk LM statistic (p-value)	43.339 (0.000)	32.713 (0.000)
Kleibergen-Paap Wald rk F statistic	32.661	12.753
Observations	128899	128899

Fonte: ns. elaborazioni

Una serie di test di robustness è stata effettuata per validare la solidità dei risultati. In particolare, i risultati sono confermati utilizzando alternative misure di performance contabile quali il rapporto fra Risultato Operativo su Totale attivo ed anche Utile Netto su Patrimonio Netto. Anche utilizzando alternativa variabili di controllo (ad esempio, logaritmo del Cash Holding oppure crescita in termini di fatturato), *CEO duality* e *female CEO duality* mantengono la stessa significatività statistica. Stessi risultati si riscontrano anche utilizzando la tecnica del Three stage-least squared (3SLS), sempre in grado di tenere sotto controllo problemi di endogeneity.

5. Conclusioni

I risultati della presente analisi supportano la rilevanza della diversità di genere sulle performance aziendali. In particolare, i risultati empirici mettono in evidenza il “lato positivo” della governance femminile.

L’analisi della leadership aziendale in termini di *gender diversity* evidenzia come la presenza di una donna nel doppio ruolo di presidente del CdA e amministratore delegato eserciti una forte influenza positiva sulle performance aziendali. Mentre l’effetto della *CEO duality* sulle

performance aziendali è negativo, in linea con i risultati di precedenti studi empirici (Berg e Smith, 1978; Rechner e Dalton, 1991; Pi e Timme, 1993; Fosberg e Nelson, 1999; Chen *et al.*, 2005), una *CEO duality* al femminile si mostra foriera di virtuose dinamiche decisionali per l'impresa. Una *CEO duality* “in rosa” aumenta la probabilità di avere una buona amministrazione delle risorse aziendali e potrebbe contribuire in modo più efficace a migliorare le performance dell'impresa.

Tale risultato si mostra in linea con i sostenitori della teoria della *stewardship* (Donaldson e Davis, 1991; Mallette e Fowler, 1992; Boyd, 1995; Peng *et al.*, 2007) ed è coerente con l'opinione che le donne possano offrire un contributo efficace nelle decisioni aziendali riducendo l'opportunismo manageriale grazie a superiori valori di eticità e moralità. Il “lato oscuro” della *CEO duality*, in termini di forte concentrazione di potere e dominio manageriale opportunismo ed espropriazione di risorse a scapito degli investitori, si “illumina” grazie al ruolo delle donne. Il “lato positivo” della dualità femminile nella leadership CEO-presidente, consente di godere dei classici vantaggi della leadership combinata congiuntamente all'unità nella direzione aziendale e a minori costi di informazione (Brickley *et al.*, 1997).

Il presente lavoro ha importanti implicazioni pratiche e di ricerca. In termini di implicazioni manageriali, i risultati empirici sottolineano il ruolo preminente della rappresentanza femminile nella gestione aziendale e nel CdA di un'impresa, in grado di migliorare la governance e le performance complessive aziendali. Di conseguenza, le imprese dovrebbero sponsorizzare tale ruolo come potenziale punto di forza. Un CEO donna altamente qualificato che svolge anche il ruolo di presidente del CdA mostra un apprezzamento del mercato e presenta potenzialmente dei benefici anche in termini di immagine aziendale.

Se fosse la maggiore eticità al centro dell'effetto positivo della *female CEO duality* le imprese potrebbero cercare di ottenere buone performance anche nel caso di *CEO duality* maschile, andando alla ricerca di persone in possesso di tali valori. Possedere sani principi etici e morali dovrebbero rientrare nel profilo tipico di soggetti apicali all'interno di cari aziendali. Potrebbe, pertanto, essere oggetto di future analisi cercare di capire se è una questione di gender, per una combinazione di più fattori che caratterizzano le donne rispetto agli uomini, oppure la necessità di una maggiore responsabilità sociale ad aver determinato i risultati della presente analisi. Sicuramente il presente riscontro va a corroborare l'importante della responsabilità sociale e di principi etici di cui le imprese devono tener conto nel momento di decidere la propria struttura di leadership.

Gli effetti positivi della *female CEO duality* potrebbero essere un sottoprodotto della maggiore propensione etica e morale che le donne hanno rispetto ai maschi, oppure di un effetto reputazione sul mercato, che consentono una riduzione dell'opportunismo e dei costi di informazione che tipicamente caratterizzano la *CEO duality*.

Inoltre, il presente lavoro evidenzia che l'effetto della dualità del CEO sulla performance aziendale dipende dalle caratteristiche del CEO ancora più di altri aspetti. Un tale risultato suggerisce la necessità di introdurre nuovi criteri di valutazione nell'assegnazione di posizioni chiave nella struttura manageriale delle imprese. Durante il processo di assunzione è importante testare l'atteggiamento etico e la moralità del candidato.

Infine, il presente risultato pone dei dubbi su possibili politiche proposte in alcuni paesi su normative che impongano la separazione nei ruoli di amministratore delegato e presidente del CdA. Tale doppio ruolo dovrebbe essere promosso se potenzialmente vantaggioso per l'impresa.

Il presente lavoro va contro corrente e ribalta la visione che suggerisce la separazione tra i ruoli di CEO e presidente del CdA, fornendo spunti utili anche per i futuri ricercatori. Riscontrato tale valore della *female CEO duality* sarebbe importante analizzarne in future ricerche gli antecedenti di tale fenomeno, per scoprire i motivi che rendono il dualismo in rosa CEO-presidente un buon motore di sviluppo per le performance aziendali. Ad esempio, potrebbe essere interessante indagare le differenze settoriali in merito al ruolo della *female CEO duality* sulla performance delle imprese quotate in Borsa. È possibile che la superiori performance della *female CEO duality* possa essere *industry-specific*. Più in generale, i risultati di ricerca suggeriscono di indagare ulteriormente il ruolo del gender per una migliore comprensione della leadership diversificata all'interno delle

organizzazioni, in quanto la diversità di genere potrebbe determinare performance positive altrettanto importanti per la creazione di posti di lavoro e la crescita economica

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Politiche di reshoring e attrazione degli investimenti: evidenze empiriche dal contesto Italiano all'epoca del coronavirus

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Abstract

Inquadramento della ricerca. Negli ultimi anni, i cambiamenti politici ed economici globali e la pandemia del Covid-19 hanno spinto molte aziende a ripensare la localizzazione delle loro catene del valore a favore di strategie di reshoring al fine di ridurre la dipendenza da fonti globali.

Obiettivo del paper. Il presente lavoro si propone di indagare se e come il fenomeno in oggetto abbia interessato il contesto Italiano, evidenziando le politiche governative e analizzando le strategie di reshoring attuate dalle imprese a partire dall'attuazione delle prime misure restrittive a seguito della diffusione del Covid-19.

Metodologia. L'analisi qualitativa di tipo esplorativo ha consentito di descrivere il fenomeno sulla base dell'interpretazione di informazioni e dati raccolti da fonti secondarie.

Risultati. I risultati preliminari, ottenuti sulla base di fattori politici, economici, organizzativi e sociali, evidenziano il ruolo delle politiche governative a supporto dell'attrazione degli investimenti e gettano luce su nuove prospettive sul futuro della filiera particolarmente rilevanti per affrontare l'attuale complessità legata ai cambiamenti economici, sociali e ambientali.

Limiti della ricerca. Le considerazioni effettuate potrebbero essere approfondite attraverso l'adozione di ulteriori metodologie. La somministrazione di questionari in profondità a piccole e medie imprese del contesto italiano consentirebbe di approfondire la problematica e di rendere i risultati maggiormente generalizzabili.

Implicazioni manageriali. Nell'attuale contesto di turbolenza e complessità, il fenomeno del reshoring è stato preso in considerazione da diverse aziende Italiane per ridurre la dipendenza da fonti globali e migliorare la resilienza delle supply chain.

Originalità del paper. L'originalità del lavoro risiede nel tentativo di evidenziare il ruolo delle politiche governative, ad esempio legate a fondi speciali, agevolazioni fiscali, Zone Economiche Speciali (ZES), a supporto delle iniziative di reshoring nel contesto italiano, sottolineando l'impatto sul territorio in termini di crescita occupazionale e minore dipendenza dall'estero.

Parole chiave: reshoring; supply chain management; Covid-19; politiche industriali; strategie.

Framing of the research. Recent worldwide political and economic changes, as well as the Covid-19 outbreak, have driven many companies to reconsider the location of their value chains in favor of reshoring strategies in order to reduce their dependence on global sources.

Purpose of the paper. The present work proposes to investigate whether and how the phenomenon in question has affected Italian context, highlighting the government policies and analyzing the reshoring strategies implemented by companies since the implementation of the first restrictive measures following the spread of the Covid-19.

Methodology. The exploratory analysis allowed a description of the phenomenon based on the interpretation of information and data collected from secondary sources.

Results. Preliminary results, based on political, economic, organizational and social factors, highlight the role of government policies in supporting investment attraction and shed light on new perspectives on the future of the supply chain that are particularly relevant to addressing the current complexity associated with economic, social and environmental changes.

Research limitations. The considerations made could be expanded upon by incorporating additional approaches. The delivery of detailed questionnaires to small and medium-sized firms in the Italian environment would allow for more depth and generalizability of the findings.

Managerial implications. In the current context of turbulence and complexity, numerous Italian companies have considered reshoring in order to reduce their reliance on global suppliers and strengthen the resilience of supply chains.

Originality of the paper. The originality of the work lies in the attempt to highlight the role of government policies, for example linked to special funds, tax breaks, Special Economic Zones (SEZ), in support of reshoring initiatives in the Italian context, highlighting the impact on the territory in terms of employment growth and reduced dependence on foreign countries.

Keywords: reshoring; supply chain management; Covid-19; industrial policies; strategies.

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1. Introduzione

A partire dagli anni '80, a livello internazionale si è diffusa la tendenza a concentrare le attività ad alto valore aggiunto e ad alta intensità di conoscenza (come ricerca e sviluppo, marketing e servizi post-vendita) nei paesi più industrializzati e a spostare le attività considerate a basso valore aggiunto e alta intensità di lavoro (come i processi produttivi) in paesi dove fosse possibile sfruttare vantaggi di costo (Contractor *et al.*, 2010; Gereffi and Fernandez-Stark, 2016; Albertoni *et al.*, 2017; Boffelli *et al.*, 2020). Ciò ha comportato la delocalizzazione di alcune attività caratteristiche della supply chain in luoghi geograficamente distanti, ma facilmente raggiungibili grazie ai progressi ottenuti nei trasporti e nella logistica. Lo spostamento delle attività a minore valore aggiunto verso questi paesi ha contribuito alla creazione delle cosiddette catene del valore globali (Baldwin and Yan, 2014; Johnson, 2018; Antràs and Chor, 2021).

In letteratura, il fenomeno sin qui descritto è stato definito *offshoring* (Dunning, 1988; Pedersen, 2006; Oshri, 2011), costituito dall'insieme dei processi dedicati al coordinamento e alla gestione di funzioni aziendali svolte oltre i confini nazionali (Levine, 2012). Negli ultimi decenni, i cambiamenti politici ed economici globali, l'assottigliamento dei vantaggi di localizzazione in paesi a basso costo e la crescente consapevolezza del "costo totale" dell'*offshoring* hanno spinto molte imprese a ripensare la localizzazione delle loro supply chain attraverso l'attuazione delle cosiddette strategie di *reshoring*, volte a riportare nei paesi d'origine le attività delocalizzate, "invertendo", dunque, le precedenti scelte di *offshoring*.

Sebbene non si tratti di un fenomeno completamente nuovo, poichè già a partire dalla fine degli anni '80 alcune imprese hanno sporadicamente attuato strategie e politiche di *reshoring*, in letteratura numerosi autori stanno ancora tentando di colmare alcune lacune relative alla concettualizzazione e alla definizione delle caratteristiche e del possibile impatto politico-economico del fenomeno in oggetto (Fratocchi *et al.*, 2014). In tal senso, vale ricordare che le definizioni di *reshoring* disponibili in letteratura pur presentando alcuni tratti comuni, tendono, spesso, ad essere alquanto diverse. Tra le più interessanti rientra quella fornita da Grossman e Rossi-Hansberg (2008), secondo i quali il *reshoring* sarebbe, genericamente, dato dall'insieme delle decisioni di localizzazione di alcune attività produttive, che non risentono della natura e/o della dimensione dell'impresa che le attua. Fratocchi *et al.* (2014), invece, scendendo più nel dettaglio, considerano il *reshoring* come la strategia che le imprese adottano quando decidono di riportare in patria, completamente o in parte, alcune delle attività delocalizzate in paesi offshore, sia mettendo fine alle attività svolte all'estero per svolgerle in patria sia sostituendo fornitori internazionali con fornitori "domestici".

Accanto al mondo accademico, la rilevanza del fenomeno in oggetto è stata riconosciuta anche dal mondo politico e istituzionale, così come testimoniato dalle politiche e dalle azioni che vari governi nazionali hanno attuato al fine di incentivare la rinascita e/o lo sviluppo locale (Pegoraro *et al.*, 2021).

Negli ultimi anni, a fronte della diffusione della pandemia da Covid-19 tanto il mondo accademico, quanto quello politico-istituzionale hanno riconosciuto l'impatto dirompente che le interruzioni nelle catene di fornitura globali hanno avuto sull'economia mondiale. Gli effetti negativi di tale crisi hanno pesato in maniera crescente proprio sulle scelte di localizzazione, sebbene in modo parzialmente differente a seconda del settore e/o del segmento di mercato (Barbieri *et al.*, 2020), degli switching cost associati e del contesto politico-culturale di riferimento (Strange, 2020). Tali interruzioni hanno modificato gli equilibri dei mercati globali, evidenziando la necessità di ridurre la dipendenza da fonti globali per migliorare la capacità di risposta a fenomeni critici e, dunque, la resilienza di diversi settori produttivi. Tuttavia, sebbene diverse evidenze testimonino la vantaggiosità delle strategie di *reshoring*, specialmente durante l'attuale periodo pandemico. Come ogni nazione abbia risposto in termini di gestione della catena di approvvigionamento e di politiche perseguite sono questioni a tutt'oggi aperte e, dunque, oggetto di dibattito, cui il presente lavoro intende contribuire a attraverso un'analisi di natura esplorativa orientata a rilevare e descrivere alcune delle principali determinanti che hanno spinto imprese ed

istituzioni italiane a pianificare, promuovere ed attuare iniziative di reshoring. A tal fine, l'interrogativo che ha ispirato questo studio può essere sintetizzato come segue:

RQ1: Quali sono i principali fattori e/o le principali spinte al reshoring in ambito italiano a seguito della pandemia da Covid-19?

Il lavoro è strutturato come segue: la sezione 2 offre una panoramica sulla definizione di reshoring e sulle tendenze globali e gli approcci di policy degli ultimi anni; la sezione 3 presenta una nota metodologica; la sezione 4 fornisce un quadro delle politiche italiane e iniziative imprenditoriali nel contesto del reshoring durante la pandemia; la sezione 5 infine presenta le principali conclusioni e future linee di ricerca.

2. Background teorico

2.1 Strategie di reshoring: vantaggio competitivo e fattori abilitanti

Negli ultimi anni, per effetto della crescente incertezza e dei numerosi cambiamenti che hanno interessato gli scenari politici ed economici globali, le imprese hanno ripensato la localizzazione delle proprie catene del valore globali (Wan *et al.*, 2019 a,b). Le decisioni di offshoring che molte di esse avevano preso sono state, perciò, messe in discussione, anche a fronte del recente indebolimento dei tradizionali squilibri esistenti tra le economie avanzate ed emergenti. Ciò ha determinato la riduzione dell'impatto di quelli che erano i principali driver alla base dell'offshoring, come ad esempio la riduzione di costi di diversa natura (Manning *et al.*, 2008; Lewin *et al.*, 2009). In tal senso, infatti, è interessante evidenziare come, recentemente, il costo del lavoro sia tendenzialmente aumentato nelle economie emergenti e diminuito nei paesi avanzati, dove il tasso di disoccupazione indica un eccesso di offerta in tal senso (Arlbjørn and Mikkelsen, 2014; Van Den Bossche *et al.*, 2014).

In questo scenario, le imprese hanno iniziato a ricollocare le proprie attività offshore nei paesi di origine, riportando di fatto a casa le attività che in precedenza erano state delocalizzate. Questo fenomeno, noto in letteratura come "reshoring", è definito come l'atto volontario di spostare parte delle operazioni manifatturiere totali (cioè non forzato dai governi dei paesi ospitanti) da una località offshore al paese d'origine della casa madre (Albertoni *et al.*, 2017; Delis *et al.*, 2019). La rilocalizzazione della produzione verso i paesi di origine, inoltre, è stata variamente definita ed è nota come *onshoring*, *inshoring* o *backshoring*, assumendo talvolta sfumature di significato leggermente diverse. Tuttavia, il presente contributo farà riferimento al termine "reshoring", a fronte della sua maggiore diffusione sia tra gli accademici, che tra i professionisti (Barbieri *et al.*, 2018; Wiesmann *et al.*, 2017).

La letteratura recente ha analizzato il fenomeno del reshoring evidenziandone i tratti essenziali e le spinte che possono condurre a questo tipo di scelta strategica (Di Mauro *et al.*, 2018; Foerstl *et al.*, 2016; Pegoraro *et al.*, 2022). Gli approcci teorici attingono principalmente a: 1) la teoria dell'internazionalizzazione, associando il fenomeno in oggetto alle tendenze economiche globali (Di Mauro *et al.*, 2018), 2) la teoria dei costi di transazione, collegando le decisioni di reshoring e più in generale di localizzazione delle attività produttive al contenimento di questa tipologia di costi (Foerstl *et al.*, 2016), 3) la letteratura sul supply chain management quando afferma che fattori legati al contesto locale possono spingere l'impresa verso decisioni di reshoring (Pegoraro *et al.*, 2022).

Gli studi sul tema dimostrano che le scelte di reshoring possono derivare dal venir meno di condizioni che in precedenza avevano determinato le scelte di offshoring, oppure dall'insorgere di condizioni particolarmente vantaggiose nella nuova opzione localizzativa. Pertanto, il *reshoring* rappresenta una scelta strategica che affonda le sue radici in fattori diversi, interni e/o esterni all'impresa, di natura politica, economica, organizzativa e/o sociale, che possono riguardare tanto il

contesto delle localizzazioni offshore, da cui l'impresa si ritira, quanto quello domestico, nel quale l'impresa decide di rientrare.

Come affermato in precedenza, l'assottigliamento dei vantaggi di localizzazione in alcuni paesi a basso costo e la crescente consapevolezza del "costo totale" dell'offshoring hanno spinto molte imprese a ripensare la localizzazione delle loro catene globali del valore (Wan *et al.*, 2019 a,b). La maggiore consapevolezza dei costi sommersi dell'offshoring (es. tempi di consegna più lunghi, costi di trasporto, perdite di proprietà intellettuale e differenze culturali) e dei benefici generati dal controllo diretto delle fasi di produzione (es. i beni comuni industriali) sono tra i principali fattori che spingono le imprese a "riportare a casa" una parte o la totalità delle attività produttive precedentemente delocalizzate. Inoltre, la gestione delle catene di fornitura globali è stata messa sotto esame anche dal punto di vista della responsabilità sociale delle imprese. Walker *et al.* (2014) hanno evidenziato la pressione crescente esercitata da governi e istituzioni internazionali sulle imprese per evitare che esse adottino comportamenti irresponsabili, scegliendo luoghi con poca protezione del lavoro, salari al di sotto del livello di sussistenza e poca considerazione per la salute e la sicurezza dei dipendenti. Questo suggerisce cioè che gli aspetti di opportunità economica e organizzativa si intersecano con gli aspetti etici e sociali, e che in questo scenario il decisore pubblico può favorire una traiettoria già avviata verso il rientro delle attività precedentemente delocalizzate. Più specificamente, si registra un crescente desiderio da parte del mondo politico e istituzionale ad impegnarsi nel "rimpatrio" delle catene di fornitura al fine di raggiungere obiettivi di sviluppo del territorio. A seguito delle crisi globali recentemente vissute, i governi hanno iniziato sempre più spesso a considerare il fenomeno del *reshoring* come una possibile soluzione ai problemi di ordine socio-economico che caratterizzano ambiti territoriali specifici (Booth, 2013; PricewaterhouseCoopers, 2012). L'amministrazione statunitense, ad esempio, ha sfidato i tradizionali capisaldi del *freetrade* per "riportare a casa" alcune attività produttive (Tate, 2014) e, per la prima volta da decenni, nel 2016 il paese ha registrato un incremento netto di oltre 25.000 posti di lavoro, dovuto anche all'efficacia delle politiche di *reshoring* attuate (Reshoring Initiative Report, 2017). Anche l'Unione Europea ha avviato politiche a sostegno della reindustrializzazione (EPRS, 2014). In particolare, il governo tedesco ha lanciato il programma "Industrie 4.0", mettendo a disposizione 200 milioni per rilanciare l'attività manifatturiera nel paese, anche attraverso l'attrazione di attività economiche all'estero (Stentoft *et al.*, 2016). Sebbene il dibattito in merito al *reshoring* abbia riguardato soprattutto le attività manifatturiere, alcune imprese stanno iniziando a riportare in patria anche attività legate al settore dei servizi. Ad esempio, la *General Electric* e la *General Motors* hanno deciso di portare avanti delle strategie di *reshoring* dedicate ai servizi IT (The Economist, 2013).

Negli ultimi anni, la diffusione della pandemia da Covid-19 ha evidenziato la vulnerabilità delle catene di approvvigionamento globali che hanno subito diverse interruzioni, anche a causa dell'eccessiva dipendenza dal sistema produttivo e manifatturiero asiatico, in particolare, cinese. La diffusione del virus, che inizialmente ha portato alla chiusura temporanea delle fabbriche nella provincia cinese dell'Hubei, ha causato interruzioni nelle attività di produzione in molti paesi che solo successivamente hanno compreso la reale portata della dipendenza dalle forniture provenienti dalla Cina. Come riportato da Mondal (2021), un anno prima della pandemia, il "Gruppo dei Sette" (G7), composto da Canada, Francia, Germania, Italia, Giappone, Regno Unito e Stati Uniti, era molto dipendente dalla Cina anche per le importazioni di materiale medico, situazione che si è rivelata critica proprio con il diffondersi a livello globale del virus. In tale periodo, si è, infatti, assistito alla indisponibilità sui mercati occidentali di dispositivi medici di largo consumo come mascherine chirurgiche o guanti in lattice.

3. Note metodologiche

L'analisi empirica al cuore del presente lavoro è stata svolta seguendo un approccio esplorativo, particolarmente utile quando si ha la necessità di dover circoscrivere, descrivere e analizzare le

caratteristiche di un problema/fenomeno particolare non ancora ben conosciuto (Kvale and Brinkmann, 2007). Infatti, secondo Kvale (1997) lo svolgimento di analisi di natura esplorativa è finalizzato principalmente all'individuazione di nuove "dimensioni" e/o caratteristiche dell'unità di analisi considerata. Ne consegue che tale approccio appare particolarmente utile allo scopo dello studio in oggetto, ovvero a indagare a livello nazionale e definire meglio un fenomeno che sta acquisendo rilevanza crescente come il reshoring. Tale approccio, infatti, consente di identificare situazioni, opportunità o ancora problemi che caratterizzano uno specifico ambito di riferimento, identificando, inoltre, i fattori chiave che lo caratterizzano (Van Wyk, 2012). Ne consegue che, a seguito dei risultati ottenuti dall'analisi teorica svolta nelle sezioni precedenti, è stato possibile definire uno specifico framework di analisi, basato su una serie elementi chiave attraverso cui comprendere meglio la natura, le caratteristiche e le tendenze recenti del reshoring (Tab.1). In particolare, l'analisi di natura puramente qualitativa interesserà il reshoring a livello esclusivamente italiano e si baserà sulla raccolta e sull'analisi di dati secondari (Yin, 2003, 2013).

Tab.1: Alcune delle principali spinte al reshoring.

Principali spinte al reshoring	Evidenze empiriche relative alle iniziative di <i>reshoring</i>
<i>Fattori politici</i>	<ul style="list-style-type: none"> ● Legislazione locale atta ad attrarre investimenti esteri ● Nuove leggi a sostegno del <i>reshoring</i> ● Politiche di finanziamento per spingere le aziende manifatturiere a fornire dispositivi di protezione
<i>Fattori economici</i>	<ul style="list-style-type: none"> ● Incentivi anti-delocalizzazione ● Benefici fiscali
<i>Fattori organizzativi</i>	<ul style="list-style-type: none"> ● Misure di riordino e semplificazione degli incentivi per attrarre investimenti nelle regioni meridionali ● Punti di contatto regionali e strutture pubbliche di supporto alle procedure amministrative e alla negoziazione con le imprese
<i>Fattori sociali</i>	<ul style="list-style-type: none"> ● Rivitalizzazione del territorio ● Crescita occupazionale ● Contenimento del divario tra nord e sud Italia

Fonte: elaborazione a cura degli autori.

Seguendo l'approccio in oggetto sono stati raccolti dati secondari (Hox and Boeijs, 2005) relativi al fenomeno del *reshoring* in Italia e a eventuali strategie attuate in tal senso dalle imprese basate nel nostro paese a seguito della diffusione della pandemia da Covid-19. A tal fine sono stati consultati una serie di report ufficiali, pubblicazioni di settore e anche dati nazionali. Le informazioni raccolte sono state, infine, organizzate e presentate utilizzando quattro categorie corrispondenti ad alcune delle principali spinte al *reshoring*, ovvero: fattori economici, politici, organizzativi e sociali.

4. Risultati dell'analisi

4.1 Il contesto socio-economico Italiano e il reshoring durante la diffusione del Covid-19

L'Italia è da sempre profondamente integrata nelle reti produttive internazionali. Ciò è testimoniato dalla partecipazione di numerose imprese nazionali alle cosiddette supply chain globali, stimata come superiore alla media mondiale per tutti i settori manifatturieri ad eccezione di quelli che riguardano la produzione elettronica e di personal computer. Alcuni studi (Castellani, 2007; Chiarvesio and Romanello; 2018; Kinkel *et al.*, 2021) hanno evidenziato come a livello nazionale siano principalmente le imprese di dimensioni e capacità produttiva maggiore ad attuare strategie di delocalizzazione e/o di offshoring. Tuttavia, esse non sono comparabili per

composizione della forza lavoro, capacità organizzative e manageriali e propensione all'innovazione.

Eventi critici come la crisi economica del 2008, che ha messo in luce i numerosi aspetti negativi della globalizzazione, lo sviluppo tecnologico sfociato nella diffusione del “paradigma” di Industria 4.0 e non da ultimo la pandemia da Covid-19 (Marin *et al.*, 2017; Talamo and Sabatino, 2018; Gupta *et al.*, 2021) hanno spinto un numero crescente di imprese e governi occidentali a ripensare le proprie strategie di delocalizzazione. Questa tendenza è, recentemente, cresciuta a seguito anche del blocco di alcune attività produttive dovuto al conflitto russo-ucraino.

L'Italia è stato il primo paese occidentale in cui si è diffusa la pandemia da Covid-19 e il primo paese europeo a introdurre severe misure di contenimento, basate su stringenti restrizioni alle attività individuali e d'impresa. Secondo le stime Istat (2020), l'impatto di tali misure emergenziali sul sistema economico è stato oltremodo rilevante. Infatti, nel secondo trimestre del 2020 il Prodotto Interno Lordo (PIL) ha registrato una riduzione congiunturale di circa il 13%, mentre la riduzione annua totale è stimata intorno al 9% (Istat, 2020). L'indagine sulle prospettive delle imprese manifatturiere e dei servizi svolta dalla Banca d'Italia tra settembre e ottobre 2020 consente una quantificazione più precisa degli effetti congiunturali determinati dalla pandemia. Nei primi nove mesi dell'anno, infatti, oltre il 60% delle imprese italiane ha registrato un calo del fatturato superiore al 4% rispetto allo stesso periodo dell'anno precedente. A fronte di tali perdite e considerata la crescente incertezza dei mercati internazionali, causate anche da nascenti spinte protezionistiche e dalle più recenti tensioni geopolitiche, alcune imprese sono state spinte a rivedere le proprie strategie di internazionalizzazione. La revisione di tali scelte è stata ispirata anche da una serie di azioni politiche, che a livello nazionale hanno promosso azioni di *reshoring*. In particolare, l'allora ministro dello Sviluppo Economico, Carlo Calenda, aveva già fatto nel “Piano Nazionale Industria 4.0” (2017) una riflessione sulle iniziative di *reshoring*. Il piano in oggetto, infatti, pone l'accento su un fenomeno quanto mai importante, ovvero il fatto che l'implementazione sempre più spinta di tecnologie innovative possa contribuire alla diminuzione del differenziale dei costi di produzione, riducendolo in alcuni casi fino al 90%. Nel “Piano Nazionale Industria 4.0”, viene, inoltre, sottolineato che il ritorno in patria di alcune produzioni potrebbe determinare anche una compensazione dal punto di vista occupazionale.

Il contesto pandemico, inoltre, ha reso il problema ancora più evidente e la soluzione ancora più urgente. In tal senso, si hanno segnali positivi che vengono dalle iniziative europee volte a definire e attuare una concreta politica industriale comunitaria, di cui si trovano tracce nel *Recovery Plan Next Generation UE*, che l'Italia sta applicando principalmente con il “Piano Nazionale di Ripresa e Resilienza”, conosciuto anche come PNRR, che mira ad aumentare la resilienza del sistema economico nazionale e a promuovere, al tempo stesso, l'indipendenza strategica del sistema produttivo nazionale, anche attraverso azioni di *reshoring* dirette al territorio dell'Unione Europea.

Seguono alcuni esempi di imprese che recentemente hanno ri-localizzato in Europa parte delle attività precedentemente delocalizzate in paesi offshore. L'impresa francese *Stil* (Terzian, 2020) ha deciso di riportare la produzione di termometri in vetro in Francia a causa dell'inaspettata chiusura dei suoi fornitori cinesi, mentre l'italiana Coccato e Mezzetti Srl ha ripreso la produzione di una maschera facciale biodegradabile monouso in Italia dopo averne interrotto la produzione nel 2005 a causa della concorrenza low-cost proveniente dalla Cina (Greco 2020; Barbieri *et al.*, 2020). Questo è in linea con le parole del presidente del gruppo francese Sanofi e della Federazione francese delle industrie sanitarie, che hanno riconosciuto la necessità di riportare in Francia - o almeno in Europa - la produzione di principi attivi farmaceutici (Fayçal, 2020). Più recentemente, il governo francese ha lanciato un bando per progetti volti a ricreare localmente la filiera del paracetamolo entro i prossimi 3 anni (Le Figaro, 2020). Quest'ultimo esempio dimostra come tali decisioni possano essere incentivate dai policymaker attraverso progetti specifici volti a stimolare iniziative di delocalizzazione di filiere strategiche (Barbieri *et al.*, 2020).

4.2 Applicazione del framework di analisi

Dall'analisi svolta, applicando al contesto italiano il framework sviluppato sulla base della ricognizione della letteratura effettuata in precedenza, sono emerse alcune evidenze relative alle iniziative di *reshoring* implementate in ambito nazionale a seguito della diffusione della pandemia da Covid-19. Tali evidenze sono di seguito brevemente presentate e descritte, seguendo l'ordine dei concetti chiave contenuti nel framework precedentemente presentato (fattori economici, politici, organizzativi e sociali) (vedi Tab.1)

Fattori politici

In Italia, sono state attuate diverse iniziative politiche volte a stimolare iniziative di *reshoring*. Ad esempio, un'iniziativa particolare basata sui finanziamenti durante la pandemia da Covid-19 ha spinto le aziende manifatturiere a "ristrutturare" la loro catena di fornitura di dispositivi medici e di protezione, portando molte imprese del settore tessile e della moda ad avviare nuove linee di produzione destinate alla creazione e alla commercializzazione di dispositivi di protezione individuale (DPI). In alcuni casi queste iniziative sono state coordinate da associazioni imprenditoriali locali o nazionali (Barbieri *et al.*, 2020).

A supportare iniziative del genere sono venute anche le parole dell'allora Presidente del Consiglio, Mario Draghi, che in Senato ha evidenziato la necessità di rendere le filiere nazionali resilienti, ovvero poco vulnerabili a shock, crisi e tensioni che vengono dall'esterno.

La definizione di queste politiche ha supportato l'attuazione di diverse strategie di *reshoring*. Secondo la già citata indagine condotta dalla Banca d'Italia (2020) su un campione di circa 3.000 imprese, alla luce dei problemi legati alle filiere globali durante la pandemia, il 20% delle aziende intervistate ha dichiarato di stare valutando di riorganizzare più localmente le attività della propria catena del valore per esercitare un maggiore controllo sulle attività e sui processi svolti all'estero, per ridurre l'esposizione ai rischi internazionali e la dipendenza dall'estero e per rafforzare la componente *Made in Italy*. L'attenzione delle istituzioni locali al "rimpatrio" di alcune attività precedentemente delocalizzate in paesi offshore è testimoniata dalle iniziative attuate da alcune regioni italiane, come ad esempio il Piemonte con la definizione del "contratto di insediamento", la Lombardia con gli "accordi di attrattività", l'Emilia Romagna con la "Strategia regionale di innovazione per la specializzazione intelligente", la Puglia e il Veneto con il "Progetto *reshoring*", le Marche e l'Umbria con accordi settoriali specifici e in fine l'Abruzzo con la "Carta di Pescara". La necessità di dare uniformità alle suddette iniziative, inserendole in una strategia nazionale chiara e definita, nonché supportando con l'emanazione di leggi specifiche, ha condotto già prima della diffusione della pandemia da Covid-19, ovvero nel 2018, alla definizione di un disegno di legge intitolato "Regime di aiuti e norme per favorire il rimpatrio delle imprese italiane e in favore della riqualificazione di aree industriali dismesse", finalizzato a semplificare il "rimpatrio" di attività economico-produttive delocalizzate da oltre 5 anni.

Fattori economici

In ambito nazionale, sono stati definiti anche alcuni incentivi anti-delocalizzazione e azioni volte a disincentivare l'attuazione di future strategie di delocalizzazione, contenuti principalmente nel cosiddetto "Decreto anti-delocalizzazione" e nella Legge di Bilancio 2018, che definiscono un "percorso obbligato" per le imprese nazionali e non che decidono di cessare le attività sul territorio nazionale, il cui mancato rispetto prevede il pagamento di multe (pari al 2% del fatturato dell'ultimo esercizio) e inserimento in una *black list* (che vieta l'accesso a finanziamenti e/o incentivi pubblici per 3 anni). Queste misure, volte a supportare e stimolare la produttività nazionale e proteggere l'occupazione, sono state pensate e dirette principalmente per le imprese di grandi dimensioni (Catapano, 2020). Inoltre, sono state definite misure fiscali per contrastare la delocalizzazione delle attività produttive e accelerare il processo di *reshoring* sul territorio italiano (Catapano, 2020). Si veda in proposito il disegno di legge n. 2335, che all'articolo 2 riporta gli incentivi fiscali in termini

di credito di imposta per le imprese che svolgono l'intero processo produttivo sul territorio nazionale, pena la perdita del beneficio (DDL S., 2021).

In fine, è stato recentemente pubblicato il “Documento di Strategia per un Piano Operativo Straordinario di Attrazione degli Investimenti” (Regione, 2021) che spinge all'adozione di strategie di reshoring considerando le attuali condizioni geo-politiche determinate dall'emergenza sanitaria globale. Il documento, però, evidenzia che il fenomeno del *reshoring* attualmente appare difficile da implementare su scala nazionale a causa di diverse questioni importanti da affrontare, tra cui ad esempio la certificazione complessiva delle filiere e la promozione di politiche ad hoc per favorire questi processi.

Fattori organizzativi

Fondazione Mezzogiorno e Unione Industriali Napoli hanno recentemente presentato misure che, attraverso un riordino e una semplificazione degli incentivi per lo sviluppo industriale del Paese, possono attrarre nuovi investimenti nelle regioni meridionali. Le proposte incoraggiano il rafforzamento di impianti produttivi già attivi e il *reshoring* di altre strutture un tempo delocalizzate attraverso l'attrazione di nuovi investimenti (Corriere, 2021). In tal senso, è interessante il caso della regione Campania, dove le aziende facenti capo al settore della moda hanno chiesto alle istituzioni regionali di agire a favore di misure volte a facilitare il ritorno delle loro attività sul territorio.

Diversi vantaggi legati alle strategie di *reshoring* derivano dalla filiera localizzata, dalle relazioni collaborative con i fornitori e dal raggiungimento dei principi di sostenibilità (Ashby, 2016; Vona & Cosimato, 2021). Un esempio concreto viene dalla Regione Veneto, dove all'interno dell'allegato alla delibera consiliare n.143 30.11.2021 relativa all'adozione della nota di aggiornamento del documento di economia e finanza regionale (DEFR) 2022-2024, si fa riferimento alle misure regionali atte a favorire l'attrazione degli investimenti e il reshoring anche attraverso la creazione di punti di contatto regionali (es. hub, uffici di informazione, ecc.).

Fattori sociali

Tra le azioni volte a rivitalizzare il territorio e specifiche aree produttive, rientra ad esempio lo studio sottoposto al Presidente della Giunta e all'Assessore alle Attività Produttive condotto dal Marchio della Moda e del Design della Campania, che da alcuni anni si è riconosciuto nel Modec (Fashion and Design Brand della Campania), il cui obiettivo è limitare la dipendenza del settore moda dalle forniture estere di materie prime e semilavorati. Questo settore, infatti, ha assistito a importanti effetti in termini di strategie di reshoring, poiché già qualche anno prima della pandemia, le competenze distintive locali e la qualità del *Made in Italy* hanno spinto grandi marchi come Prada, Ferragamo, Piquadro, Benetton e Falconeri, a riportare la produzione (o parte di essa) in Italia (Cdp, 2020). Tali azioni di *reshoring* hanno determinato un ritorno di ordini, che darà alle imprese la possibilità di sfruttare la capacità produttiva locale, contenendo la cassa integrazione e scongiurando la chiusura di stabilimenti con conseguenti licenziamenti. Anche Diadora - azienda italiana di abbigliamento sportivo - ha attuato, a partire dal 2015, azioni di reshoring e per far fronte alle difficoltà di approvvigionamento e trasporto degli ultimi mesi, ha riattivato uno stabilimento produttivo a Caerano San Marco, in provincia di Treviso. In tale stabilimento a fine 2021 è stato prodotto il nuovo modello “Equipe Atomo”, un tipo di scarpe da corsa che porta sulla tomaia un piccolo tricolore, poiché la calzatura è stata interamente progettata e realizzata in Italia.

In termini di contributo alla rivitalizzazione delle aree meridionali, il reshoring può avere un impatto importante. Infatti, i cluster industriali più disponibili all'attuazione di strategie di reshoring appaiono quelli delle regioni dell'area centro-adriatica e della Campania (Minà, 2020). In questa direzione, il presidente di Confindustria Moda - Claudio Marenzi - ha evidenziato che “se sulla carta un eventuale *reshoring* italiano interesserebbe per primi i distretti più reattivi come Toscana, Lombardia, Veneto ed Emilia Romagna, potrebbe esserci una grande opportunità anche per il Sud”.

In tali azioni rientra, inoltre, l'individuazione delle cosiddette Zone Economiche Speciali (ZES) nel Mezzogiorno con lo scopo di favorire la creazione di condizioni favorevoli allo sviluppo del

tessuto produttivo e di stabilire agevolazioni doganali, fiscali, finanziarie e amministrative volte a promuovere lo sviluppo delle attività già presenti sul territorio, ad attrarre nuovi investimenti e a riportare in patria attività precedentemente delocalizzate. In termini di politiche a sostegno dell'occupazione vale ricordare la decisione del colosso cinese *Haier*, proprietario dello storico gruppo italiano di elettrodomestici Candy, di rimpatriare la produzione di lavatrici delocalizzata in Cina e nel Guangdong, salvando posti di lavoro nel contesto italiano e puntando su competenze e capacità locali.

5. Discussione dei risultati

I risultati ottenuti a seguito dell'analisi esplorativa, svolta applicando il framework presentato in precedenza (Tab.1) ad una serie di casistiche specifiche, hanno permesso di evidenziare i principali fattori che alimentano le decisioni di reshoring, soprattutto a seguito della diffusione della pandemia da Covid-19. A fronte di ciò è stato, inoltre, possibile rispondere alla domanda di ricerca che ha ispirato questo lavoro. A tal proposito è emerso che le principali spinte al reshoring sono, recentemente, venute da fattori di natura economica, organizzativa e sociale. L'influenza di questi fattori è testimoniata dal fatto che i driver ad essi associati sono stati tutti implementati nella pratica corrente da imprese e/o istituzioni nazionali. Tali driver sono 1) incentivi anti-delocalizzazione, 2) benefici fiscali per i "fattori economici", 3) misure di riordino e semplificazione degli incentivi per attrarre investimenti nelle regioni meridionali, 4) Punti di contatto regionali e strutture pubbliche di supporto alle procedure amministrative e alla negoziazione con le imprese, per i "fattori organizzativi", e 5) rivitalizzazione del territorio, 6) sostegno e crescita occupazionale, 7) contenimento del divario tra nord e sud Italia.

Per quanto riguarda, invece, i fattori politici, in ambito nazionale, è stata rilevata la presenza di due dei tre driver individuati per entrambi. In particolare, tra quelli associati ai "fattori politici" è stata rilevata la presenza di 1) legislazione locale atta ad attrarre investimenti esteri, 2) politiche di finanziamento per spingere le aziende manifatturiere a fornire dispositivi di protezione.

Dall'analisi dei risultati brevemente esposti è possibile rilevare come essi siano, sostanzialmente, in linea con alcune macro-tendenze in atto a livello sia nazionale, che internazionale, ovvero la volontà di governi ed istituzioni di supportare, principalmente con l'attuazione di iniziative politiche ed economiche, lo sviluppo e/o la rivitalizzazione dei sistemi produttivi ed economici nazionali promuovendo strategie e azioni di reshoring. Ciò si configura come un processo in atto già prima della diffusione della pandemia da Covid-19. Infatti, secondo Eurofound nel 2019 la maggior parte delle azioni di reshoring hanno interessato i seguenti paesi, Regno Unito (17%), Italia (15%), Francia (14%), Danimarca (8%), Norvegia (8%) e Germania (7%) (Eurofound, 2019). Più nel dettaglio, i principali driver che portano all'adozione del reshoring includono la riorganizzazione aziendale globale (menzionata nel 24% di tutti i casi), i tempi di consegna (22%), l'automazione dei processi (20%), la scarsa qualità della produzione ottenuta in paesi offshore (19%), la vicinanza ai clienti (17%) e gli effetti del "made in" (16%) (Eurofound, 2019). Invece, a partire dal 2020, i fenomeni di reshoring rilevati a livello nazionale sono stati 175 (Ielo, 2021). Tuttavia, il numero sembra essere sottostimato in quanto non sussistendo l'obbligo di comunicazione, alcune imprese preferiscono non dare risalto al fatto di aver riportato la produzione in patria.

6. Implicazioni, conclusioni e future linee di ricerca

Nello scenario attuale, osservando le prime evidenze empiriche che emergono dalle informazioni e dai dati ottenuti da fonti secondarie, è possibile riconoscere il ruolo scatenante giocato dalla pandemia da Covid-19 nell'adozione di strategie di *reshoring*. In tale contesto, caratterizzato da turbolenza e crescente complessità, il *reshoring* può rappresentare un modo per ridurre la dipendenza da fonti globali e migliorare la resilienza delle proprie supply chain, ed è stato preso in

considerazione da diverse aziende in questo periodo. Nel contesto Italiano, infatti, le attività della catena del valore sono state riorganizzate da diverse imprese in modo più locale al fine di esercitare un maggiore controllo sulle attività e sui processi svolti all'estero, di ridurre l'esposizione ai rischi internazionali e la dipendenza dall'estero, e di rafforzare il Made in Italy. Tuttavia, ancora la maggioranza delle imprese italiane non ha deciso di portare le proprie attività produttive in Italia a causa degli elevati costi che hanno sostenuto per delocalizzare gli impianti, irrecuperabili in caso di interruzione dei rapporti. In linea con un nuovo desiderio delle imprese di allinearsi con un senso di nazionalismo, un ruolo cruciale è quindi ricoperto dall'introduzione di politiche adeguate atte a riportare in patria le attività produttive e finalizzate all'attrazione degli investimenti.

I risultati sin qui ottenuti presentano diverse implicazioni di ricerca, manageriali e di policy.

Sebbene una prospettiva unica sugli scenari della supply chain non esista attualmente, tuttavia la pandemia ha indotto a nuove riflessioni sui pro e i contro delle catene del valore globali. Le prime evidenze gettano luce su nuove prospettive sul futuro delle catene di approvvigionamento, particolarmente rilevanti per affrontare l'attuale complessità dei cambiamenti economici, sociali e ambientali. In particolare, gli attuali eventi stanno costringendo le imprese a reingegnerizzare le catene di valore globali e a considerare il raggiungimento di una maggiore autosufficienza in termini di approvvigionamento, nonché l'attuazione di strategie di *reshoring*. Gli effetti del perdurare della crisi pandemica, infatti, hanno dimostrato che la lunghezza delle catene di approvvigionamento può rappresentare un elemento di vulnerabilità quando si verificano interruzioni impreviste che, insieme alla scarsità di alcuni materiali, causano anche un aumento dei prezzi. Tale scenario rende le scelte di offshoring non più e non sempre sostenibili, aprendo progressivamente la strada alla loro inversione.

Oltre al contesto pandemico, altre perturbazioni possono influire sulla continuità delle catene di fornitura. Gli scienziati, infatti, hanno evidenziato che il cambiamento climatico porterà alla manifestazione di eventi meteorologici sempre più estremi e alla diffusione di nuove epidemie e/o pandemie. In assenza di un'azione decisiva sulla mitigazione del clima, gli shock che si potranno riverberare sul sistema economico globale diventeranno sempre più comuni e le imprese saranno costrette ad aumentare la resilienza delle loro catene globali del valore. Le strategie di *reshoring* potrebbero essere considerate una soluzione in tal senso, in quanto rappresentano un modo sia per ridurre la dipendenza dalle fonti di approvvigionamento globali sia per fronteggiare eventi critici e inaspettati (van Hoek and Dobrzykowski, 2021; Evenett, 2020; Strange, 2020).

Strange (2020), tuttavia, evidenzia non solo potenzialità, ma anche le criticità legate alle strategie di *reshoring* nell'era del Covid-19. Il *reshoring*, infatti, dovrebbe accorciare le catene di approvvigionamento e renderle meno vulnerabili alle restrizioni imposte al movimento transfrontaliero, nonché più vicine e reattive alle esigenze dei loro clienti. Al tempo stesso, però, tale scelta può aumentare l'esposizione delle imprese alle interruzioni di fornitura nelle loro economie nazionali e potrebbe comunque richiedere materie prime e altri input provenienti solo da oltreoceano, semplicemente spostando la dipendenza dalle importazioni più a monte nella catena di approvvigionamento.

Nella pratica, in tutto il mondo e nello specifico nel contesto Italiano sono già state introdotte, durante l'epidemia di Covid-19, diverse politiche di sostegno alla complessa situazione delle imprese manifatturiere legate a fondi speciali, agevolazioni fiscali, incentivi anti-delocalizzazione e documenti strategici. Strumenti già definiti negli anni passati, come le Zone Economiche Speciali (ZES), possono inoltre favorire la creazione di condizioni favorevoli per lo sviluppo del tessuto produttivo, per attrarre investimenti nel Mezzogiorno e per affrontare la questione euro-mediterranea, contribuendo anche alla transizione verso uno sviluppo sostenibile del green new deal. Al fine di rendere più rapida ed efficace la realizzazione delle proposte di investimento sono stati istituiti punti di contatto regionali e strutture pubbliche di supporto alle procedure amministrative e alla negoziazione con le imprese (Coco and Lepore, 2020).

Inoltre, attraverso un attento utilizzo dei fondi della Ue secondo le indicazioni del PNRR bisogna provare ad attuare una vera e propria re-industrializzazione che riporti in patria le aziende, attraverso piani fiscali e strategie studiate minuziosamente, e riequilibri l'economia creando

occupazione, soprattutto nelle regioni depresse di un paese sviluppato. In questa direzione, per cogliere le opportunità legate alle iniziative di *reshoring*, i paesi interessati dovranno intensificare i loro sforzi di promozione degli investimenti, informando i potenziali investitori delle opportunità commerciali offerte, mostrando il loro impegno a mantenere un buon clima commerciale e un atteggiamento accogliente nei confronti degli investimenti esteri. La promozione degli investimenti è efficace ma non funzionerà senza il sostegno della leadership politica al vertice (Harding e Javorcik, 2011, 2013; Evenett, 2020). In tal senso, la combinazione degli incentivi fiscali strategici, un impegno reale per un trattamento equo, la predisposizione di regole stabili e trasparenti insieme ad un atteggiamento favorevole agli investitori possono sostenere concretamente le iniziative di *reshoring*.

Tuttavia, il fenomeno del *reshoring* sembra attualmente difficile da implementare su larga scala perché ci sono diverse questioni importanti da affrontare come la certificazione dell'intera filiera, la predisposizione di un quadro normativo, e altre questioni rilevanti come la riduzione dei costi energetici e il deficit logistico-infrastrutturale. Se questi avanzamenti vengono perseguiti, potrebbe essere possibile aumentare l'attrattiva del territorio attraverso la creazione di nuovi progetti in diverse regioni d'Italia ed anche affrontare il divario tra nord e sud Italia.

Questo studio crea opportunità per ricerche future per esaminare altri aspetti legati alle trasformazioni avvenute nella gestione della filiera negli ultimi anni. I lavori futuri possono indagare strumenti specifici, come gli alberi decisionali e gli approcci di analisi del rischio, che possono essere utilmente applicati per modellare e valutare le decisioni di *reshoring*, in modo tale da tenere esplicitamente conto dell'incertezza in tempi turbolenti. La determinazione dei fattori critici dietro le decisioni di *reshoring*, come l'affidabilità delle forniture, potrebbe migliorare l'attenzione manageriale e la chiarezza sui benefici e le motivazioni. Secondo il concetto di "Autonomia Strategica" elaborato dall'OCSE, che mira ad assicurare prodotti essenziali in base alle priorità degli stati, potrebbe essere interessante, anche a livello aziendale, definire una sorta di piano strategico di emergenza che permetta alle aziende di rispondere in caso di shock globali attraverso un mix di delocalizzazione delle fasi più sensibili e creazione di una rete locale di backup (Econopoly, 2021). In questo senso, potrebbe essere interessante fare un'utile ricognizione di ciò che deve essere necessariamente portato a casa, sapendo che ci sono aziende che hanno delocalizzato la produzione e altre che hanno completamente esternalizzato (all'estero) e si riforniscono da lì (senza produrre).

Il principale limite di questo lavoro è connesso all'analisi del contesto italiano e all'utilizzo di un approccio puramente qualitativo ed esplorativo. In tal senso, potrebbe essere interessante ampliare l'analisi delle strategie e politiche di *reshoring* adottate nel periodo pandemico anche in altri contesti, oltre quello italiano. Inoltre, potrebbe essere utile utilizzare ulteriori metodologie. Ad esempio, la somministrazione di questionari in profondità a piccole e medie imprese italiane permetterebbe di effettuare una valutazione maggiormente specifica della realtà in esame, mettendo in evidenza parallelismi e differenze che potrebbero garantire una più efficace generalizzazione dei risultati ottenuti.

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Alternative platform-based market-entry models and strategies: a smart construction case study[♦]

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Abstract

Framing of the research. *Despite the expanded research and innovation activities around smart construction, there is still a lack of empirical studies of platform business emergence and related market-entry models and strategies. Studies have still focused more on the technologies themselves and the single-firm level, but less on platform-based value compositions at the ecosystem level.*

Purpose of the paper. *The purpose of this study is to increase empirical understanding on the emergence of platform-based business from an ecosystem perspective and to examine related alternative market-entry models and strategies in smart construction.*

Methodology. *The empirical study is based on a longitudinal qualitative and multi-method case study, conducted in Finland between September 2020 and December 2021.*

Results. *First, the study demonstrated the emergence of platform-based business from an ecosystem perspective and co-design of related alternative market-entry models and strategies in smart construction. Second, five alternative platform-based entry models were classified with preferences among ecosystem actors. Further, platform-based entry models seemed to embed several optional platform entry strategies. Third, the findings indicated a critical role of the clear visionary leader for orchestrating and facilitating a co-evolutionary process.*

Research limitations. *This empirical study is based on a single case study in the ongoing co-evolution state. Thus, the findings are only tentative and open avenues for further studies.*

Managerial implications. *The paper provides a deeper understanding on platform ecosystem emergence in smart construction in platform ecosystem establishment. Particularly, the adjusted conceptual frameworks may support ecosystem orchestrators and involved actors when evaluating alternative market-entry models and strategies for further development.*

Originality of the paper. *The paper brings new empirical insights to identified research gaps by demonstrating complex and dynamic emergence and co-evolution of platform-based innovation towards co-designing alternative platform-based market entry models and strategies from an ecosystem perspective in smart construction.*

Keywords: *platform business; data-driven solutions; entry models; entry strategies; smart construction; case study*

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1. Introduction

Digitalization opens up new value creation opportunities throughout different industries. Further, fast-growing data and platform economy enable new innovation and value creation opportunities across industries and beyond established linear value creation logics. Thus, data and platform economy challenges, or even disrupts, established value chains, particularly in traditional industries, such as construction (e.g., Lappalainen and Aromaa, 2021; Maxwell, 2018). Despite the digitalization trend and advanced technologies enabling both improved efficiency and completely new value creation opportunities, the construction industry is struggling with significant productivity challenges worldwide. However, there are a lot of ongoing research and experiments regarding digital solutions for complex, knowledge-intensive decision making and orchestration in dynamic construction projects (e.g., Woodhead *et al.*, 2018; Zhao *et al.*, 2019; Jia *et al.*, 2019; Hall *et al.*, 2020).

Despite the expanded research and innovation activities around smart construction, there is still a lack of empirical studies of platform business emergence and related market-entry models and strategies. Studies have still focused more on the technologies themselves, and the business potential at the single-firm level, but less on platform-based value compositions at the ecosystem level (Leminen *et al.*, 2018; Mikkola *et al.*, 2020; Maxwell, 2018). There are indications that both the ecosystem approach and platform ecosystem mechanisms, by enabling digitalization and data economy, advance systemic changes crucial in construction and the built environment in tackling the so-called grand challenges, such as sustainability (Lappalainen and Aromaa, 2021). Therefore, the purpose of this study is to increase empirical understanding on the emergence of platform-based business from an ecosystem perspective and to examine related alternative market entry models and strategies in smart construction. This paper builds on theoretical debates and recent studies regarding platform ecosystem characteristics as well as platform-based market-entry models and strategies, particularly in the construction industry (e.g., Gawer, 2014; Parker *et al.*, 2016; Stummer *et al.*, 2018; Woodhead *et al.*, 2018; Hein *et al.*, 2020; Sorri *et al.*, 2019; Isckia *et al.*, 2020; Wallin *et al.*, 2021; Karhu and Ritala, 2020).

The empirical study is based on a longitudinal qualitative case study, conducted in Finland between September 2020 and December 2021. The goal was to examine the emergence of a platform-based ecosystem in smart construction, from establishing a multi-actor ecosystem and co-innovating platform-based (value) offering toward co-designing alternative options for market entry. This paper focuses particularly on alternative platform-based, market-entry models and strategies in smart construction. In the next section, theoretical background is presented, followed by the methodology and the case description. The paper continues with the summary of the main results and ends with the discussion and conclusions.

2. Theoretical Background

This paper combines theoretical approaches on critical platform ecosystem characteristics, emergence, and co-evolution in addition to market-entry models and strategies. To narrow the identified research gaps, the purpose of this study is to increase empirical understanding on the emergence of platform-based business from an ecosystem perspective and to examine related alternative market-entry models and strategies in smart construction.

2.1 Platform ecosystem definition

In a fast-growing data economy, the platform ecosystem concept has been widely adopted among researchers and practitioners. Platform ecosystems are defined as to be created around technological platforms, which are typically owned or governed by the platform leader(s) that connect multiple sides of markets, such as users, advertisers, developers, and content providers, to

facilitate value co-creation and capture (e.g., Aarikka-Stenroos and Ritala, 2017, 25; Hein *et al.*, 2020, 4; Wareham *et al.*, 2014). While platform ecosystems enabling non-linear, dynamic value creation and capture, they challenge traditional, linear value creation logic, corporate governance models, rules, and relationships between product and service owner(s), vendors and users, and how they are generated in emerging ecosystems (e.g., Parker *et al.*, 2016; Hein *et al.*, 2020). The roles of actors change or become more diverse, and new players become critical, such as the developers, called complementors. Each (organizational) actor needs to make a strategic decision and negotiate its role in the emergent platform ecosystem, either as an owner or in alternative roles, such as a financier, coordinator, producer, facilitator, or developer (Hein *et al.*, 2020; Lappalainen and Federley, 2021; Valkokari *et al.*, 2017). Further, Jacobides *et al.*, (2018) define that ecosystem emergence is enabled by modularity and complementarities. The core of ecosystems constitutes combinations of modular complementarities and shared rules of operation (Ibid; cf. Thomas & Autio, 2020).

2.2 Critical characteristics for establishing sustainable platform business

The platform functions as a coordination and control mechanism of the ecosystem, suggesting a paradigm shift from viewing the digital platform as a pure technological platform to approaching it as a platform-enabled business ecosystem with its resources, assets, and actors (Valkokari, 2015; Thomas and Autio, 2020; Xu *et al.*, 2018). *Nevertheless, what are critical characteristics for establishing and orchestrating a sustainable platform business?* As Sorri *et al.*, (2019) concluded, in their systematic literature review of key platform elements, there is a “great deal of variation within the sources regarding which characteristics are considered important when developing successful digital platforms”. However, *value creation potential and logic*, also including the main actors, *network effects and governance* seemed to be highlighted in almost all core source references in their literature review. Therefore, they were chosen as the focus areas in our empirical study.

Value creation potential and logic involves identification of actor roles for value to be created and how to achieve the beneficiaries’ attraction and commitment in a one-, two- or multisided platform in the target market. Furthermore, as critical differentiation from the linear business logic, *core interaction and mechanisms of network effects* need to be designed. The core interaction is defined as the exchange of value that attracts most users to interact on the platform and should enable expansion beyond the original core interaction over time to ensure competitiveness and growth (Parker *et al.*, 2016). According to Parker *et al.*, (2016, 17) “network effects refer to the impact that a number of users of a platform has on value created for each user”. While enhancing scalability and defensibility, positive network effects are a fundamental source of value creation and competitiveness in a platform business. (Ibid; Gawer and Cusumano, 2014; Hein *et al.*, 2020.) In order to capture value, a revenue model for the platform needs to be carefully developed for optimal and dynamic pricing (incl. other incentives) to serve various actors (Lappalainen and Federley, 2021; Parker *et al.*, 2016).

Regarding *the Governance*, Hein *et al.* (2020) referred to three alternative archetypes of ownership, such as a central platform owner, a consortium of partners, and a decentralized peer-to-peer network to balance control rights against the autonomy of ecosystem actors (De Reuver *et al.*, 2018). As an alternative to typical owner-based management models, for instance a licensing platform and open source can be applied (e.g., Parker and van Alatyne, 2009; Parker *et al.*, 2016). The ownership status affects the evolutionary dynamics of an ecosystem in terms of how governance mechanisms, such as input and output control and decision rights, are exploited (Tiwana, 2014; Hein *et al.*, 2020). Therefore, the *openness of platform architecture* comprise both technical and collaborative/contractual mechanisms, which enable access and participation modes of key actor groups in value creation and innovation (Hein *et al.*, 2020; Tura *et al.*, 2018; Parker *et al.*, 2016; Lappalainen and Federley, 2021). The level of openness appeared to change along the platform co-evolution, even though previous architectural and strategic design choices play an

important role in the platform ecosystem life cycle (e.g., Isckia *et al.*, 2020). Modular architecture makes growing complexity manageable.

In addition to these critical elements, Tura *et al.*, (2018) in their comprehensive platform design framework, highlight *platform competition*, which includes design considerations on launch, competitiveness, *innovation*, and scalability of the platform. Competitiveness in a platform launch and diffusion is built by attracting, reaching, and maintaining critical mass against incumbent or other new players. While the complexity of platform ecosystem increases, increased openness is a necessity, calling for different governance mechanisms to balance with co-creation and value capture, as well as competition and collaboration within a co-evolving platform ecosystem against competitors (e.g., Hein *et al.*, 2020; Isckia *et al.*, 2020; Cennamo and Santaló, 2019; Letaifa, 2014; Lappalainen and Federley, 2021). Ischia *et al.* (2020) interestingly demonstrated how platform owners build capabilities and orchestrate the coupling process between the innovation part and the business development part of the platform ecosystem.

2.3 Platform entry strategies

Although platform strategies have been studied widely, there is the need to increase understanding and clarify optimal entry strategies. In their systematic literature review, Wallin *et al.* (2021) identified altogether 22 platform entry strategies, with four main categories, such as 1) Onboarding 2) Offering, 3) Opportunistic strategies, and 4) Pricing (the least important but not a focus in this paper). *Onboarding strategies* related to the sequence of entry and preferred user groups. These include entry strategies, such as one-sided launch or alternatively simultaneous onboarding by building multi-sided participation incrementally, marquee users' or producers' strategies, targeting users with dual roles, micro-market launch, and so-called producer evangelist (e.g., Wallin *et al.*, 2021; Parker *et al.*, 2016; Stummer *et al.*, 2018; Evans and Schmalensee, 2010). This means designing the platform to encourage producers to bring their own customers as users to the platform (Parker *et al.*, 2016, 96). Entry strategies may also be built on the *platform offering*, such as standalone products or services, coring, seeding or exclusivity agreement strategies (e.g., Wallin *et al.*, 2021; Parker *et al.*, 2016; Stummer *et al.*, 2018).

Instead, *opportunistic strategies* consist of entry strategies, where the entrant platform avoids at same time big upfront investments in value creation and captures value by utilizing the incumbent ecosystem's resources (Karhu and Ritala, 2020). Here Karhu and Ritala (2020, 2) have identified three alternative strategies: 1) copying parts of those resources (exploitation), 2) following the development cycle of key boundary resources (pacing), or 3) placing itself inside the platform (injection) (cf. Piggyback strategy mentioned by Parker *et al.*, 2016). Essentially, these strategies challenge and may change the so-called winner-takes-all logic and dynamic typical in platform business (Ibid). Overall, according to Wallin *et al.*, (2021) studies indicate that, in business practice, these entry strategies are applied by combining several specific strategies. The competitive environment is changing so rapidly that agile strategies are necessary.

2.4 Co-evolution approaches of platform-based ecosystem: from generic to contextual frameworks

Platform ecosystem emergence and co-evolution have mainly been studied theoretically, or as ex-post studies of well-known global platform success stories (e.g., Ischia *et al.*, 2020; Sorri *et al.*, 2019). The most classical model of ecosystem co-evolution comprises the life-cycle phases of birth, expansion, leadership, and self-renewal-or alternatively, death (Moore, 1996). Based on empirical studies, respective sequential models have been proposed (e.g., Ketonen-Oksi and Valkokari, 2020; Letaifa, 2014). An emphasis has been on ecosystem dynamics regarding value-creation vs. capture and collaboration vs. competition. Alternatively, Gawer (2014) presented an organizational continuum of technological platforms, where according to Gawer (2014, 1246), for each degree of interface openness, there is a corresponding organizational form, a set of accessible capabilities, and a corresponding type of governance. By calling the framework as a continuum, Gawer (2014, 1246)

demonstrated a “kind of fluidity, and possible evolutionary pathways, between the configurations” (cf. Leminen *et al.* 2018). However, this generic integrative framework does not include a value proposition dimension.

The co-evolutionary approach to digital transformation *in the construction industry* illustrates the transitions from an RFID-centric focus to an IoT focus. The latter enables a combination of data from different sources for knowledge-intensive decision making, even in real time among various actors in construction projects (e.g., Woodhead *et al.*, 2018; Lu *et al.*, 2011; Zao *et al.*, 2019). However, as Woodhead *et al.*, (2018, 36) concluded, instead of combining point solutions, a key step for construction companies is to establish *strategy-driven IoT ecosystems* with long-term advantages. They defined the IoT ecosystem as “an integrated “layer” of hardware, software, connectivity, and information flows linked to key decision-making activities. This “layer” is much wider than the construction industry itself and includes all industries that play some kind of role in a continually adapting built environment such as a smart city”. Accordingly, the ingredients for an IoT ecosystem are known in the construction industry. However, there is often a lack of a bold *vision* that “creates a synthesized possibility that stands on top of well-curated data that makes mining and using it in new applications easy to achieve” (Woodhead *et al.*, 2018, 42). However, they did not explicitly refer a need for construction *ecosystem-wide digital platforms*, while Maxwell (2018) proposed re-thinking value generation enabled by a construction-industry-wide platform ecosystem in breaking boundaries between traditional sub-domains. (Lappalainen & Aromaa, 2021.)

To summarize, the purpose of this study is to increase empirical understanding on the emergence of platform-based business from an ecosystem perspective and to examine related alternative market-entry models and strategies in smart construction. The main research question is as follows: *What kind of alternative platform-based market-entry models and strategies can be identified in smart construction?*

3. Methodology

A longitudinal case-study approach (Yin 2003) was applied to empirically examine the platform ecosystem emergence towards a platform business ecosystem in the Finnish construction industry. The entire research process followed an abductive research approach, where empirical and theoretical exploration was iteratively alternated and intertwined (Dubois and Gadde, 2002). The empirical research target was related to an ambitious vision of six company partners, a research institute, and a public funding agency to establish a global smart building platform ecosystem. The two-year joint project adopted a strong multi-disciplinary research and co-innovation approach. This study aimed at examining the emergence of a platform ecosystem in *smart construction*, from establishing a multi-actor ecosystem and co-innovating a platform-based (value) offering towards co-designing alternative entry models and strategies for market entry. The case study is described in more detail in the later sub-section.

3.1 The empirical research process

In order to study dynamic platform ecosystem emergence at real-time, participative observation, two-phased thematic interviews and collaborative business design workshop were selected as the research methods. The longitudinal case study was implemented between September 2020 and December 2021.

Tab. 1: The methods of the empirical case study

Method	Time Schedule	Outcome
Participative observation in weekly Teams meetings, the field and company visit	Sep 2020-May 2021	Memos, presentation slides
Literature review	Sep 2020-Nov 2021	Research gaps & needs, concepts, methodology
First-round interview, N=13	Nov 2020-Jan 2021	Recordings, memos
Second-round interview N=12	May-June 2021	Transcriptions, memos
Collaborative business design workshop among key partners N=14	October 2021	Photos of group works from the flip charts and memos

Source: our elaboration

Participative observation (Hennink *et al.*, 2011) in weekly Teams meetings as a shared practice of the platform ecosystem actors enabled understanding co-innovation and co-evolution as dynamic and long-term processes and testing tentative assumptions along with the ongoing processes. Unfortunately, due to the Covid-19 pandemic, company and construction site visits were limited to only single opportunities.

Altogether, 25 thematic interviews, divided into two rounds, were conducted. They included representatives from various involved actors, such as builder, supplier, and equipment rental in addition to system integrator, technology integrator, connectivity provider, platform architecture developer, as well as data analytics and application specialists. In the first round, the themes of the interviews covered (1) current and future challenges in the construction and building life-cycle, (2) value co-creation opportunities specified in use cases, and (3) expectations towards collaboration. In the second round, the themes included (1) co-innovation as a process and the outcomes, (2) contributions to user-experience goals, and (3) business opportunities and interests for a common platform ecosystem. The questions were specified according to the roles and responsibilities of the interviewees. The most of the interviewees involved in the both interview rounds, but there were some changes due to dynamic participation in the co-innovation processes. Before participating, all interviewees signed an informed consent form that included information about the purpose of the study and data confidentiality.

As this was longitudinal iterative case-study followed by abductive research approach, where empirical and theoretical exploration was iteratively alternated and intertwined (Dubois and Gadde, 2002), the analysis was conducted in the several phases along the empirical research. Moreover, the raw empirical data was rich and enabled several research focus areas, and have already produced several publications (e.g. Lappalainen and Aromaa, 2021; Aromaa *et al.*, 2021). A qualitative data analysis has been guided by those research questions and was based on the main interview themes listed above and the selected theoretical approaches. In the more detailed case description, we presented previous phases and outcomes of the platform ecosystem emergence and related case study (see 3.2).

Further, during the empirical study the researchers realized that the raw empirical interview data also enabled to examine and construct *alternative platform-based market-entry models and strategies*. Therefore, they refocused the analysis of raw interview data from the themes such as Expectations towards collaboration, Co-innovation as a process and the outcomes, and Business opportunities and interests for a common platform ecosystem. For that analysis, the research question was specified. In addition, supplementary literature review was conducted regarding critical platform ecosystem characteristics for constructing alternative platform-based market-entry models and platform entry strategies. These concepts played the role of preliminary thematic classification in an iterative analysis of selecting, coding, and categorizing the data and further elaborating conceptualization. (cf. Sekaran and Bougie, 2016, 332-347). As a result, the researchers drafted five scenarios as platform-based entry models for the selected target construction market. These adjusted conceptual frameworks with case study results are presented in Table 3 (Results) and Figure 3 (Conclusions and Discussions). The researchers presented these scenarios to the key ecosystem actors, which saw them relevant for further elaboration. For that purpose, the researchers prepared and facilitated a collaborative workshop for the key ecosystem actors (N=14). The

program included introduction, customer case, step-by-step collaborative elaboration of the proposed five scenarios (individually and within three groups), and a wrap up between groups with closing discussion. The researchers collected the scenario material co-produced by the groups in the flip charts, in addition to memos from the group and final discussions. These were utilized to finalize comparison of five platform-based market-entry models, and to analyze them against entry strategies classified in the literature and presented in the Theoretical background Section.

3.2 The Case description

The aim was to enable safe and smooth processes and a great productivity leap in construction projects by developing shared platform-based digital solutions. The co-innovation process followed the construction of the residential building and involved several project members, such as solution developers, a builder, and a research partner. In addition, various actors joined the ecosystem activities along with the co-innovation process.

Co-innovation process and emergence of the platform ecosystem was started by the System integrator (being also key logistic solution provider), who took the orchestrator role and gathered critical actors representing different roles and specialized knowledge regarding building construction, the related materials supply chains, and technology development, in addition to researchers. First, the focus was on tracking and monitoring materials to improve material logistics in construction projects. However, as a result of collaborative exploration, multiple use cases were co-created, expanding the scope from materials tracking and monitoring to rental equipment, people safety, and workflows in addition to indoor conditions. Altogether, seven specified Proof of Concept (POC) projects were conducted as parallel co-development processes combined with the digital innovation platform for data storage and sharing among involved developers. The developed technology infrastructure was installed at the real building construction site as physical experimental platform, enabling the technical and UX validation of POCs. POC owners, researchers, and the orchestrator conducted evaluation covering technological, data, business, ecological, and UX perspectives.

The main ecosystem outcomes resulted in the co-innovation processes are summarized in Table 2.

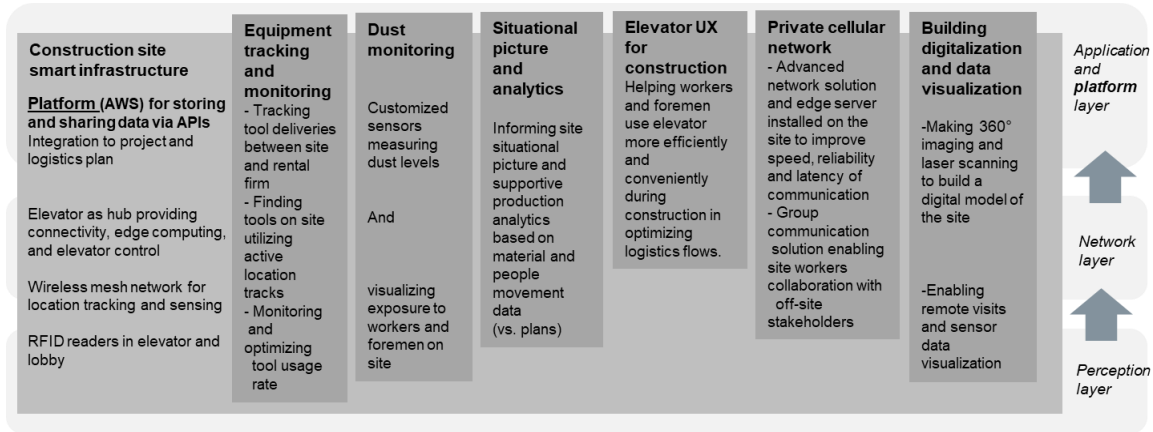
Tab. 2: Summary of the ecosystem outcomes.

Vision	Co-innovation capabilities	New value creation and capture opportunities serving various actors	Platform business capabilities
Enabling safe and smooth processes and a great productivity leap in construction projects by developing shared platform-based digital solutions.	Critical complementary resources of ecosystem actors Joint innovation platform (data storage, transfer via APIs) Enabling selective Developer engagement (APIs, guidance, toolkits)	Seven POCs (Figure 3) providing systemic platform-based solution instead of separate single point solutions	Alternative scenarios for go-to-market models Contributions to alternative models for Governance, Business models and Technical architecture with Design principles

Source: Adjusted from Lappalainen & Aromaa, 2021, p. 11.

New business opportunities in terms of seven POCs are summarized in Figure 3: (1) Construction site smart infrastructure; (2) Equipment tracking and monitoring; (3) Dust monitoring; (4) Situational picture and analytics; (5) Elevator UX; (6) Private cellular network; and (7) Building digitalization and data visualization (Figure 1).

Fig. 1: Seven POCs posited in the IoT platform framework for the smart buildings.

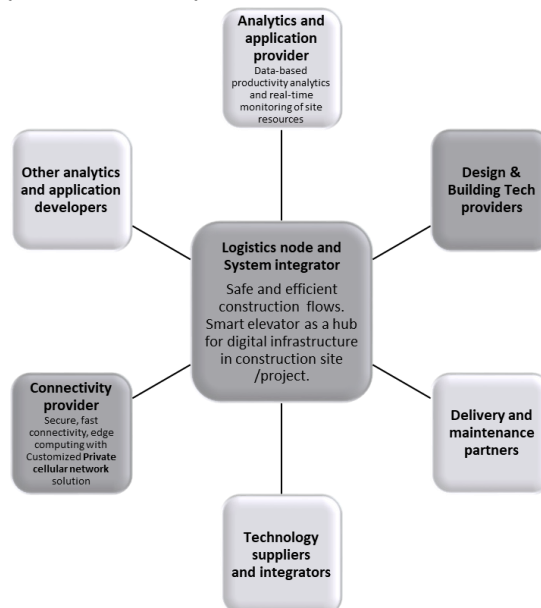


Source: Adjusted from Lappalainen & Aromaa, 2021, p. 11.

As illustrated in Figure 1, the construction site smart infrastructure serves as the multi-layered basement for the other POCs, benefiting different actors in complex and dynamic knowledge-intensive on-site and off-site activities in the construction projects and related supply chains. The business potential of the POCs was evaluated as rather significant in terms of facilitating knowledge-intensive, real-time decision-making, transparency, and communication among involved actors on-site and off-site (Aromaa *et al.*, 2021). According to several interviewees, even small efficiency and productivity improvements may have significant economic impacts for all involved actors (Ibid.). Moreover, the POCs based on complementariness form *systemic platform-based value composition* with numerous scalable value co-creation and capture opportunities in the construction industry (cf. Jacobides *et al.*, 2018). Compared with single and separate point solutions (cf. Woodhead *et al.*, 2018), this was seen as a *base for differentiation and competitiveness*, even in the global construction market. However, as seen in Figure 1, there were also competitive solutions within the systemic platform-based value composition.

As an introduction for co-designing entry models in the collaborative workshop, participants were asked to specify critical ecosystem actors and related value offering in order to ensure differentiation and competitiveness in the selected target market. Figure 2 presents a *simplified illustration of the main actors with their roles in the platform-based value offering*, which participants defined as critical in terms of competitiveness and differentiation.

Fig. 2: The simplified illustration of the main actors with their roles in value offering.



Source: Our elaboration.

The dark gray illustrates key actors and light gray numerous partners, mainly SME companies. As seen, logistics node/system integrator as an orchestrator of a co-innovation process and establisher of a platform-based innovation ecosystem were seen as a natural orchestrator of the platform business ecosystem too. Both the orchestrator and connectivity provider are established pioneering and global players with local networks and partners in marketing, sales, operations, delivery, and maintenance. In design and building tech partners, there may be some key partners related to the smart building life cycle. Further, some design tech partners were identified as critical for competitive value offering, but so far lack from the current co-evolved ecosystem. Overall, high-level security, standardized ontology, modularity, and interoperability were defined as the critical design principles for the technological architecture to enable a competitive value offering.

4. Results

In the following, the main results are presented to answer the research question of *what kind of alternative platform-based market-entry models and strategies can be identified in smart construction*. Empirical findings are also integrated in the key concepts and literature presented in Theoretical background Section.

4.1. Alternative platform-based market-entry models

As described in the Methodology section, the researchers generated five scenarios of alternative market-entry models based on the interview data gathered along the co-innovation process. We call them scenarios because they are still rather general and emergent. In the co-design workshop, those five scenarios were introduced, and participants were asked for further elaboration regarding *which are the most relevant scenarios and why, and whether there are still other alternatives*. Based on the analysis, researchers specified five alternative scenarios for market-entry models, including sales and marketing options and distribution, installation and maintenance options. As seen in Table 3, the scenarios were compared based on critical platform ecosystem characteristics such as *Core interaction and network effects, Innovation potential, Openness (tech.+collab. architecture) and Governance*, which were presented in the Theoretical background Section.

Tab. 3: Summary of five scenarios for alternative platform-based market-entry models.

Scenario /Elements	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Sales and marketing	1. Cross marketing and selling between Connectivity provider and System integrator 2. Direct marketing and selling by individual partners				
Value composition/offering base	Key partners' offering and related operations	Key partners' offering and related operations with <i>limited add-ons</i> by application developers	<i>Expanded</i> networked offering and related operations	Key partners' offering and related operations with <i>co-innovation potential</i>	<i>Joint</i> platform-based offering and operations
Platform decisions	Key partners operate in their company-specific platforms with necessary mutual (dyadic) interfaces	Key partners operate in their company-specific platforms with necessary mutual (dyadic) interfaces Connectivity provider serves <i>apps store -type platform</i> for SMEs	Analytics and application developer serves also platform for key partners /ecosystem	Key partners operate in their company-specific platforms with necessary mutual (dyadic) interfaces <i>Joint innovation platform</i> with developer portal	Joint platform among ecosystem actors
<i>Core interaction and network effects</i>	None	Limited	Expanded	Limited	Maximum
<i>Innovation potential</i>	Limited	Limited	Expanded	Great	Maximum
<i>Openness (tech.+collab. architecture)</i>	Closed	Selectively open	Selectively open	Selectively open	Several levels of openness
<i>Governance</i>	Value chain, Company-specific platform models	Value chain /Mixed	Platform licensing model	Shared ownership model, Platform licensing model, Central platform ownership model	Central platform ownership model
Distribution, installation and maintenance	1. System integrator responsible for installing and maintenance all digital infra in the construction site 2. Dedicated local partners of the System integrator installing and maintenance all digital infra in the construction site 3. Dedicated local partners of Connectivity provider installing and maintenance base stations				

Source: Our elaboration.

As seen from Table 3, five alternative market-entry models differ from each other in several critical ways. *Scenario 1* consists of key actors developing their current offerings by operating in their company-specific platforms with necessary mutual (dyadic) interfaces. However, these platform decisions do not enable original core interaction (*Data sharing and combining from multiple sources*) and mechanisms for network effects. Innovation potential is also very limited due to mainly dyadic interfaces, and thus openness, in terms of technical architecture, can be defined as closed. Therefore, the governance model is actually characterized as a traditional value chain model or company-specific platform models, which does *not support to build on those agreed differentiation factors*.

Scenario 2 includes the same basis as Scenario 1, but in addition, the connectivity provider serves an apps-store-type platform for SMEs. Therefore, in order to enable these kinds of value co-creation opportunities, selectively, openness is needed for Big data sharing and combining, such as API interfaces between key actors and selected SMEs. Compared with a traditional value-chain governance model, not only technical and collaborative boundary resources, but also new value creation logics (business models) are called for among actors. Even selective/limited SME engagement allows serving multiple users in construction projects and sites (with apps store). However, Scenario 2 still *lacks* the comprehensive, platform-based value offering as the *main co-defined differentiation factor*.

In *Scenario 3*, steps toward this type of value offering and platform-based value creation logic are taken when selected SME partner, the analytics, and application developer also serve a *joint platform for key partners*. A shared platform enables building on core interaction (Data sharing and combining from multiple sources) and positive network effects (e.g., to attract SMEs as complementors and customers, as end users). However, these, along with innovation potential, are defined only as expanded due to *reservations related to ownership of the platform and related governance and business models*. The owner of the platform came from outside the original partners of the platform ecosystem initiative; but the company has valuable strategic and complementary capabilities needed for a competitive and differentiated value offering and market-entry model. A platform licensing model might be considered as the relevant governance model among platform owners and other key actors (e.g., the system integrator and the connectivity provider).

Scenario 4 again consists of the same basis as Scenario 1, but also includes a *Joint innovation platform*. This platform decision enables great innovation potential and calls for selective openness in technical and collaborative boundary resources to enable developer (SME) engagement. However, fundamental elements of a platform business, such as *core interaction and network effects are limited* in the innovation platform (and activities) when key actors launch outcomes in their company-specific offerings and platforms. As seen from Table 3, several alternative governance models for joint innovation platforms could be identified. Further investigations are needed, which is the most relevant for key actors to exploit innovation potential.

Finally, *Scenario 5* is built on the original vision of a joint platform-based value offering, which is exploited via a joint platform among key partners for the benefit of expanding a multi-sided platform ecosystem. From the platform economy perspective, this platform decision enables maximum opportunities for core interaction and mechanisms of network effects to generate value in both business and innovation activities among diverse actors of multi-sided platform ecosystems. A central platform ownership model seems to be the most relevant governance model with agile business models. In addition, several levels of openness are needed in terms of technical and collaborative boundary resources.

Among workshop participants, there were *different views of relevant market-entry scenarios*. Most of them shared the view of the Key partners' offering, where key partners operate in their company-specific platforms, with necessary mutual (dyadic) interfaces and supplementing company-specific offerings. Further, two alternative options were supported to enable developer involvement by many of participants. Scenario 2, including digital marketplace for SMEs, was seen as important for business-model entry and competitive customer/end-user experience. Scenario 4,

including a joint innovation platform, was proposed to enable mutual data sharing, experiments, and transparency, in addition to feeding business co-innovation. However, participants shared the view that a *joint platform ecosystem was not a relevant market-entry alternative (scenario 5), but may still form a long-term vision*. Further, participants agreed that a lead ecosystem partner is needed in all other options except scenario 1, and plays a crucial role in the next steps to further elaborate these relevant scenarios among key actors.

Market entry scenarios were supplemented with alternative channels for sales and marketing, as well as distribution, installation, and maintenance, which are summarized in Table 3. Cross marketing and selling by key partners were mostly supported, because as big global companies, they have established sales and marketing channels and direct customer relations (with the construction companies). In addition, one group proposed joint ventures for agile sales and marketing. Many alternatives for distribution, installation, and maintenance models and partners were supported. Participants experienced difficulties in deciding on the optimal model, when the offering is still under development. Key global actors have already established channels and local partner networks for distribution and installation. However, needs for new specialized local partners were also identified.

4.2 Alternative platform-based market-entry strategies

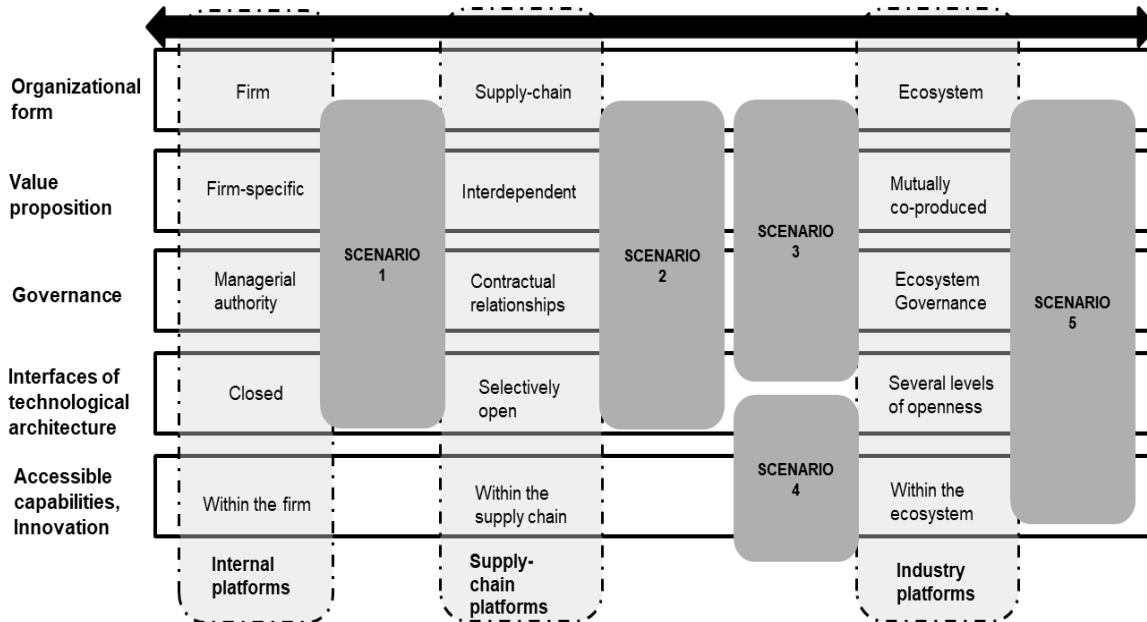
When reflecting on the results from market-entry models to platform entry strategies presented in the Theoretical background, the following interpretations can be made. First, the original vision of the studied platform ecosystem initiative was based on *differentiation logic*, typical for platform business (e.g., Karhu and Ritala, 2020). A complete and systemic platform-based value offering, including the entire digital infrastructure and AI-enabled analytics and applications for various construction ecosystem actors, was co-defined as the main differentiation factor against point-like solutions widely available in the selected target market. This characterized *offering-related entry strategy*, called the *Exclusivity agreement*, “where offering exclusive high-quality content can help signaling positive prospects for the platform and accelerate a platform’s growth” (Wallin *et al.*, 2021, 4-5; Stummer *et al.*, 2018). However, these platform entry strategies seem to be valid mainly in scenarios 3 and 5, which were not supported by the workshop participants. Instead, platform entry strategy focused on onboarding, called *Producer evangelism*, fit with all five scenarios. This strategy stresses the role of producers to bring in their own customers to the platform (Wallin *et al.*, 2021; Parker *et al.*, 2016). Finally, participants strongly supported building on the key partners’ company-specific platforms with necessary mutual (dyadic) interfaces and supplementing company-specific offerings, which refers to so-called *Opportunistic strategies*. On the other hand, investments cannot be avoided and “quick wins” in platform business may not be possible in the complex, institutionalized and rather conservative construction market (cf. Karhu and Ritala, 2020; Hall *et al.*, 2020; Woodhead *et al.*, 2018; Maxwell, 2018).

5. Conclusions and Discussions

In Figure 3, alternative platform-based, market-entry models are posited in the adjusted organizational continuum of technological platforms defined by Gawer (2014, 1246), which highlights the differences between scenarios. Further, the framework is supplemented with a value proposition dimension. Moreover, these scenarios were not only seen as alternative market-entry models but also as *co-evolutionary steps*, e.g., from firm-specific and supply-chain-type of platform business toward eco-systemic models and strategies. The findings are aligned with previous studies, which also illustrated diversity and novel opportunities instead of path dependency (e.g., Gawer, 2014; Leminen *et al.*, 2018). However, previous literature also supports our research findings that platform ecosystem approaches in the construction industry is particularly challenging, while necessary in pursuing systemic transitions, such as digitalization and sustainability (e.g., Woodhead

et al., 2018; Maxwell, 2018). Actually, Ikeda and Marshall (2019, 34) proposed this kind of The Platform over Platform strategy as the most-advanced entry strategy, where “by offering their customers even more compelling and unique cross-platform experiences, entrant(s) can create new mega-platform environments, overarching existing, otherwise successful platform systems”.

Fig. 3: Alternative scenarios for platform-based entry models in the integrative framework.



Source: Adapted from Gawer, 2014, p. 1246.

To conclude, first, the longitudinal empirical case study *demonstrated the emergence of platform-based business from an ecosystem perspective* and the co-design of related alternative market-entry models and strategies in smart construction. The original platform ecosystem initiative in smart construction proved to have a very ambitious long-term vision and was challenged along platform-based ecosystem emergence. There were complex issues to be solved beyond traditional industry borders, business and institutional logics to enable novel data and platform business opportunities. However, the basement has been co-developed for the “construction flow ecosystem”.

Second, five alternative scenarios for *platform-based market entry models* were classified based on *critical platform ecosystem characteristics* (e.g. Sorri et al., 2019; Parker et al., 2016; Tura et al., 2018; Hein et al., 2020; Isckia et al., 2020). Scenarios aroused some variation in preferences among the key ecosystem actors. Further, platform-based entry models seemed to embed several optional *platform entry strategies*. This conclusion is aligned with previous literature; studies indicate that, in business practice, these entry strategies are applied by combining several specific strategies (e.g., Wallin et al., 2021; Parker et al., 2016). Competitive environments change so rapidly that agile strategies are necessary.

Third, the *holistic conceptual frames* (Table 3 and Figure 3) to compare identified and further developed alternative market-entry scenarios were structured and adjusted based on earlier literature (e.g., Gawer, 2014; Parker et al., 2016; Tura et al., 2018; Sorri et al., 2019; Ischia et al., 2020). Moreover, they could be seen not only as entry models, but also as alternative development steps.

Fourth, the results indicated a critical role of the *clear visionary leader* for orchestrating and facilitating a co-evolutionary process from platform-based innovation toward a platform-based business ecosystem. As the earlier platform ecosystem literature shows, platforms are typically established around a focal actor (e.g., Valkokari, 2015, 2017; Hein et al., 2020; Ichia et al., 2020). In the case study, the main focus was on the co-innovation process and the development of platform-based value offering among ecosystem actors across traditional industry borders. Further,

the first initiative for co-designing alternative market-entry models were taken to direct further development among key ecosystem actors, which also revealed the crucial need for common strategic alignment and a visionary leader or orchestrator.

As the main theoretical implications, the study brings new empirical insights to identified research gaps by demonstrating complex and dynamic emergence and co-evolution of platform-based innovation toward alternative platform-based, market-entry models and strategies from an ecosystem perspective in smart construction. The study contributes to previous literature by structuring and adjusting conceptual frames to analyze those alternative platform-based entry models and strategies. *As practical implications*, a deeper understanding on platform ecosystem emergence in smart construction is provided in a platform ecosystem establishment. Particularly, the adjusted conceptual frameworks may support ecosystem orchestrators and involved actors in evaluating alternative market-entry models and strategies for further development. Regarding *research limitations*, this empirical study is based on a single case study in the ongoing co-evolution state. Thus, the empirical findings are only *tentative* and not generalizable as such, but instead opening avenues for further studies. Therefore, as the interesting *further research needs* would be to continue this study as a follow-up study to the next co-evolution phases. Another option could be to expand a single case study for new cases to increase empirical evidence, verified conceptual frames, and understanding regarding platform ecosystem emergence and relevant market-entry models and strategies to support ecosystemic change needed in the construction industry.

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Business-related human rights abuses: a study of chinese and indian corporations

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Abstract

Framing of the research. *We draw from behavioral theory of the firm and neo-institutional theory to investigate the antecedents of human rights abuses by emerging country firms.*

Purpose of the paper. *We study the relationship between firms' performance relative to their industry peers and the probability to commit human rights abuses. We also explore how this relationship is moderated by the regulatory pressure firms face at home and in the countries where they internationalize through foreign direct investments and the adoption of Corporate Social Responsibility (CSR) policies.*

Methodology. *We estimate a dynamic correlated random effect probit model on a sample of 125 large public companies from two important Asian economies - China and India - which we observe in the period 1992 to 2012.*

Results. *We find that high-performing Chinese and Indian firms are more likely to abuse human rights than their low-performing peers. However, this effect is mitigated by the presence of strong external (i.e. rule of law) and internal (i.e. CSR) institutions.*

Research limitations. *As prior research on corporate misconduct, we rely only on human rights abuses that have been discovered by the media*

Managerial implications. *Our findings shed light on the causal conjunctions between emerging country firms' performance, internationalization, home and host country institutions, pro-social behavior, and their involvement in abusive behavior.*

Originality of the paper. *We contribute to the literature on emerging country firms by studying the antecedents of their involvement in human rights abuses as form of misconduct, which can potentially threaten their efforts to overcome the liability of origin and acquire legitimacy with international stakeholders.*

Keywords: *Business-related human rights abuse; corporate social responsibility (CSR); institutions; high-performance; China; India.*

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1. Introduction

Contemporary capitalism has received considerable criticism for its inability to deliver equitable prosperity and to protect the most vulnerable people from exploitation and suffering (Schneider, 2020). In discussing the trappings of capitalism, most scholars and commentators emphasize the catastrophic effects the neoliberal model has had on the environment and climate change (e.g., Cipler *et al.*, 2015), while others point at the macro-level unjust distribution of economic gains observed in the growing within-country economic inequalities (Piketty, 2014). We focus on a third issue that to date has been considered of less concern than these two, but is currently being given growing policy attention, namely business-related human rights abuse. Those suffering such abuse are often workers, indigenous groups, or other vulnerable community members, including consumers and end-users, whose fundamental rights have been damaged or diminished due to business activities or operations (Giuliani, 2019). Forced labor or child labor are among the most severe forms of human rights abuse against workers. Another form of human rights infringement refers to indigenous people deprived of their right to land, water, and health. Further, end users exposed to toxic products or production waste spills have their right to life threatened.

Following the revised draft of the international treaty on the issue of business and human rights (released on 16 July 2019)¹ a ‘human rights violation or abuse’ means “*any harm committed by a State or a business enterprise, through acts or omissions in the context of business activities, against any person or group of persons, individually or collectively, including physical or mental injury, emotional suffering, economic loss or substantial impairment of their human rights, including environmental rights*” (Art 1; emphasis added). In defining human rights, the United Nations Guiding Principles on Business and Human Rights (UNGPs) (United Nations, 2011: 14) refer to the International Bill of Human Rights, summarized as “consisting of the Universal Declaration of Human Rights and the main instruments through which it has been codified: the International Covenant on Civil and Political Rights and the International Covenant on Economic, Social and Cultural Rights, coupled with the principles concerning fundamental rights in the eight ILO core conventions as set out in the Declaration on Fundamental Principles and Rights at Work.” Also, depending on the circumstances, the UNGPs recommend referring to specific treaties and instruments the UN has put out to protect the rights of specific vulnerable groups such as indigenous peoples, women, minorities, children, persons with disabilities, or migrants.

Due to its inherently strong legal roots, the theme of business and human rights has for long been a subject of international law which has largely been studied normatively. Research therefore focused on developing normative frameworks to address the problem of business-related human rights abuse, aimed at minimizing such occurrences (see e.g., Bernaz, 2016; Kobrin, 2009; Muchlinski, 2001; Smit, *et al.*, 2020). Recently, analyzing business-related human rights abuse has become more interdisciplinary and also more open to positivist approaches. Following this development, there have been calls to investigate the ‘anatomy’ of this kind of abuse (Wettstein *et al.*, 2019). Research questions arise about the conditions under which big companies are more inclined to abuse human rights. Also, we know little about the human rights conduct of companies established in emerging countries where the protection and promotion of human rights can be particularly fragile due to weak home country institutions (Doh *et al.*, 2018). As Wettstein *et al.* (2019: 59) put it “paying more attention to the role and characteristics of emerging markets will become critical for [business and human rights]” because “the rise of emerging-market multinationals ... has the potential to shape and change the global economy in profound ways.” Further, the scarcity of large-scale empirical datasets on business-related human rights abuses has constrained systematic empirical analyses to fill those gaps (Olsen *et al.*, 2020).

This article takes some steps toward filling the gaps by exploring one important driver of business-related human rights abuses, i.e. the firm’s performance relative to its industry peers (i.e. ‘relative performance’). We examine the baseline relationship between relative performance and the

¹ https://www.ohchr.org/Documents/HRBodies/HRCouncil/WGTransCorp/OEIGWG_RevisedDraft_LBI.pdf, last accessed December 16, 2020.

probability of abuses in the context of two emerging countries, hypothesizing that, *ceteris paribus*, companies with higher relative performance, termed ‘high-performers,’ are more likely to abuse human rights than their low-performing peers. Additionally, we examine how the proposed baseline relationship is moderated by (i) the regulatory environment (strength of the rule of law) to which companies are exposed, and (ii) their own internal institutions proxied by their corporate social responsibility (CSR) commitment. Our study is based on an original dataset including a sample of 125 large public companies from two important Asian economies - China and India - which we observe in the period 1992 to 2012. After estimating a dynamic correlated random effect probit model, we confirm that high-performing firms are more likely to abuse human rights than their low-performing peers. However, this effect is mitigated by the presence of strong external (i.e. rule of law) and internal (i.e. CSR) institutions.

The article is organised as follows: section 2 develops the research hypotheses. Section 3 explains the methodology and it provides details on the database as well as on the estimation strategy. Section 4 shows the empirical results, and Section 5 gives the conclusion.

2. Theory and Hypotheses

Human rights abuses are violations of rights established by international treaties, and therefore can be considered a crime of sorts or, more broadly, a type of misconduct. Criminologists and other scholars investigating the origins of crime have for many years associated misconduct with the need to correct low-performance, resource scarcity, and deprivation. As early as the 1930s, sociologist Robert Merton theorized that individuals striving to achieve socially accepted goals (or aspirations), but lack financial resources to achieve them, are more inclined to commit crime (Merton, 1938). As he put it: “frustration and thwarted aspiration lead to the search for avenues of escape from a culturally induced intolerable situation; or unrelieved ambition may eventuate in illicit attempts to acquire the dominant values” (p. 680).² At an organizational level, the view that low-performance triggers misconduct has found considerable empirical support (Jeong and Siegel, 2017; Mckendall and Wagner, 1997; Staw and Sz wajkowski, 1975; Xu *et al.*, 2019). Then logic dictates that poorly performing firms are more likely to engage in unlawful or otherwise defined ‘bad’ practices to improve their performance and fulfill their goals. Social scientists have often invoked behavioral theory to explain the cognitive mechanisms of this conduct (Greve *et al.*, 2010). In their study on the causes of financial misrepresentation, Harris and Bromiley (2007: 353) suggest that “[w]hile firms with performance close to their reference points may hope to achieve aspirations via legitimate means, firms performing far below their aspirations may find few perceived legitimate solutions. Thus, the distance a firm performs below its reference points increases the likelihood of misrepresentation.” Hence, the dominant view for many years has been one maintaining that under-performance makes organizations less risk averse (Kahneman and Tversky, 1979), and more likely to misbehave in order to achieve their performance goals.

An interesting dimension of holding this theory for true, is its implications regarding how we judge contemporary capitalism. If we consider corporate misbehavior to be a problem of (mostly) failing, uncompetitive and under-resourced firms, we largely explain these firms’ ‘bad’ conduct as the result of them being the weakest capitalistic actors. This view’s natural normative implication is therefore that such firms need ‘more capitalism,’ as in more competitive markets, more innovation, better access to finance, etc. to be able to escape from low-performance and, in turn, to curtail bad behavior. Ascribing to this theory therefore would discard the need to rethink capitalism in order to address its pitfalls. Such a perspective is unlikely to spark any profound discussion on how to reform the current organization of production and consumption to make it more sustainable and less harmful to human rights. This article offers an alternative perspective. We argue that when firms

² He did not mean to imply that poor people are more likely to engage in criminal activities as such, but rather that, under given pressures to conform to certain social and cultural values – such as achievement of pecuniary success, the lack of opportunities to transcend class lines would have led to the normalization of illicit behaviors to reach such success.

outperform their peers, they are *more* - not less - likely to violate human rights. We elaborate our theoretical development below.

2.1 Hypotheses

Firms have different motivations for taking more risks than they already have. The risks associated with human rights abuses are expressed in terms of reputational loss if the abuse is detected and amplified in a given context, or of diminished legitimacy *vis a vis* important stakeholders, such as the government, international partners, or financial institutions. Additionally, companies abusing human rights face allegations that entail the risk of lawsuits which in turn could increase litigation costs. However, business-related human rights abuses also provide advantages to firms. Business conduct decidedly respectful of human rights could carry higher costs, such as those involved in better conditions for workers, not using slave or unpaid labor, investing in less contaminating production processes, negotiating with indigenous communities and compensating them in cases of displacement. The way companies manage the tension between human rights-related risks and benefits discriminates against companies that abuse human rights and companies that are less likely to do so, all other things being equal. However, what exactly influences this process, remains unclear. As mentioned, low-performance is one frequently invoked reason for misbehavior because striving for economic advantage can prompt low-performing firms to cut corners in pursuing their goals. Yet, we still do not understand the nature of this relationships well, also given the paucity of studies in this area of research (Greve *et al.*, 2010).

Our research context is one of large scale public companies in emerging countries. We build our research hypotheses by considering emerging countries as a boundary condition. Our baseline hypothesis is that, compared to low-performing companies, high performers are more likely to take risky decisions that result in human rights violations. Earlier assumptions that companies take more risks when their performance levels are below their aspiration levels, took for granted that the companies pursue only one goal, namely to improve their performance weakness. Studies with such assumptions generally neglect that companies often pursue multiple goals (Greve and Gaba, 2017) and that certain goals might take precedence over others at given moments or in given circumstances. We suggest that high performing companies in emerging economies predominantly aim to maintain their competitive edge over other industry players, particularly to signal their leadership position in global capitalism to external audiences (Krishnan and Kozhikode, 2015; Mishina *et al.*, 2010). Emerging economies are under several dimensions developing countries with very fragile environments characterized by weak institutions, low international legitimacy, lagging innovation systems. Due to such fragility, Western audiences have in the past stigmatized their firms as being unreliable or low-quality producers (Cuervo-Cazurra and Genc, 2008). It has taken many years for some of these companies to catch up with the international frontier. Hence, we argue that when such companies manage to obtain positive affirmation from high performing industry peers, they will fight harder to retain that position, because they fear future losses more than they value potential gains. Our study attends to this struggle of companies aspiring to meet their aim of consolidating their position as new leading actors in global capitalism. To achieve this, they will be keen to take extra risks by cutting corners and engaging in abusive behavior. In contrast, we expect that low performing firms will be more risk-averse and intent on avoiding failure, and therefore will be more focused on protecting themselves in risky situations. Accordingly, we posit:

Hypothesis 1: Ceteris paribus, emerging economies' high performing companies (i.e., with higher than industry average performance) are more likely to abuse human rights than low-performing ones.

Next, we seek to qualify this baseline relationship by considering two moderating conditions, referring first to the varying degrees of exposure these firms have to regulatory enforcement, and second to their internal self-regulation efforts through CSR.

Concerning the first moderator, we draw on earlier studies showing that regulatory enforcement is a key determinant of corporate behavior (see e.g., Aguilera *et al.*, 2018). Firms are subject to their home country's regulatory pressures, and in the case of internationalizing firms, also to foreign countries' regulations, especially if their ventures take the form of foreign direct investments (Kostova *et al.*, 2008). We expect the extent of the regulatory pressures a firm experiences at home and/or in a host country to modify the level of risk related to human rights abuses. Stronger regulatory pressure can imply higher risk because the relevant regulatory and police agencies are more likely to detect and punish misconduct (Bernaz, 2016). The opposite will apply if operations are predominantly in low regulatory enforcement contexts where it is easier to get away with abusive behavior (Surroca *et al.*, 2013). We suggest that the regulatory enforcement strength of the home and host countries (for internationalized firms) will moderate our baseline relationship negatively. The logic is that, if regulatory sanctions are stronger, the risks associated with human rights abuse will be higher, which will conflict with high performing firms' aspirations of maintaining their competitive edge *vis a vis* industry peers. Accordingly, we posit:

Hypothesis 2: The positive baseline relationship is negatively moderated by the level of companies' exposure to regulatory pressures.

Additionally, we suggest that companies' self-regulation via their CSR policies negatively moderates our baseline relationship. We envisage different mechanisms through which CSR can moderate the baseline relationship. First, as their performance relative to industry peers increases, high performing companies resources available for concrete CSR projects to address human rights problems will grow, thus enabling them to avoid human rights violations. Second, high performers that invest more intensively in CSR activities might be more alert to the fact that, compared to their low-performing peers, their operations are less likely to remain obscure. They are more likely than others to be scrutinized and monitored by Non-Governmental Organizations (NGOs) and watchdog organizations, and thus more likely to attract reputational and litigation costs, which could deter them from abusing human rights (Ashforth and Gibbs, 1990; Morsing and Schultz, 2006). Therefore, we expect that the baseline relationship will be less positive for firms that more intensively adopt CSR policies. Accordingly, we posit:

Hypothesis 3: The positive baseline relationship is moderated negatively by the intensity of companies' CSR policy adoption.

3. Methodology

3.1 Sample

To test these hypotheses, we used a unique hand-collected longitudinal dataset. Our sample comprises 125 companies from China and India selected from the Forbes Global 2000 ranking. Forbes annually ranks the world's largest public companies, therefore we used this ranking to select our sample of the most prominent and powerful economic players in our target countries. We were interested in these countries due to them being among the largest and fastest growing Asian economies (UNCTAD, 2014). We considered large public firms for their prominence both domestically and internationally, and their potentially significant impact on society. They were more likely than smaller companies to be reported extensively in the press and by NGOs for human rights abuses. For the firms in our sample we collected data from 1992 to 2012, obtaining an unbalanced panel of 1,292 firm-year observations. Our sample covers firms in the banking (24%), metals and mining (20%), heavy industry (13%), real estate (8%) sectors. The remaining 35% of

firms were from the automobile, chemicals and pharmaceuticals, electricity and other utilities, electronics, food and beverages, retail, telecommunication and service sectors.³

3.2 Dependent variable

The dependent variable was built through a manual coding of the information retrieved via the Business and Human Rights Resource Centre (BHRRC), one of the most reliable business and human rights knowledge hubs providing regularly updated information on any evidence of business-related human rights abuses (Bernaz, 2016). We downloaded and coded more than 1000 documents that included NGO reports, journal and newspaper articles, and other relevant documents (including video-documentaries where available). We employed two independent coders to ensure consistency in the coding process and we recruited an independent human rights law expert to advise and cross-validate our coded information. On average, 41% of the companies in our sample had at least one reported human rights abuse in our dataset (38% of the Chinese firms and 45% of the Indian companies). Our dependent variable, human rights abuses (HRA_s), is a dummy variable that takes the value 1 if firm i at time t is involved in at least one human rights abuse, and 0 otherwise. We acknowledge that the notion of human rights abuse includes a variety of offences. Over the period of observation, we recorded 238 firm-year human rights abuse events, of which 52% are against workers, 45% against communities, and only 3% against consumers. Although it would have been interesting to investigate the causes of each kind of abuse separately, we note that since human rights abuses are relatively ‘rare’ events (Cuervo-Cazurra *et al.*, 2021), pooling the abuses in one dependent variable allows us enough freedom to run robust econometric analyses, which would not be possible otherwise. Hence our study observes the general human rights conduct of firms at a more macroscopic level.

We use a dynamic specification in our econometric model, which means that as independent variables in the analysis, we include both the one-year lagged dependent variable ($HRA_{(t-1)}$) and the value of the dependent variable at the beginning of the period ($HRA_{(t0)}$) to take account of this variable’s state dependence, associated endogeneity, and initial conditions problems (see next section).

3.3 Independent variables

Most of the independent and control variables included in our econometric models were lagged one year ($t-1$) with respect to the reference year of the dependent variable (t), to reduce concerns about reverse causality from possible contemporaneous idiosyncratic feedbacks from the dependent to the independent variables.

To test Hypothesis 1, we followed earlier research by measuring firm performance as Return on Assets (ROA) because it is less volatile and less sensitive to heterogeneity in firms’ financial structures than other measures, such as Return on Equity. For this reason ROA is conventionally used for this kind of estimation (Audia and Greve, 2006; Greve, 2003; Harris and Bromiley, 2007; Iyer and Miller, 2015; Mishina *et al.*, 2010, among many others). According to our theoretical framework, our performance variable (ROA) was measured as the difference between firm i ’s ROA at time $t-1$ and the firm i industry’s average ROA . We retrieved the data from Datastream and used Thomson Reuters Business Classification to match each firm to its related industry group.⁴

To account for the effect of possible asymmetries associated with positive vs. negative values of firm performance (relative to industry) on the likelihood of involvement in human rights abuses, we considered the interaction term between ROA and a dummy variable ($DummyROA$) which takes the

³ We selected our sample to represent the most economically relevant companies in their respective countries, and therefore some industries might be more represented than others due to their greater relevance in the home economy.

⁴ See Thomson Reuters Business Classification at <http://financial.thomsonreuters.com/content/dam/openweb/documents/pdf/financial/trbc-fact-sheet.pdf>. last accessed December 16, 2020.

value 1 if firm i 's ROA at time $t-1$ is above the industry's average ROA in the same year (i.e. $ROA > 0$), and the value 0 otherwise (i.e. $ROA < 0$).

To test Hypothesis 2, we used a proxy of the regulatory pressure to which a firm is exposed (considering both the home country pressures and, for internationalized firms, the pressure of host countries). We built a combined variable, *Regulatory Pressure*, which accounts for the strength of the rule of law and the judiciary system in the home as well as in the foreign countries in which the companies have invested. We retrieved the latter investments through multiple sources (FDIMarkets; Zephyr (Bureau van Dijk), and SDC Platinum (Thomson Reuters)) and used them here as a measure of the firms' degree of exposure to foreign markets (export data is unfortunately not publicly disclosed). Next, we measured the regulatory environment relying on the Worldwide Governance Indicators' (*WGI_ROL*) Rule of Law Index that the World Bank developed.⁵ The variable *Regulatory Pressure* for firm i was then defined as a weighted average of the home and foreign host countries' *WGI_ROL* up to year $t-1$ according to the following formula:

$$Regulatory\ Pressure = \frac{\sum_{t=1}^{T-1} \sum_{j=1}^J P_{jit} * WGI_ROL_{jt}}{\sum_{t=1}^{T-1} \sum_{j=1}^J P_{jit}} \quad j=1, \dots, J; \quad t=1, \dots, T-1$$

where P_{ijt} is an indicator variable equal to 1 if firm i is exposed to country j regulatory pressure at period t (or if j is the firm's home country); WGI_ROL_{jt} is the value of *WGI_ROL* for each country j at period t ; $\sum_{t=1}^{T-1} \sum_{j=1}^J P_{jit}$ is the number of countries firm i is exposed to up to time $t-1$. We also ran robustness checks with a different specification of this variable, which accounts only for international pressure.

To test Hypothesis 3, we measured the intensity of firms' CSR policy adoption, considering five CSR initiatives or policies which were coded as 0,1 depending on their presence (1) or absence (0) in each year t . The first initiative, philanthropy, includes information about philanthropic initiatives, donations, and other activities that benefit different types of stakeholders. We retrieved philanthropic information via direct contacts with corporations and corporate websites. Second, information on *transparency* was obtained via CSR reports which took the value of 1 if the firm published a CSR report and made it available on its corporate website. Third, we gained insight on *accountability* via the company's adoption of the Global Reporting Initiative (GRI) principles for non-financial reporting. In this case, we collected information on the years in which the firm had produced an accountability report according to GRI guidelines by consulting both GRI and corporate websites. Fourth, we considered *orientation to principles*, which was coded by the company's adherence to the United Nations Global Compact (UNGC), a voluntarily initiative involving commitment to aligning operations and strategies with ten universally accepted principles related to human rights, labor rights, environmental sustainability, and anti-corruption.⁶ We collected information on the years in which a Communication of Progress was submitted to the UNGC. Finally we followed the CSR initiative *sponsorship to the UNGC*, which was coded 1 if the company had made a financial contribution the UNGC Foundation (generally amounting to rather modest sums). Based on these five dummy variables, we constructed a composite index (*CSR*) which reflects the intensity of firms' engagement in CSR policies, based on the number of initiatives firm i undertook at time $t-1$, and then rescaled on a range of 0 to 1.

3.4 Control variables

We controlled for a number of additional factors known to relate to *HRA*s. First, we included firm age (*Age*) measured as the log of the number of years since the firm's foundation, and firm size (*Size*) proxied by the log of the number of workers at time $t-1$. Second, we controlled for the firm's market risk (*Risk*), measured on the basis of the firm's ROE volatility at time $t-1$ (i.e. based on

⁵ See WGI at <http://info.worldbank.org/governance/wgi/index.aspx#doc>, last accessed July 20, 2018.

⁶ See UNGC at <https://www.unglobalcompact.org/> last accessed December 16, 2020.

annual fluctuations in the ROE around its trend value, calculated using non-parametric estimation). We retrieved this data from Datastream. Third, we add a dummy variable (*International*) which takes the value 1 if firm *i* has internationalized its activities (in the form of greenfield or brownfield investment, a merger or acquisition) up to time *t-1*, and 0 otherwise.

Additionally, we controlled for media exposure (*Media Exposure*) since the likelihood of a firm’s involvement in human rights abuses being reported depends on the extent to which the company is on the media and NGOs’ radar (Fiaschi *et al.*, 2017). We measured firms’ media exposure as the log of the number of articles mentioning firm *i* at time *t-1*, browsed on NexisUni (News section). Further, since business-related human rights abuses are more likely in some industries than in others (Giuliani and Macchi, 2014), we included industry dummies. We aggregated industries in three groups based on their macro industry classification, to distinguish between firms in the extractive, manufacturing, and services sectors. The reference group, *Extractive*, included firms in the oil, gas, and mining industries; *Manufacturing* included automobiles, chemicals and pharmaceuticals, electronics, food and beverages, and heavy industries; and *Services* included banking, electricity and other utilities, logistics, real estate, retail, and telecommunications. We also included country-specificities using country dummies, with *India* as the reference group, to account for differences in the history, regulations, and institutional arrangements of the home countries which could affect corporations’ human rights conduct (Matten and Moon, 2008). Finally, we included time dummies (*Time dummies*) to account for *HRA* time trends.

3.5 Estimation procedure

To test our hypotheses, we estimated the probability of firm *i*'s involvement in at least one human rights abuse in a given year *t* employing a dynamic correlated random effects probit model (Hyslop, 1999; Stewart, 2006; Wooldridge, 2005). This model is particularly useful for longitudinal data and strong state dependence (see the transition matrix in Table 1) of the dependent variable, because it helps to distinguish between true state dependence, i.e., time dependence driven by the effects of previous abuses on subsequent events, and spurious state dependence which is driven by the presence of time-invariant unobserved individual effects (unobserved heterogeneity).

Table 1 presents the transition matrix, which cross-tabulates the values (with row percentages) of *HRAs* in *t-1* vs. *t*, to check the degree of association (persistence) between the two binary outcomes. The transition matrix shows that there is high state dependence in the probability of an abuse along time, with 95.8% of firms recording no abuse in *t-1* and no *HRA* event at time *t*, and with 83.1% of firms with at least one human rights abuse in *t-1* having an *HRA* event at time *t* as well.

Tab. 1: Transition matrix

<i>HRA_{t-1}</i>	<i>HRA_t</i>		Total
	0	1	
0	1,073 95.80%	47 4.20%	1,120 100%
1	29 16.86%	143 83.14%	172 100%
Total	1,102 85.29%	190 14.71%	1,292 100%

Source: our elaboration.

We used the following econometric specification:

$$HRA_{it} = \gamma HRA_{it-1} + \beta X_{it-1} + \alpha_i + u_{it} \quad i \in \{1, 2, \dots, N\}, t \in \{1, 2, \dots, T_i\} \quad (1)$$

where *HRA_{it}* is the binary dependent variable, *X_{it-1}* is the (1xk) vector of pre-determined independent and control variables (defined above) including the one-year lagged value of the

dependent variable HRA_{it-1} ; (γ, β) is the set of unknown parameters, α_i is an individual-specific time invariant term, and $u_{it} \sim N(0, \sigma_u^2)$ is a random idiosyncratic disturbance term.

Model (1) is estimated using maximum likelihood techniques that do not require any (within, between, or first difference) transformation of the original variables, and thus, are not affected by the types of estimation bias (e.g., Nickell, 1981) generally associated with fixed-effects model estimations involving these kinds of transformations. However, as acknowledged in the econometric literature (see e.g., Mundlak, 1978; Skrondal and Rabe-Hesketh, 2014; Wooldridge, 2005), maximum likelihood estimators applied to nonlinear panel data models might be inconsistent because of two kinds of endogeneity problems, namely lacking independence of the initial response HRA_{i0} and the random intercept α_i (the so-called initial conditions problem), and lacking independence of the covariates X_{it-1} and the random intercept α_i (endogenous covariates problem). To account for these problems we adopted the solution Skrondal and Rabe-Hesketh (2014) recommended, and estimated a compound conditioning model allowing the random intercept term α_i to be correlated with the initial value of the dependent variable HRA_{i0} (Aitkin and Alfò, 1998), the initial values of the independent variables X_{i0} (Rabe-Hesketh and Skrondal, 2013), and the within-subject means of the independent variables \bar{X}_{it-1} (Mundlak, 1978; Wooldridge, 2005) up to year $t-1$. The final conditioning joint model adopted for the random intercept, is the following:

$$\alpha_i = \alpha_0 + \delta_{y_0} HRA_{i0} + \delta_{x_0} X_{i0} + \delta_{\bar{x}_{t-1}} \bar{X}_{it-1} + \eta_i$$

where $\eta_i \sim N(0, \sigma_\eta^2)$ is an individual-specific random error term.

4. Results

Table 2 presents the descriptive statistics and the correlation matrix of the variables used in the models. Given the high correlation between some of the variables, we checked for potential multicollinearity by computing, for each linear specification of the estimated model, the mean variance inflation factor (VIF), which shows that multicollinearity seems not to be a serious problem if we adopt the rule-of-thumb cutoff value of 10 (Kutner *et al.*, 2004).

Tab. 2: Descriptive statistics and correlation matrix.

	Variables	mean	sd	1	2	3	4	5	6	7	8	9	10
1	HRA	0.15	0.35	1									
2	ROA	0.03	0.06	0.01	1								
3	DummyROA	0.71	0.45	0.00	0.58	1							
4	Regulatory Pressure	0.05	0.49	0.03	0.11	0.12	1						
5	CSR	0.28	0.23	0.25	0.06	0.01	0.24	1					
6	Age	3.22	0.90	0.10	0.06	0.14	0.34	0.19	1				
7	Size	9.68	1.85	0.20	-0.13	-0.14	0.09	0.28	0.04	1			
8	Risk	0.08	0.14	-0.05	-0.08	-0.11	-0.08	-0.03	-0.03	-0.03	1		
9	SOE	0.52	0.50	0.03	-0.28	-0.20	-0.20	-0.06	0.08	0.24	-0.08	1	
10	International	0.49	0.50	0.13	-0.02	0.02	0.51	0.31	0.17	0.31	-0.08	-0.08	1
11	Media Exposure	2.85	1.87	0.19	-0.03	-0.12	0.11	0.35	0.05	0.38	0.01	0.07	0.30

Source: our elaboration

4.1 Hypotheses Testing

Table 3 shows the results of the estimated baseline equation (1) without interactions. For comparison, Model 1 reports the estimated parameters of the static random effects probit model (i.e. excluding the lagged dependent variable among the regressors), and Model 2 reports the estimated parameters of the dynamic correlated random effects probit model without any correction for endogeneity. Model 3 reports the estimated parameters including only the initial value of the dependent variable $HRA_{s_{i0}}$ in the random term equation (2), and Model 4 reports the estimated parameters which also includes the initial values of the independent variables X_{i0} . Finally, Model 5

reports the estimated parameters and marginal effects with the full specification including also the within-subject means of the independent variables \bar{X}_{it-1} in the random term equation (2), hence correcting for both the initial condition and the endogenous covariate problems.⁷

We find that the ROA's coefficient is positive and statistically significant in all the models, which supports Hypothesis 1. In particular, comparing Model 1's estimates (i.e. the static specification used in the previous empirical literature) with the other dynamic estimates of Models (2-5), shows that when the lagged dependent variable is omitted (as in Model 1), the magnitude of the estimated ROA coefficient (along with other persistent regressors such as *Age*, *International* and *Media Exposure*) is upwardly biased. This occurs because (i) the static Model 1 cannot distinguish between true vs. spurious state dependence (Heckman, 1981), and (ii) the dynamic Models (2-5) are able to disentangle the short-run vs. long-run effects associated with each independent variable, whereas the static Model 1 simply combines these effects. In Model 5, the estimated short-run (i.e. one-year lagged) ROA effect is equal to 0.44 while the estimated long run effect that can be approximated by applying the formula $\frac{\hat{\beta}_{ROA}}{1-\hat{\gamma}}$, is equal to 0.5.

Before turning to test the moderating hypotheses, we briefly comment on the direct effects of the moderating variables. *Regulatory Pressure* has a negative and significant direct effect on the dependent variable *HRA* in all the estimated models (Models 1-5 Table 3), which means that the stronger the regulatory environment of the countries where firms have their operations, the lower the probability of the company being reported for abuse. This result is in line with prior international business research on the effects countries institutional qualities have on firms' (mis-)behavior (e.g., Fiaschi *et al.*, 2017; Keig *et al.*, 2015; Surroca *et al.*, 2013). It is interesting also that the *CSR* coefficient is positive and significant in Models 1-4 in Table 3; however, this result could be biased by reverse causality (e.g. adoption of CSR might be driven by prior involvement in human rights abuses), since in these models only the initial condition problem was taken into account. Notably, the positive coefficient becomes smaller and non-significant when within-subject averages are added in the fully specified model (Model 5 in Table 3) to correct also for the endogenous covariate problem.

Tab. 3: Dynamic correlated random effect probit baseline model results

Independent variables	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Marg.Eff. (5)
<i>HRA</i> _{t-1}		1.88*** (0.27)	1.59*** (0.24)	1.58*** (0.24)	1.54*** (0.24)	0.12*** (0.03)
ROA	5.42*** (2.04)	2.68* (1.55)	1.85 (1.54)	2.83 (1.73)	5.46** (2.42)	0.43** (0.19)
Regulatory Pressure	-0.55* (0.29)	-0.45** (0.22)	-0.53** (0.23)	-0.56** (0.23)	-0.52** (0.24)	-0.04** (0.02)
CSR	1.22** (0.57)	0.94** (0.44)	1.08** (0.47)	1.30*** (0.49)	0.58 (0.63)	0.05 (0.05)
Age	0.75** (0.30)	0.22 (0.15)	0.23 (0.15)	0.19 (0.15)	0.23 (0.15)	0.02 (0.01)
Size	0.09 (0.12)	0.12 (0.08)	0.08 (0.07)	0.07 (0.08)	0.06 (0.08)	0.01 (0.01)
Risk	-2.59** (1.09)	-1.14 (0.85)	-1.13 (0.83)	-1.63* (0.95)	-2.08** (1.04)	-0.16** (0.08)
SOE	0.17 (0.49)	-0.01 (0.24)	-0.14 (0.24)	-0.10 (0.25)	-0.09 (0.25)	-0.01 (0.02)
International	0.43 (0.30)	0.12 (0.22)	0.19 (0.22)	0.23 (0.23)	0.26 (0.23)	0.02 (0.02)
Media Exposure	0.34*** (0.10)	0.15** (0.07)	0.15** (0.07)	0.14** (0.07)	0.13 (0.11)	0.01 (0.01)
Manufacturing	-0.96 (0.79)	-0.24 (0.36)	-0.07 (0.36)	0.14 (0.38)	0.12 (0.39)	0.01 (0.03)
Service	-2.96***	-1.14***	-0.80**	-0.63*	-0.60*	-0.05*

⁷ In particular, in X_{i0} and \bar{X}_{it-1} , we included the set of initial values and within-subject averages of the following time varying independent variables: *ROA*, *CSR*, *DummyROA*, *Media Exposure*, and *Risk*. The variables *Size*, *International*, and *Regulatory Pressure* are not included for multicollinearity reasons and because the latter variable is already expressed as a (weighted) within-subject average.

	(0.80)	(0.41)	(0.37)	(0.37)	(0.36)	(0.03)
China	0.16	-0.07	-0.04	-0.31	-0.31	-0.02
	(0.55)	(0.27)	(0.28)	(0.30)	(0.30)	(0.02)
HRA ₀			2.47***	2.89***	2.88***	0.23***
			(0.68)	(0.77)	(0.75)	(0.05)
X ₀				YES	YES	YES
X _{t-1}					YES	YES
Time dummies	YES	YES	YES	YES	YES	YES
Constant	-5.86***	-4.03***	-3.86***	-3.79***	-3.92***	
	(1.72)	(1.00)	(0.98)	(0.96)	(0.96)	
Number of observations	1,292	1,292	1,292	1,292	1,292	1,292

*p < 0.10; **p < 0.05; ***p < 0.01; standard errors in parenthesis.

To further explore whether the baseline relationship has nonlinearities and is moderated by other independent variables (Hypotheses 2-3), we extended the model in column (5) with additional interaction terms. Table 4 reports the main results. To assess the overall strength of the moderating factors (or, using the Baron and Kenny, 1986's definition, to test their differential validity) in Models 7 and 8, we report, at the bottom of Table 4, the likelihood-ratio (LR) X^2 statistic to test the joint statistical significance of the interaction terms, using Model 6 as the null one. The overall moderating effects of *Regulatory Pressure* and *CSR* are jointly significant at the 1% and 5% levels, respectively. Since we were estimating a set of nonlinear probit models with several interaction terms, we could not retrieve the magnitude of the estimated marginal effects or the statistical significance of the moderating factors based on the estimated coefficients and relative standard errors. Hence, following Zelner's (2009) guidelines, we simulated the magnitude and statistical significance of the marginal and moderating effects by computing and comparing the predicted probabilities of each model using delta methods (Tsai and Gill, 2013).

Tab. 4: Dynamic correlated random effect probit interaction model results

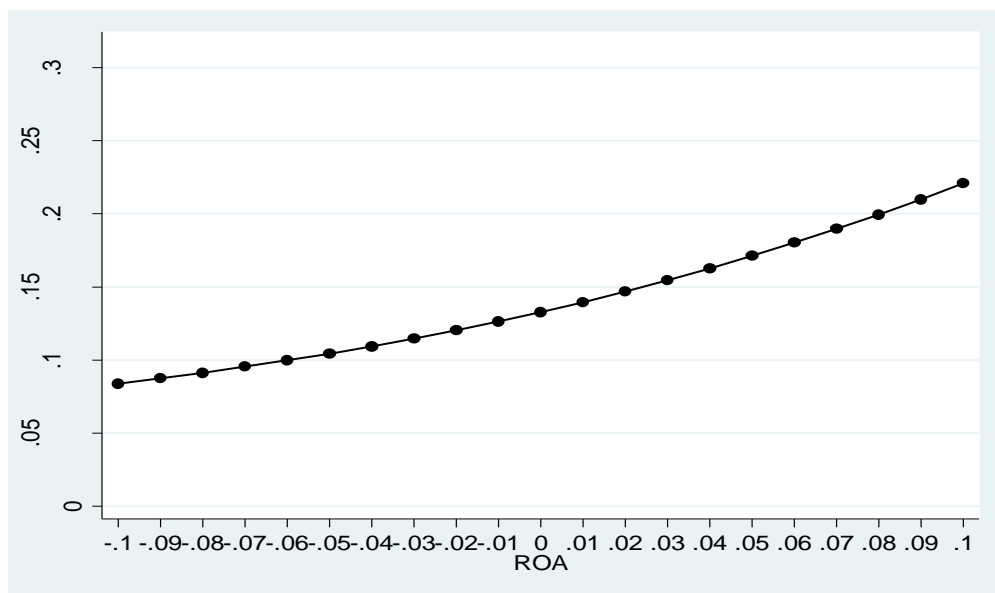
VARIABLES	Model (6)	Model (7)	Model (8)
HRA _{t-1}	1.52***	1.48***	1.55***
	(0.24)	(0.26)	(0.24)
ROA	10.49*	10.77*	25.40**
	(5.63)	(5.77)	(12.92)
DummyROA	-0.35	-0.30	-0.90*
	(0.25)	(0.25)	(0.47)
ROA* DummyROA	-4.51	-5.35	-14.93
	(6.01)	(6.30)	(13.01)
Regulatory Pressure	-0.53**	-0.54	-0.51**
	(0.24)	(0.41)	(0.24)
Regulatory Pressure* DummyROA		-0.22	
		(0.48)	
ROA* Regulatory Pressure		-0.95	
		(9.80)	
ROA* DummyROA * Regulatory Pressure		4.34	
		(10.03)	
CSR	0.67	0.69	-0.24
	(0.65)	(0.66)	(1.15)
CSR * DummyROA			1.62
			(1.23)
ROA*CSR			-43.98
			(30.92)
ROA* DummyROA * CSR			28.45
			(32.04)
Age	0.22	0.24	0.21
	(0.15)	(0.16)	(0.15)
Size	0.06	0.06	0.09
	(0.08)	(0.08)	(0.08)
Risk	-2.06*	-2.06*	-2.29**
	(1.07)	(1.07)	(1.09)
SOE	-0.11	-0.13	-0.08
	(0.26)	(0.27)	(0.26)
International	0.28	0.27	0.24
	(0.23)	(0.24)	(0.23)
Media Exposure	0.13	0.13	0.13
	(0.11)	(0.11)	(0.11)
Manufacturing	0.16	0.15	0.15

	(0.40)	(0.41)	(0.39)
Service	-0.56	-0.61	-0.51
	(0.38)	(0.39)	(0.37)
China	-0.33	-0.31	-0.36
	(0.31)	(0.32)	(0.30)
HRA ₀	3.03***	3.13***	2.95***
	(0.79)	(0.84)	(0.77)
X ₀	YES	YES	YES
X _{t-1}	YES	YES	YES
Time dummies	YES	YES	YES
Constant	-3.69***	-3.72***	-3.63***
	(1.00)	(1.03)	(1.03)
X ² LR Test for joint significance of interactions		3.24*	8.16**
Number of observations	1,292	1,292	1,292

*p < 0.10; **p < 0.05; ***p < 0.01; standard errors in parenthesis.

Figure 1 shows the predictive probability of *HRA* for different *ROA* values based on the estimation results reported in Table 4 Model 6, which allows for asymmetric effects of positive and negative *ROA* values. The relationship between performance above the reference industry (*DummyROA*) and the probability of *HRA* remains positive, providing support for Hypothesis 1. Moreover, this relationship is even stronger for large positive *ROA* values. The estimated average (short-run) marginal effect ($\frac{\partial \Pr(HRCA_{it}=1)}{\partial ROA_{it-1}}$) of *ROA* on the probability of involvement in a human rights abuse (hence the ‘average slope’ of the predicted line in Figure 1) is 0.50 (standard error 0.23).

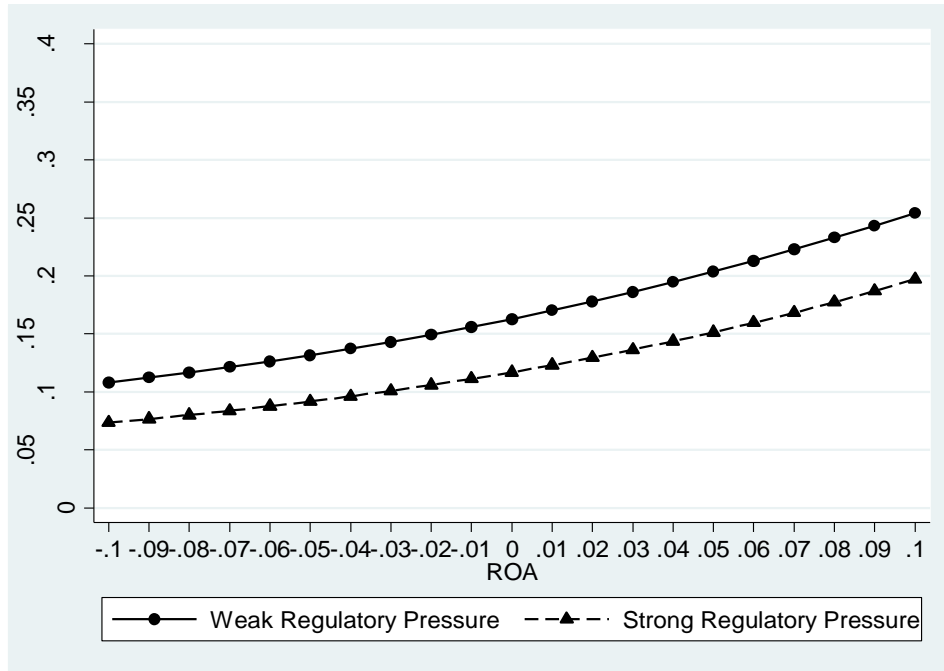
Fig. 1: Predicted probability of being involved in at least one *HRA* for different values of *ROA*.



Source: our elaboration based on Model 6 from Table 4.

Hypothesis 2 predicts that a positive relationship between firm performance and *HRA* will be weaker in a context of strong regulatory pressure. Model 7 tests this hypothesis and Figure 2 depicts the effect of firm performance on the predicted *HRA* probability for two levels of *Regulatory Pressure*: low -0.4 (value of 25th percentile), and high 0.4 (value of 75th percentile). The positive relation between *ROA* and the probability of involvement in a human rights abuse is stronger if *Regulatory Pressure* is low, and is weaker if *Regulatory Pressure* is high, which supports Hypothesis 2. The estimated average (short-run) marginal effects of *ROA* on the probability of *HRA* in this model (hence the ‘average slope’ of the two lines depicted in Figure 2), for low and high values of *Regulatory Pressure* are, respectively, 0.68 (standard error 0.36), and 0.61 (standard error 0.26).

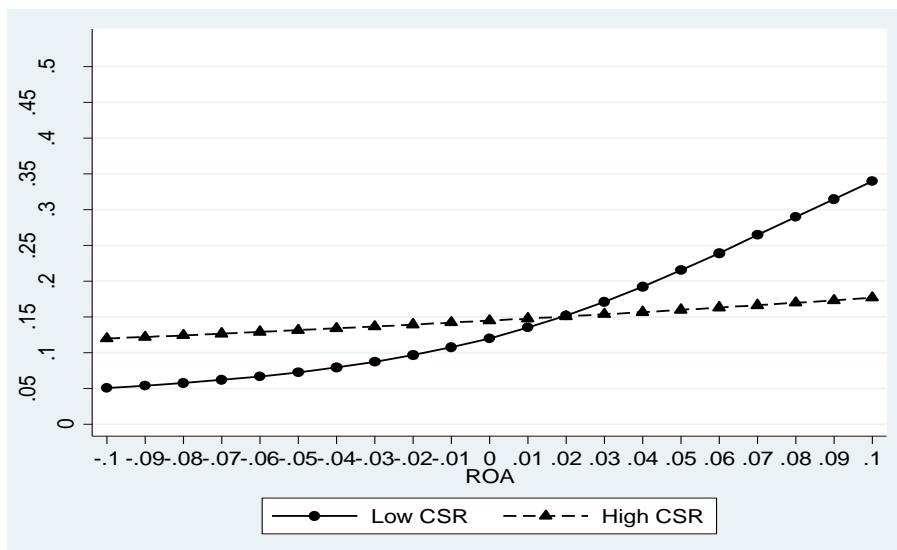
Fig. 2: Moderating effects of Regulatory Pressure



Source: our elaboration based on Model 7 from Table 4.

Hypothesis 3 predicts that a positive relationship between firm performance and *HRA* will be weaker for more intensive adoption of CSR policies. Figure 3 shows the moderating effect of *CSR*, using the predicted probabilities that were computed based on the estimation results reported in Model 8 for different levels of *CSR*: low 0 (no adoption of CSR policies), and high 0.5 (value of 75th percentile). The positive relation between *ROA* and the propensity for involvement in a human rights abuse is stronger (steeper) when *CSR* is low, and is weaker (flatter) when *CSR* is high, which supports our Hypothesis 3 of a negative moderating effect. In particular, the estimated average (short-run) marginal effects of *ROA* on *HRA* (hence the average slope of the lines depicted in Figure 3) when *CSR* is either low or high, are respectively 1.22 (standard error 0.45) and 0.30 (standard error 0.33). Hence, intensive adoption of CSR policies neutralizes the positive effect of *ROA* and the probability of involvement in human rights abuses.

Fig. 3: Moderating effects of CSR



Source: our elaboration based on Model 8 from Table 4.

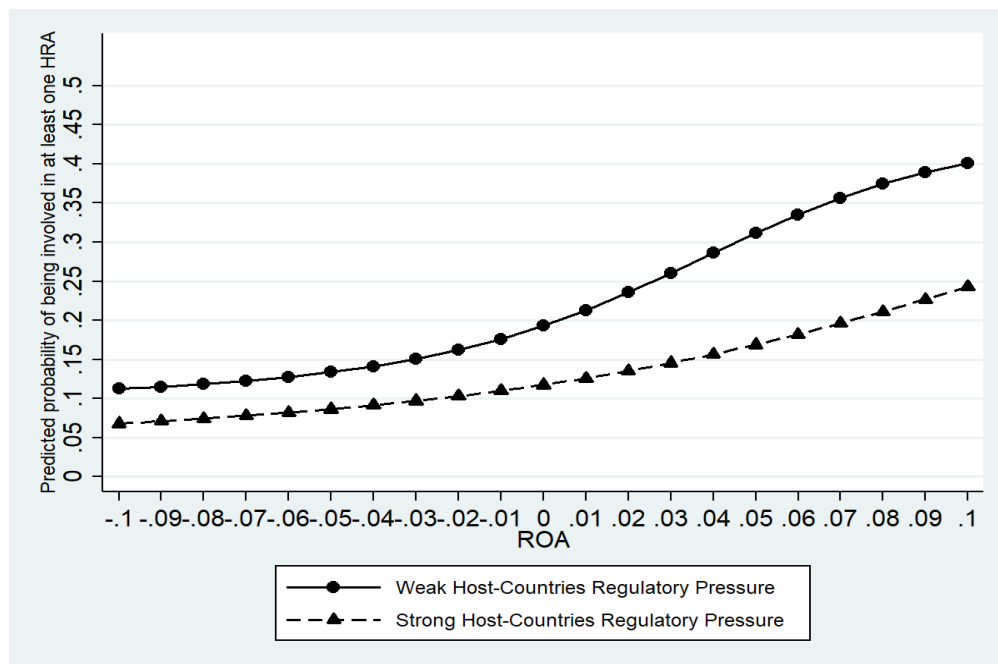
Regarding the control variables, the coefficient of *Media Exposure* is positive and significant in Models 1-4 in Table 3, but this result could be biased by reverse causality (e.g. enhanced media attention may be driven by rumors of possible involvement in human rights offences), since in these models only the initial condition problem is taken into account. In fact, this positive coefficient becomes smaller and non-significant when within-subject averages are added in the fully specified model (Table 3, Model 5) to correct for the endogenous covariate problem as well. The same spurious positive effect is found for the main *CSR* coefficient in Models 1-4. The coefficient of *Risk* is negative and significant in Models 1, 4 and 5 in Table 3, which means that firms with higher ROE volatility are less likely to abuse human rights. In our models, *Size*, *Age*, *SOE* and *China* are non-significant, which suggests that none of these variables explains, *ceteris paribus*, human rights abuses. Finally, we found that *Services* industries firms are less likely to harm human rights than firms in the *Extractive* industry. This finding is in line with previous evidence and concerns about the extractive industries' serious and dangerous impact on society (Giuliani and Macchi, 2014).

4.2 Robustness checks

We performed several robustness checks. To test whether the rapid development of international trade relations since the early 2000s (e.g. since China joined the WTO) affects our results, we re-estimated the econometric model using only data from 1999 onwards. Doing this, we found support for our main analysis (results available upon request from the authors).

To investigate the potentially different moderating roles countries' regulatory pressure could have played in more detail, we also re-run estimations by considering only the international regulatory pressures, thus focusing on internationalized firms only. We consistently found the positive relation between *ROA* and *HRA* to be significantly stronger if companies internationalize more in countries with weaker rule of law standards, and vice versa (see Figure 4). This provides further support for Hypothesis 2, showing the importance of emerging country firms' exposure to countries with a strong institutional apparatus.

Fig. 4: Moderating effects of Host Countries Regulatory Pressure



Source: our elaboration based on Model 7 in Table 4

On this moderator, we also ran the estimates considering the World Bank 'Voice and Accountability' indicator rather than the Rule of Law indicator, in order to account for corporate

responses to country-level freedom of expression, freedom of association, and media freedom. In all cases, the results were consistent with our main.

Finally, since our sample was drawn from the 2012 Forbes Global 2000 rankings, we tested for possible sample selection and attrition bias, i.e. we considered the fact that our panel could be unbalanced because some firms were unlisted, not active, or had changed ownership during our period of analysis. We used inverse probability weights (IPWs) with a two-step procedure. First, we collected information on Forbes Global 2000 rankings for the previous three years (2011, 2010, 2009) and we estimated, for each company, the conditional probability of inclusion in these rankings using non parametric techniques (Li and Racine, 2007). In a second step, we computed IPWs using a similar procedure to Wooldridge (2007), and then re-estimated our models using this weighting procedure. It assigned more ‘importance’ to ‘fragile’ companies that, in a given year, were more likely to be included in the Forbes ranking ‘by chance’, and less ‘importance’ to companies that were more stable in the ranking. The results of these robustness checks provide strong evidence that neither selection nor attrition cause serious biases in our estimates, which is in line with other similar analyses (Cheng and Trivedi, 2015).

5. Discussion and Conclusion

Business-related human rights infringements are amongst some of the most worrying grand sustainability challenges that need a solution. Considering large companies from emerging countries as a boundary condition, we argue that firms performing better than their industry peers (high-performers) are more likely to violate human rights than their low-performing peers, and we explore the moderating factors of this baseline relationship. Using an original dataset including a sample of 125 large public companies from China and India observed over the 20-year period between 1992 and 2012, we found that high-performers are more likely to abuse human rights than low-performing firms, although less so when they are subject to institutional pressures. Such pressures relate to a country’s rule of law that negatively moderates the baseline relationship, while this relationship becomes flat for firms with a strong CSR commitment. Our results contrast with the dominant view that misconduct or abusive conduct stems from resource constraints and low-performance.

In fact, for many years, profitable firms have been one of the symbols of ‘good’ capitalism, demonstrating how this model could benefit society via economic value generation, also by creating new employment opportunities and improving employees’ income. In this view, profitable firms demonstrate that the business sector produces the most efficient economic value-generating organizations and that how capitalism is currently organized provides the best model for achieving such an efficient allocation of resources. While numerous scholars (e.g., Zingales, 2017) have extensively discussed this viewpoint’s limitations, far less attention has been dedicated to the extent to which profitable firms violate human rights. Such firms are more often discussed in terms of their contribution to the enjoyment of rights associated with improved economic conditions.

Our analysis suggests that super-profitable firms can indeed cause harm through human rights violation in fulfilling some of their multiple goals. This result is robust to several specifications and controlling for different factors, therefore we believe it is useful to inform current conversations on how to rethink capitalism (e.g., de Bakker *et al.*, 2020; Henderson, 2020; Stiglitz, 2019). If unconstrained capitalism does not work as intended, how can it be reformed? The moderators’ results show that institutions matter - both those external to the firm (i.e. countries’ strong rule of law, and speech and press freedom) and the internal ones (i.e. CSR). In policy terms this means that abuses are not deterred by giving firms ‘more capitalism,’ but rather by giving them stronger institutions. A policy mix involving both hard and self-regulatory instruments is more likely to tame capitalism’s excesses. However, this promising insight needs be considered in light of the direct effects of the two institutional pressures: whereas regulatory pressures reduce the probability that a firm will abuse human rights, we found that CSR has no significant effect on human rights

violation. This casts more doubt on whether CSR is really a corrective measure in addressing capitalism's problematic effects (Schneider, 2020).

Overall, these results indicate that in the business sector respect for human rights is not, so to speak, in the natural order of things; in fact, human rights protection needs the right kind of attention from the relevant institutional or governing bodies. It is thus encouraging that countries are taking steps to regulate business-related human rights abuse. Following the 2011 UNGPs, several countries have adopted policy instruments to minimise business-related human rights infringement. These include the 2017 French Corporate Duty of Vigilance Law, the 2015 UK Modern Slavery Act, and the 2019 Dutch Child Labour Due Diligence Law.⁸ Whether these new business and human rights regulations will be effective in curbing human rights abuses in the business sector remains an open question for future research.

More opportunities for further research arise in considering the limitations of our study. First, our empirical analysis is based on a limited sample of large public companies in two emerging countries, therefore results need to be seen in the context of this boundary condition. Mishina and colleagues (2010) found, similarly, that high-performing firms act illegally in the context of S&P 500 manufacturers, which strengthens the credibility of our results. However, evidence proving a positive relationship between economic performance and human rights violation or crime remains scant. This calls for more research to better qualify this relationship. Also, interesting research questions arise regarding the potential link between over-performing firms' human rights harm and their shareholders' wealth or capital accumulation over time, since this paper has not explored that issue. Does higher incidence of human rights abuse correlate with, even to lead to, shareholders' abnormal wealth accumulation?

Second, a caveat in our work is that our sample's low performing firms are second-tier global or national leaders that perform poorly relative to their industry peers, but are not low performers in absolute terms. This needs to be accounted for in interpreting the findings. Hence, given the context of our research, we cannot rule out that smaller unlisted firms might engage in wrongful conduct to escape their condition of low-performance. However, smaller firms' harm to human rights is likely to be on a lower scale compared to the harm bigger companies cause. Also, on feasibility grounds, large scale longitudinal quantitative analyses on smaller firms are unfeasible due to lack of data on human rights abuses in that context.

Third, to measure human rights abuses we considered infringements, regardless of whether they had been judged so in legal proceedings, given that only a small minority of human rights violations result in lawsuits and receive a final judicial decision. Moreover, like other work on the same topic (Surroca *et al.*, 2013), we relied only on evidence of business conduct that had been reported, thus our dependent variable might underestimate the problem. This concern is mitigated here because we assessed inter-firm differences on the probability of their being involved in an abuse. In this context, it could be problematic if some companies are more intensively observed (and therefore, their negative conduct would receive more media attention) than others. This explains why we included media exposure in the control variables. However, we acknowledge that more research is needed to further refine the existing measures of human rights abuse (for a discussion, see Fiaschi *et al.*, 2020).

Fourth, our study does not adopt a firm-year-country multi-level approach for reasons of parsimony; such an approach would require additional assumptions to test the unidirectionality of the interaction effects within and across levels of analysis.

Finally, our measure of CSR is a rough approximation of the extent to which firms consider socially responsible practices, but it does not help to disentangle truly transformative CSR actions from purely symbolic ones. Also, while CSR policies might indicate a commitment to achieve social goals, they may not necessarily be designed to help the company address human rights issues. We suggest future research could fine-tune the analysis by focusing specifically on the quality of companies' human rights policies. Such policies could be used in future works because they have

⁸ For a full review of national and supra-national business and human rights regulatory developments, see European Commission, 2020.

become easier to observe since the UNGPs were developed in 2011, following which various countries have adopted new hard law regulations.

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Women and international strategy: preliminary results

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Abstract

Framing of the research. *Despite the large literature focusing separately on women in the upper echelons and on firm internationalization, gender differences in international business research have so far received little attention. We enrich this field by adopting the liberal feminist theory. We search for discrimination and/or barriers within the firm (i.e., internal context) and in the external context as they can negatively affect the effectiveness of women directors when internationalizing.*

Purpose of the paper. *By relying on the liberal feminist theory we suggest that while men and women are equally capable to internationalize, women may face gendered barriers within and outside the firm, which hinder internationalization. We aim to detect if and how the (internal and external) context mediate the impact of women in the upper echelons on internationalization.*

Methodology. *A dataset of 2,861 Italian firms referring to 2017 is used.*

Results. *Our analysis shows that when the (external and/or internal) context is non-egalitarian, women-led firms are less likely to internationalize due to the existing barriers.*

Research limitations. *The general limitation in the quantitative research design could be addressed with a deeper analysis of the characteristics of female directors. The limitation regarding observation time could be faced considering the span of time women have been on the board. The roles the women hold (e.g., CEO) could also be investigated.*

Managerial implications. *Remedial strategies should focus on development of the firm in order to make it more egalitarian. Moreover, public incentive programs should address impediments such as non-egalitarian attitudes or other gendered barriers.*

Originality of the paper. *We enriched the theory of international businesses by adopting the liberal feminist theory, envisioning a “feminist international business theory”. We searched for discrimination and/or barriers in the internal and/or external context.*

Keywords: *Women; Upper echelon; Internationalization; FDI; Context; Empirical analysis*

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1. Introduction

Women represent both a potential source of economic and social development (Ahl, 2006; Farrell and Hersch, 2005; Jennings and Brush, 2013). In recent years, there has been an increasing academic and policy attention to women entrepreneurs and managers (Idris and Saridakis, 2020) and they are considered as crucial to achieving the sustainable development goals (Eden and Wagstaff, 2021; Akter *et al.*, 2019). Furthermore, at the policy level, since 2013 the European Commission has started to provide direction to improve gender balance on boards. Consequently, more efforts have been taken towards a greater involvement of women during the decision-making process within firms (Berenguer *et al.*, 2016; Martín-Ugedo and Minguez-Vera, 2014; Nielsen and Huse, 2010). We consider that this topic needs further development, in general, and, in particular, as management scholars we should start to consider the influence on a firm's strategies as a driver for further development.

Specifically, this paper aims to develop a deep analysis on the role of women in the internationalization strategy by adopting the liberal feminist theory (Black, 1989). Our logic considers pillars.

First, the strategic role of internationalisation for the firm's development. Firm internationalisation has received attention as it is beneficial for businesses at different levels (Dagnino *et al.*, 2019). It enhances organizational capabilities and generates new resources that are crucial to firm performance, survival and growth (Chen *et al.*, 2016; Freixanet and Rialp, 2020). Despite the increasing interest and the large literature focusing separately on women in the upper echelons and on firm internationalization (Williams, 2013), gender differences in international business research have so far received little attention (Idris and Saridakis, 2020). The few existing studies on the topic focus on aspects such as the driving forces, the challenges faced, and the strategies adopted by women-led firms (Dean and Ford, 2017; Stead, 2017; Tlaiss, 2015). Furthermore, this still tightened but increasing literature has produced mixed findings suggesting either a negative or an insignificant relationship (Pergelova *et al.*, 2018; Karam and Zaki, 2020). Marginally gender is considered by relying on the feminist theory, and to the best of our knowledge, only four studies apply them (i.e., Moreira *et al.*, 2018; Orser *et al.*, 2010; Pergelova *et al.*, 2018; Ramón-Llorens *et al.*, 2017). Then, the need for further research evidence is more than essential (Alsos *et al.*, 2013; Bullough *et al.*, 2017; Moreira *et al.*, 2019).

Second, we aim to develop a framework that build a bridge on the two literature: the international business and the feminist theory. In line with liberal feminism's view, we assume that men and women are essentially the same in term of ability to internationalize (Ahl, 2006), but women may face discrimination and/or gendered barriers within the firm (i.e., internal context) and in the external context, which both can act as non-egalitarian and limit them to internationalize. Consequently, while many studies focus on the barriers women face in reaching the board of directors (Grosvold, 2011), we build our rationale on liberal feminism and searching for discrimination and/or barriers within the firm (i.e., internal context) and in the external context as both can act as non-egalitarian and thus negatively affect the effectiveness of women directors. Every culture aspires to egalitarianism (Siegel *et al.*, 2011), defined as "the belief that all people are of equal worth and should be treated equally in society" (Schwartz, 2001, p. 65), but evidence reveals that this is not the case (Gundlach and Sammartino, 2019). We believe that all the identified moderating factors in the relationship between women in the upper echelons and firm internationalization (e.g., sector, dimension, and country) should instead be considered in light of the liberal feminist theory and therefore regarded as gendered barriers.

To reach our goal, we conduct a theoretical review on the relationship between women in the upper echelons and firm internationalization adopting the lens of the feminist theory and by providing a set of two hypotheses that will be empirically tested on a sample of 2,861 Italian firms. Our findings confirm our rationale and demonstrate that when the external and/or internal contexts are non-egalitarian, women-led firms are less likely to internationalize. Our contribution goes to the

advancement of the understanding of strategic decisions related to internationalization, providing an immediate applicability to managerial issues, and to policy recommendations.

2. Theoretical framework

2.1 *The missed link between women in upper echelons and firm internationalization*

How women in the upper echelons influence firm internationalization has been under-researched and the few studies are mainly purely phenomenon-driven without a theoretical approach. Furthermore, existing studies have not produced consistent results (Orser *et al.*, 2010; Amoros *et al.*, 2016; Welch *et al.*, 2008) despite generally finding a negative or no impact (e.g., Berenguer *et al.*, 2016; Watkins-Fassler and Rodríguez-Ariza, 2019).

According to many studies, women entrepreneurs are associated with a lower internationalization propensity (e.g., Alves *et al.*, 2017; Giotopoulos *et al.*, 2017; Marques, 2019; Nissan *et al.*, 2012) and intensity (e.g., Berenguer *et al.*, 2016; Giraldez and Berenguer Cárceles, 2016; Westhead *et al.*, 2001). On the contrary, other studies find no impact (e.g., Mohan, 2019; Ramón-Llorens *et al.*, 2017; Zimmerman and Brouthers, 2012). Indeed, the gender of the entrepreneur is not the main determinant of internationalization (Grondin and Schaefer, 1995; Williams, 2013) but it affects internationalization only indirectly via other factors (Karam and Zaki, 2020; Marques, 2015).

Other figures (i.e., women managers and directors) have received further less attention in the literature and again the results are mixed. Turning to women directors, their presence negatively affects the propensity to internationalize (Bordean and Borza, 2013; Lukason and Vissak, 2020). However, this negative relationship disappears when women directors take advantage of network advice (Idris and Saridakis, 2020). The presence of a women CEO also reduces the propensity to internationalize (W. S. Lee *et al.*, 2016). Focusing on internationalization intensity, while according to some studies it is negatively affected by the presence of women on board of directors (Bordean and Borza, 2013), other studies find opposite results. For example, according to Rivas (2012), firms with a higher presence of women directors are more likely to internationalise than firms with fewer women on boards; Berenguer *et al.* (2016) find that women directors do not impact international intensity; according to Lukason and Vissak (2020) the level of internationalization between women- and men-led firms is not significantly different.

Compared to export, the heavier forms of internationalization such as foreign direct investment have received even less attention. While Niñerola *et al.* (2016) found that gender diversity of top management teams increases the likelihood of success of the investment, Rashid (2020) demonstrates that women directors do not significantly impact foreign equity ownership.

Concluding, it seems that a purely phenomenon-driven approach has degenerated into mere empiricism.

2.2 *Towards a feminist approach in international business*

Up to now, no theory has adequately captured the gendering of firm performance and hence, gender differences in internationalization. Uppsala model of incremental internationalization and Dunning's OLI paradigm and "eclectic theory" (Dunning, 2015), later the resource-based theories of the firm (Buckley and Casson, 1976), recently "dynamic capabilities" (Barney, 1991) and related rationales that describe firm internationalization (Jones and Coviello, 2005) are mute with respect to the influence of women in upper echelon positions. To cover this gap, we propose to adopt the liberal feminist theory.

First of all, feminism refers mainly to "a system of values that challenges male dominance and advocates social, political, and economic equity of women and men in society" (Riger, 2002, p. 731); thus, what causes feminism are the identification of women's subordination in society and the

need and the aspiration to put an end to this situation (Calás *et al.*, 2009; Wu *et al.*, 2019). In particular liberal feminist theory states that men and women are essentially equal as they are endowed with the same rational capacities (Black, 1989). However, according to society, men and women are not equal and societal incidences of women's subordination result from discrimination and/or structural barriers (Byrne, 2010). Indeed, the differences between the actions of men and women found in the literature are not innate characteristics, but rather the result of fewer opportunities and gendered barriers (Ahl, 2006). In accordance with liberal feminism, we posit that women realize their full potential less frequently because they are deprived of essential opportunities like education, excluded from key financial networks or employed in lower paying jobs (Verheul and Thurik, 2001). In fact, a growing literature in experimental research demonstrates the influence of environmental factors on women competitiveness and that women are more sensitive to context (Amore *et al.*, 2014).

Furthermore, societies reveal common stereotyping practices that may generate significant gendered barriers (Eagly and Karau, 2002). A stereotype is "a belief about a group of individuals" (Kanahara, 2006) and in our specific case, stereotype is a widely shared belief about men and women innate characteristics that reveal gender discrimination, regarding what it means to be a woman or a male upper echelon in society. Evidence associated with women and men stereotypes is abundant: people believe that each gender has typical and divergent traits and behaviors (Diekmann and Eagly, 2000; Powell, 2018). These beliefs about gender pertain to communal and agentic attributes (Eagly, 1987). Communal characteristics describe primarily a concern with the welfare of other people—for example, affectionate, helpful, kind, sympathetic—and are typically women attributes (Eagly and Karau, 2002). Agentic characteristics describe primarily an assertive, controlling, and confident tendency—for example, aggressive, ambitious, dominant, independent, self-confident—and are typically men attributes (Wajcman, 2013). Both of those beliefs are the source of prejudice that we consider relevant to improve our understanding of the relationship between women in the upper echelons and firm internationalization.

2.3 Hypotheses development

For a long time, international business studies have looked at the external environment of the firm and its internal structure as they impact its international development (Buckley and Casson, 2021). In the same vein, research regarding the upper echelon has considered both the internal structure of the firm and its external environment, as considering them separately is misleading. By integrating the feminist theory, we believe that the institutional context both of the firm (i.e., internal context) and of the country of origin (i.e., external context) may influence internationalization by mediating the role of the women (Karam and Zaki, 2020). There are numerous studies in the literature that focus on the discrimination affecting women in management (Powell, 2018). Similarly, in the case of firm internationalization we believe that women in the upper echelons face barriers both from the internal and external context that impede them to realize their full potential. In this paper, we focus on non-egalitarian contexts, i.e., male oriented and patriarchal contexts in which differences between genders are taken for granted, pervasive and significant. In these contexts, gender differences are more accentuated; on the contrary, in egalitarian contexts these differences are less marked (Wood and Eagly, 2002). We evaluate how women in the upper echelons pursue an internationalization strategy when they operate in an environment characterized by gendered beliefs and gendered relations (Jennings and Brush, 2013). Specifically, we consider both the influence of the external and the internal contexts on their internationalization strategy.

2.3.1 External context

The economic behaviour of firms is affected by the external context (Gimenez and Calabrò, 2018), which refers to the country of origin and aims to frame the peculiarities of a specific area in terms of the cultural barriers embedded in its history (Naldi *et al.*, 2021). The traditional and non egalitarian perception about women's role in patriarchal society generates a less favorable social climate with regard to women in the upper echelon, discriminatory treatment by the state administration and/or reduced access to resources (Winn, 2005). In line with this view, structural barriers in the economy prevent women from access to markets or resources necessary for entrepreneurship because they are not listened to (Brush *et al.*, 2004). Evidence in this regard is abundant. Bannò *et al.* (2019) analyse how lenders' stereotyped view on women in the boardroom affects firms' availability of external financing as outcomes of the social construction in a specific institutional context. Access to financing is particularly important in the case of firm internationalization as capital is a fundamental source in pursuing this strategy (Winn, 2005). It has been proved that exporting ventures owned by women face greater difficulties than men-led ventures in accessing capital (I. H. Lee *et al.*, 2016). Overcoming these obstacles is extremely important since access to funding is particularly beneficial for export expansion in women-led firms (Karam and Zaki, 2020). Gendered barriers also affect other aspects including firm competitiveness and performance. For example, a preferential treatment favouring men-led firms regarding the timing and delivering of orders may negatively impact the competitiveness of women-led firms (Weiler and Bernasek, 2001). In addition, being known is extremely important for attracting resources in an efficient and economic way, successfully operating in a competitive environment (Buttner and Moore, 1997), and participating in business associations, which is critical for accessing information and training and starting new collaborations (Gimenez and Calabrò, 2018). Regarding firm performance, Amore *et al.* (2014) show that the positive effect of women in the upper echelons on firm performance is reduced when the firm is located in geographic areas characterized by gender prejudices.

Based on the above, the following hypothesis that relies on the feminist theory is advanced:

Hypothesis 1: External context moderates the impact of gender on internationalization, so that for non-egalitarian external contexts, women-led firms are less likely to internationalize than men-led firms.

2.3.2 Internal context

Internal context refers to the features of the organizational form and its governance. To reach strategic goals, firms need to adapt the internal structure (e.g. labour division, hierarchy, skills acquisition) (Chandler, 1977). For example, the transition from small to big stage emanates from factors such as the increase in the level of professionalization and formalization. In an open, innovative, heterogeneous and dynamic environment, those organizational futures state for an egalitarian context. In these contexts, where the aforementioned barriers do not exist, the strategic choices of women in the upper echelons can be realized. Instead, in non-egalitarian contexts women risk not being listened to as they belong to the minority group. They thus risk to be a symbol without visibility and power, to not receive recognition for their contribution (neither for a formal position in the company) and, in short, to not receive the same consideration as their male counterparts.

Gendered barriers generated from the internal context are the result of several causes: gender discrimination and stereotypes, undervaluation of women's work, gender-based labour market segmentation, culture that leads to treating men and women unequally, and finally the issue of work-life balance (Eden and Wagstaff, 2021; Eden and Gupta, 2017). The non-egalitarian internal context also stems from the complexity generated by multiple causes, the lack of a dominant solution and complex linkages with other social issues. The non-equal internal context may

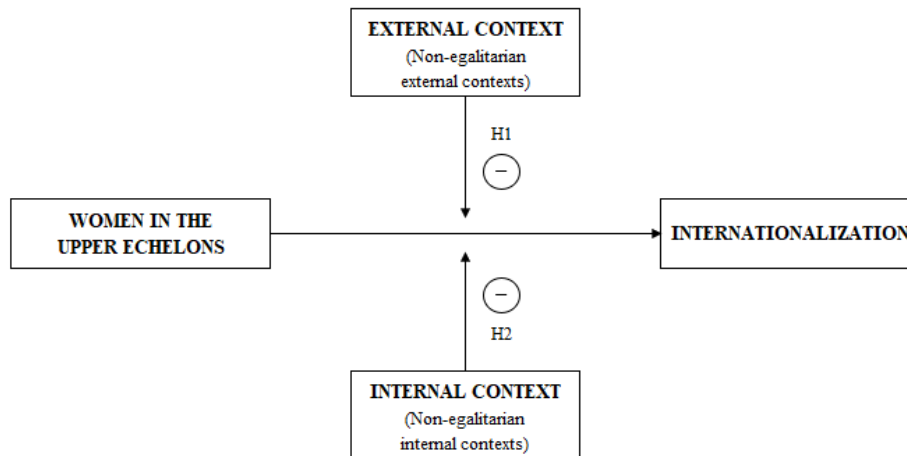
manifest divergent views on the problem, no agreed definition, and large differences in values, underlying beliefs and interpretations of outcomes (Schmitt *et al.*, 2017).

Based on the above, the following hypothesis that relies on the feminist theory is advanced:

Hypothesis 2: Internal context moderates the impact of gender on internationalization, so that for non-egalitarian internal contexts, women-led firms are less likely to internationalize than men-led firms.

The theoretical arguments along with the expectations are captured in the framework shown in Figure 1.

Fig. 1: Impact of women in the upper echelons on internationalization: a conceptual framework



3. Empirical analysis

3.1 Data and sample

The Italian context is suitable for this analysis as Italian outward foreign direct investments (FDIs) are about 24% of GDP in 2019 and Italy ranks 13th worldwide for amount of FDI in 2019 (OECD, 2020). Italy has therefore a significant presence in foreign countries (Botero *et al.*, 2015; De Massis *et al.*, 2018).

Data for the analysis, referring to the year 2017, are derived from three databases: Reprint, Aida (Bureau Van Dijk), and Espacenet. The Reprint provides a census of Italian firms that have made outward FDIs since 1986. It was employed to define the variables on internationalization. The Aida database, which contains information on Italian companies, was used to collect both financial data and details on the composition of the board of directors - specifically, the presence of women directors. Finally, the Espacenet database provides information from approximately 90 million patent documents worldwide, including information about inventions and technical developments from 1836 to the present. Espacenet provided us with the number of patents owned by each firm. The sample for this study consists of 2,861 Italian firms, of which 1,600 are multinational enterprises and 1,261 are domestic firms. Firms were selected randomly; therefore each firm had the same probability of being selected. As an additional check, the representativeness of the sample was evaluated: χ^2 tests on the distribution of firms based on their mode of entry in the foreign market, effort (i.e., number of FDIs), and geographical dispersion revealed a nonsignificant difference between the selected sample and the entire population.

3.2 Variables and Econometric Models

Dependent variable. The dependent variable *Internationalization* is measured as the number of total FDIs made by the parent company in foreign markets (Dunning and Lundan, 2008; Alessandri

et al., 2018). We acknowledge that FDIs are just one of the possible ways to go abroad; however, FDIs are a better proxy for international business than alternative options such as export (Arregle *et al.*, 2017). To identify the FDIs to be considered, an evaluation based on economic materiality rather than legal-administrative criteria was done, thus excluding FDIs carried out by financial institutions. However, intermediate, difficult to classify forms exist, such as private equity and merchant bank funds, which operate on the basis of targeted business strategies, acquiring controlling interest in firms belonging to selected industries and directly intervening in their management. These investments were included in our analysis. Instead, we excluded interest acquired from investment funds, private equity funds and merchant banks as part of management buy-outs, and when there was no direct participation in the management of the investee firm (for additional details, see Mariotti and Mutinelli, 2017). Finally, as many firms do not internationalize, this dependent variable takes the value zero for domestic firms and positive values for the multinational ones.

Independent Variables. Consistent with our logic, we operationalize women in the upper echelons through the key dimension of the number of women directors (Bear *et al.*, 2010; Ben-Amar *et al.*, 2017).

Further, considering that in contexts in which women operate there may be gendered barriers related to cultural and personal factors (e.g., lack of respect by men and refusal to do business with women), we consider the role that the context exerts on women-led firm internationalization (Gundlach and Sammartino, 2019). Specifically, the external context refers to the country of origin and aims to frame the peculiarities of a specific area in terms of cultural barriers embedded in its history, traditions, value and informal norms (Dacin *et al.*, 2002). In our paper we exploit a unique feature of the Italian context, namely, the great differences across Italian regions regarding gender roles. Recent studies show the non-egalitarian context of Southern Italy where a traditional, patriarchal, and male oriented view is the predominant one: the woman is traditionally seen as the homemaker while the man as the breadwinner. On the contrary, in Northern Italy this belief is not dominant (Amore *et al.*, 2014; Wright *et al.*, 2007). Furthermore, the European Quality of Government Index (Charron *et al.*, 2019) identifies Southern Italy as the worst in Europe in terms of institutional quality. Thus, the variable *External context* takes value one if the firm is located in Southern Italy, and zero otherwise. Instead, the internal context refers to the firm size of the firm considering that big firms present a higher level of formalization (such as procedure, tasks and role), which is evaluated as a measure of egalitarian context. The dummy variable *Internal context* (equal to one if the firm is a small or medium one) refers to the increase of the level of internal process formalization that relates to the increase of firm size (from small to big). Both of those aspects create the conditions for an egalitarian attitude reached by a small and medium firm (low) and a big firm (high) (Orser *et al.*, 2010). Moreover, in large companies gender stereotypes might be less frequent and policies that favor the careers may be adopted (Amore *et al.*, 2014).

Control Variables. In line with previous studies, we control for several firm-specific characteristics. Managerial and well-established firms are more experienced and prone to collecting information, essential for starting an effective expansion process. Firm size and firm age were included as control variables as they proxy for organizational complexity and experience and tend to be positively correlated with firm internationalization (Camisón and Villar-López, 2010; Dunning and Lundan, 2008). *Firm size* is measured as the total of domestic sales (Dillen *et al.*, 2014) while *Firm age* as the number of years since firm foundation (Hözl, 2014). *Board dimension* captures the number of members. *Innovation* is treated with a dummy variable equal to one if the firm holds at least a patent. Innovation (firm's R&D output) proxies for accumulated knowledge (Kafourous *et al.*, 2008; Kotabe *et al.*, 2002), which is a well-known stimulus for internationalization (Guadalupe *et al.*, 2012). We control for *Return on equity*, *Return on assets*, *Return on investments* and *Productivity* (measured as the value added per employee), as firms with high profitability and productivity tend to internationalize more (Lu and Beamish, 2001). *Leverage*, equal to the ratio

between debt and equity, and *Financial independence index*, measured as the ratio of equity and capital investment, were included as control variables given that both the availability and the cost of financial resources can hinder firm international growth (Wiklund *et al.*, 2009). *Risk*, computed as the standard deviation of return on assets in the last five years (Miller and Chen, 2004), was also included. Following Alessandri *et al.* (2018) and Daniel *et al.* (2004), three measures of slack resources were considered: *Available slack resources*, equal to cash flow on assets (Jain and Nag, 1998); *Recoverable slack resources*, given by capital investments on sales (Henderson and Fredrickson, 1996); and *Potential slack resources*, equal to long term debt on assets (Harrison *et al.*, 1993). Slack resources can in fact affect upper echelons' intentions by offering them room to explore new alternatives abroad and by encouraging complacency. Finally, since the type of industry affects both growth dynamics and the choice to pursue internationalization (Villalonga and Amit, 2010), five industry dummies were included based on the Pavitt Taxonomy (Bogliacino and Pianta, 2016): *Pavitt science based*, *Pavitt specialised suppliers*, *Pavitt scale and information intensive*, *Pavitt suppliers dominated industries*, and *Pavitt other*.

Table 1 reports the sources and definitions of the variables used in the empirical analysis.

Tab.1: Definitions and sources of the variables used in the empirical analysis

Variable	Definition	Source
Dependent variables		
Internationalization	Number of total FDIs made by the parent company	REPRINT
Independent variables		
Women directors	Number of women directors	AIDA
External context	Dummy variable equal to 1 if the firm is located in the South of Italy and 0 otherwise	AIDA
Internal context	Dummy variable equal to 1 if the firm is a small or medium firm and 0 otherwise	AIDA
Control variables		
Firm size	Domestic sales	AIDA
Firm age	Number of years since firm foundation	AIDA
Innovation	Dummy variable equal to one if the firm holds at least a patent and 0 otherwise	ESPACENET
Board dimension	Number of directors (male and women)	AIDA
Return on equity	Net income on equity	AIDA
Return on assets	Net income on assets	AIDA
Return on investment	Net income on investment	AIDA
Productivity	Value added per employee	AIDA
Leverage	Debts on equity	AIDA
Financial independence index	Ratio of equity and capital investments	AIDA
Risk	Standard deviation of return on assets on the last five years	AIDA
Available slack resources	Cash flow on assets	AIDA
Recoverable slack resources	Capital investments on sales	AIDA
Potential slack resources	Long terms debts on assents	AIDA
Pavitt science based	Dummy variable equal to 1 if the firm operates in a Pavitt science based industry and 0 otherwise	AIDA
Pavitt specialised suppliers	Dummy variable equal to 1 if the firm operates in a Pavitt specialised suppliers industry and 0 otherwise	AIDA
Pavitt scale and information intensive	Dummy variable equal to 1 if the firm operates in a Pavitt scale and information intensive industry and 0 otherwise	AIDA
Pavitt suppliers dominated	Dummy variable equal to 1 if the firm operates in a Pavitt suppliers dominated industry and 0 otherwise	AIDA
Pavitt other	Dummy variable equal to 1 if the firm operates in an industry not listed above and 0 otherwise	AIDA

Econometric Models. To test our hypotheses, we develop three econometric models, which assess the separate impact of *Women directors* (Base Model) and the effect of a moderating term in which the variables proxying *Internal context* (Model 1) and *External context* (Model 2) moderate *Women directors*. Three different models can therefore be used:

Base Model:

$$\text{Internationalization} = f(\text{Women directors}; \text{External context}; \text{Internal context}; \text{Control variables})$$

Model 1:

$$\text{Internationalization} = f(\text{Women directors}; \text{Women directors} \times \text{External context}; \text{External context}; \text{Internal context}; \text{Control variables})$$

Model 2:

$$\text{Internationalization} = f(\text{Women Directors}; \text{Women directors} \times \text{Internal context}; \text{External context}; \text{Internal context}; \text{Control variables})$$

To test our hypotheses, we perform ordinary least squares (OLS) regression analysis (Greene, 2003).

4. Results of the empirical analysis

4.1 Descriptive statistics

Descriptive statistics for the whole sample are reported in Panel A of Table 2. Descriptive statistics for the two subsamples with and without women directors are reported in Panel B of Table 2.

The dataset used to conduct this research is composed of 2,861 Italian firms where only 43% register at least one woman among the members of the board. 1,454 out of 2,861 firms (around 54%) are multinational and, on average, each firm carried out more than 5 FDIs. Firms with women directors made more FDIs (about 7) than those without women directors (about 4).

In the full sample, the average number of directors (male and woman) is 4.05, of which 0.79 are women. Firms with women directors tend to have larger boards of directors (with 5.42 directors on average, of which 1.85 are women) than firms without women directors (with 3.02 directors on average).

In the full sample, 21% of the firms are located in Southern Italy, while 83% are SMEs. Similar percentages of firms without women directors are located in Southern Italy (26%) and are SMEs (87%). Instead, firms with women directors tend to be located in other parts of the country (only 14% of them operate in Southern Italy) and to be larger (78% of them are SMEs).

Regarding size, not surprisingly firms without women directors are smaller than firms in the full sample and firms with women directors. Firm age in the full sample and in the two subsamples is similar and between 33 and 39 years.

In the full sample, firms own on average only 0.5 patents. On average, firms without women directors own less patents (0.47) than firms with women directors (0.54).

The average values in terms of returns (i.e., ROE, ROA and ROI) are almost similar in the sample of firms with women directors and in the one without them. Instead, firms with women directors tend to have a higher productivity and financial independence and are less risky. Regarding slack resources, their amount is similar in the samples of firms with and without women directors; however, firms without women directors tend to have higher recoverable slack resources.

The distribution of firms in the full sample and in the two subsamples in the different industries is similar. In all samples, the majority of firms operate in a Pavitt suppliers dominated industry (41%) or in a Pavitt specialised suppliers industry (31-32%). Another 11-12% of firms are active in a Pavitt scale and information intensive industry. The remaining firms operate in a Pavitt science based industry or in a Pavitt other industry.

The correlation matrix, available upon request, shows the acceptable correlation indexes (Greene, 2003).

Tab. 2: Descriptive statistics

Variable	Panel A				Panel B			
	Full sample (2,861 firms)				Firms with women directors (1,226 firms, 43%)		Firms without women directors (1,635 firms, 57%)	
	Mean/%	Std. Dev.	Min	Max	Mean/%	Std. Dev.	Mean/%	Std. Dev.
Internationalization	5.29	17.61	0.00	462.00	7.01	19.25	4.00	16.17
Women directors	0.79	1.26	0.00	11.00	1.85	1.33	0.00	0.00
External context	21%	0.40	0.00	1.00	14%	0.35	26%	0.44
Internal context	83%	0.38	0.00	1.00	78%	0.41	87%	0.34
Firm size	106,541,210.35	872,937,695.33	1,026.00	28,983,564,000.00	160,696,338.88	1,244,197,676.47	65,933,144.56	411,546,905.29
Firm age	35.60	23.28	3.00	190.00	39.00	23.81	33.05	22.55
Innovation	0.50	0.50	0.00	1.00	0.54	0.50	0.47	0.50
Board dimension	4.05	3.46	1.00	34.00	5.42	3.97	3.02	2.59
Return on equity	8%	19.14	-143.89	108.55	8%	17.74	8%	20.13
Return on assets	4%	9.19	-60.55	78.80	4%	8.42	4%	9.72
Return on investment	6%	8.05	-29.59	29.96	6%	8.17	%	7.96
Productivity	77,912.56	54,130.80	-49,300.00	496,090.00	82,153.23	57,334.77	74,732.70	51,386.64
Leverage	5.11	19.85	-11.00	300.00	4.46	18.15	5.60	21.03
Financial independence index	37.57	24.24	-44.63	100.00	39.70	23.80	35.98	24.46
Risk	3.98	6.01	0.01	50.00	3.50	5.25	4.35	6.49
Available slack resources	0.05	0.10	-1.00	1.00	0.06	0.09	0.05	0.11
Recoverable slack resources	8.13	41.95	0.00	500.00	6.93	35.69	9.02	46.07
Potential slack resources	0.13	0.16	0.00	1.29	0.13	0.16	0.13	0.17
Pavitt science based	7%	0.26	0.00	1.00	8%	0.27	7%	0.26
Pavitt specialised suppliers	32%	0.46	0.00	1.00	32%	0.47	31%	0.46
Pavitt scale and information intensive	11%	0.32	0.00	1.00	12%	0.32	11%	0.31
Pavitt suppliers dominated	41%	0.49	0.00	1.00	41%	0.49	41%	0.49
Pavitt other	8%	0.28	0.00	1.00	7%	0.25	9%	0.29

4.2 Empirical findings

Table 3 shows the regression results for the three models developed, while Figure 1 reports interaction graphs.

Women directors has a positive coefficient ($b = 0.6435$, $p < .05$ in Base Model; $b = 0.8383$, $p < .01$ in Model 1; $b = 2.0829$; $p < .01$ in Model 2), while *Internal context* has a negative coefficient significant in all models ($b = -9.4741$, $p < .01$ in Base Model; $b = -9.4525$, $p < .01$ in Model 1; $b = -6.9620$, $p < .01$ in Model 2). *External context* is not significant in any model.

Both the internal and external context reduce the positive effect of women directors; specifically, such reduction occurs when the firm operates in geographical areas where the role of women in society is confined to the family responsibilities instead of job career and when the firm is small.

Table 4 Model 1 reports the interaction effects of *Women directors* and *External context*. The regression results reveal a negative and significant coefficient ($b = -2.0562$; $p < .01$), providing strong support for Hypothesis 1 as the effect of women in the upper echelons may be lower in cultures characterized by discrimination against women. Thus, our results confirm that women in the upper echelons experience a discrimination from a non-egalitarian external context, which impedes them to internationalize. Figure 1 Left Panel depicts the effect.

Hypothesis 2 is also confirmed as the interaction effect of *Women directors* and *Internal context* reveals a negative and significant coefficient ($b = -2.4069$; $p < .01$) (Table 4 Model 2). Thus, our results confirm that women in the upper echelons experience a discrimination from the internal context and an internal barrier to internationalization. Figure 1 Right Panel depicts the effect.

The inclusion of control variables also yields interesting results. *Board dimension*, *Firm size* and *Firm age* are positive and significant in all models. *Innovation* is also positive and significantly different from zero in all models; innovation allows the firm to develop new products or services to

sell internationally. The variables measuring firm profitability and productivity matter in terms of internationalization except for *Return on Assets*. *Financial independence index* and *Leverage* are not significant in any model. The same is true for variables measuring risk, available and potential slack resources. Instead, *Recoverable slack resources* are positive and significant in all models. This result confirms that financial resources availability is a basic requirement for developing a business outside of the national borders. Finally, some of the coefficients associated with the industry dummies are significantly different from zero in some models.

4.3 Robustness check

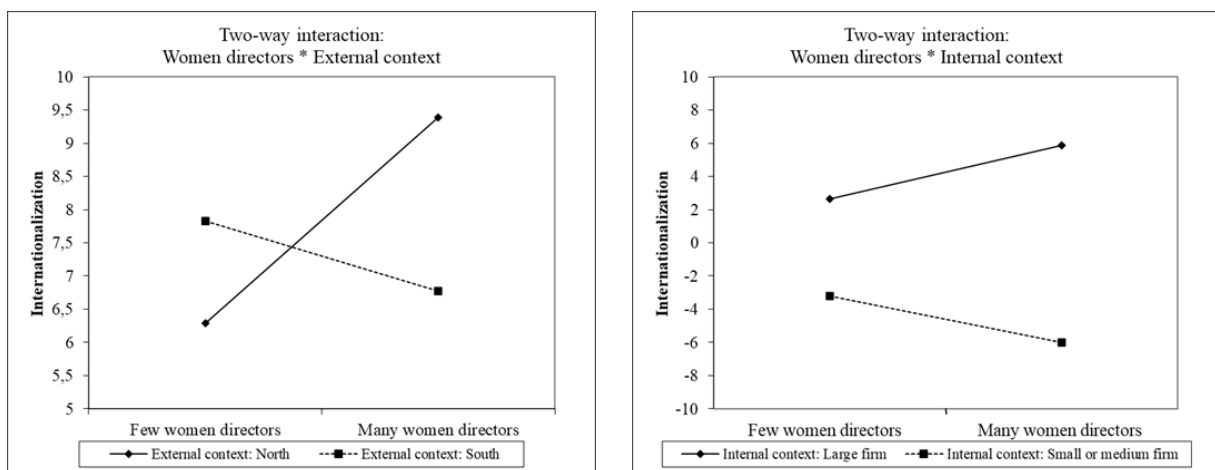
We made many robustness checks and we ran other additional models. First, we consider alternative measures of the presence of women in the upper echelons (e.g., proportion of women), finding results consistent with previous ones. Second, other proxies for internal context have been considered in the analysis and have yielded the same results. Specifically, we took into account innovation, which proxies for an open-mind and inclusive internal context, and firm age, which gives an outline of the formalization of the internal context. Their coefficients indicate the role of the institutional context in mediating the impact of women in the upper echelons on internationalization. Third, we estimated the impact of women in the upper echelons on internationalization separately for small and large firms and for the South and other regions and the coefficients report coherent results to our main regressions.

Due to the presence of both domestic and international firms, to check for possible selection bias we made a Heckman selection model, again finding in the second step the same results of the proposed Models.

In conclusion, all the alternative models produced the same results proposed in the paper.

Finally, we believe that endogeneity might not represent a major issue in our study, because our hypotheses involve interaction effects. Recent advances in econometrics by Bun and Harrison (2019) report that endogeneity is minimized when the results of interest involve interactions. Our regressions are thus safeguarded against endogeneity.

Fig. 2: Interaction effects



Tab. 3: Empirical results

<i>Dependent variable: Internationalization</i>	Base Model	Model 1 External contest	Model 2 Internal contest
Women directors	0.6435 ** (0.2698)	0.8383 *** (0.2791)	2.0829 *** (0.3811)
Women directors * External context		-2.0562 *** (0.7643)	
Women directors * Internal context			-2.4069 *** (0.4522)
External context	-0.0017 (0.7704)	0.9492 (0.8468)	-0.3918 (0.7702)
Internal context	-9.4741 *** (0.8297)	-9.4525 *** (0.8288)	-6.9620 *** (0.9511)
Firm size	0.0000 *** (0.0000)	0.0000 *** (0.0000)	0.0000 *** (0.0000)
Firm age	0.0821 *** (0.0132)	0.0822 *** (0.0132)	0.0815 *** (0.0132)
Innovation	1.9065 *** (0.6086)	1.8885 *** (0.6080)	1.9320 *** (0.6057)
Board dimension	0.3942 *** (0.1102)	0.3895 *** (0.1101)	0.3312 *** (0.1103)
Return on equity	0.0316 * (0.0181)	0.0303 * (0.0181)	0.0290 (0.0180)
Return on assets	0.0257 (0.0503)	0.0277 (0.0502)	0.0235 (0.0500)
Return on investment	-0.1816 *** (0.0405)	-0.1831 *** (0.0405)	-0.1830 *** (0.0403)
Productivity	0.0000 *** (0.0000)	0.0000 *** (0.0000)	0.0000 *** (0.0000)
Leverage	-0.0063 (0.0143)	-0.0053 (0.0143)	-0.0036 (0.0142)
Financial independence index	0.0023 (0.0132)	0.0021 (0.0131)	0.0045 (0.0131)
Risk	-0.0293 (0.0467)	-0.0266 (0.0467)	-0.0382 (0.0465)
Available slack resources	-6.7996 (4.3674)	-6.9165 (4.3629)	-6.6343 (4.3467)
Recoverable slack resources	0.0223 *** (0.0067)	0.0224 *** (0.0067)	0.0213 *** (0.0066)
Potential slack resources	1.6453 (1.8015)	1.4665 (1.8008)	1.2309 (1.7946)
Pavitt science based	-1.6529 (1.4013)	-1.5332 (1.4004)	-1.5456 (1.3947)
Pavitt specialised suppliers	-1.8940 * (1.0999)	-1.8333 * (1.0989)	-1.7733 (1.0948)
Pavitt scale and information intensive	-1.7151 (1.2635)	-1.7056 (1.2621)	-1.4310 (1.2586)
Pavitt suppliers dominated	-1.3961 (1.0448)	-1.3620 (1.0437)	-1.2056 (1.0404)
Intercept	7.2680 *** (1.6208)	7.0482 *** (1.6211)	5.5466 *** (1.6452)
Observations	2861	2861	2861
R ² / R ² adjusted	0.330 / 0.325	0.332 / 0.327	0.337 / 0.331

* $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$

5. Concluding remarks

Considering the strategic role that women can play in the international economic landscape, the aim of our paper was to develop a framework that build a bridge on the two literature: the international business and the feminist theory. Our literature review demonstrates how the literature on women in the upper echelons and on international business are well-developed apart, and how the disproportionate lack of coverage of when and how women internationalize should be considered as an anomaly. This should be considered as the first contribution of our work, at the theoretical level. There is a need to create theoretical bridge between the management literature and the feminist theory in order to develop our understanding and start to leave the stereotypical idea of women in management (D'Allura *et al.*, 2022).

In fact, our review underlines that some issues developed in feminist theories may influence the barriers that women in the upper echelons doing international business may face. First, building our rationale from the insights of the liberal feminist theory, we argue that men and women have the same capacity but they face different barriers as results of social construction. Second, by introducing the role of the internal and external contexts, we empirically demonstrate that internationalization is not necessarily related to whether upper echelon are male or women, but there is instead a complex structure relating gender with its context of social configuration, class structure, and politics. As such, our results augment recent discussions of the contexts under which women in the upper echelons can be more effective in internationalization strategy (Amore *et al.*, 2014) and take a different voice in this topic. There is not a gendered competence. Prior contributions risks to increase discrimination. The risk arises every single time we consider different firm's strategies as a result of a female or male characteristics. Our effort in this paper lead to make an inspiration for further investigation, both a the theoretical and empirical level, to create a new basis of knowledge more inclusive of the feminist theory to appreciate the value of the diversity and not in increase of stereotypes.

We argue that, while the fact that women under-representation in top management or boards of directors may be due to their choice than the absence of opportunity (Winn, 2005), their capacity to internationalise is for sure not a choice but on the contrary the possibility to be heard. Specifically, if gender differences in internationalization are associated with internal context, remedial strategies might be best focused on development of the firm in order to make it more egalitarian. Otherwise, public incentive programs might need to be targeted toward addressing impediments that might include non-egalitarian attitudes or other gendered barriers. Based on our findings, we call for a change of mind arguing that the cultural, entrepreneurial and managerial potential that women bring to business activity adds value to firm competitiveness and outcomes only if it is adequately exploited and by assuring - at the organizational level - the conditions to express themselves.

Concluding, there is a need for a political agenda in generating new knowledge, awareness and culture in the field. Policy makers require methodological reflexivity, the ability to see multiple worldviews, and the need to pay attention to context, both internal and external to the firm (Eden and Wagstaff, 2021). Moreover, considering the Agenda 2030, it is important to stress that SDG 5 is not only about workplace gender equality, but most of all it is about the empowerment of women. We believe that academic research can play a strategic role to improve our understanding on what and how (men and) women's contribution is expressed in different internal and external contexts. In particular, we encourage other research to focus on the role of women in international business in order to revisit and rethink the key assumptions of the field.

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Assessing policy impact on organizational inventions: the case of the stockholm convention

GIANLUCA BIGGI*

Abstract

Framing of the research. *Industrialized economies have historically maintained the hope that the advances in science, technology and innovation would have offered to the humanity a wide range of options to improve its well-being and attain a sustained economic growth. The transition towards a high technological frontier arising from the rapid advances of science, technology and innovation have opened a debate on the relations between innovation-induced industrial activities, related possible social and environmental threats and the role of policies to keep up with industry developments.*

Purpose of the paper. *Once companies develop hazardous products which can be dangerous for the environment and human health, it takes very long for regulatory bodies to ban these products. The purpose of this paper is to investigate the impact of regulatory action on firms' inventive strategies.*

Methodology. *Using a difference-in-difference approach, the paper tests the impact of regulation on a sample of toxic chemical patents against a control sample of untreated pesticides.*

Results. *The regulation aimed at phasing out the use, trade and production of toxic chemicals increases the rate of inventive activities related to those chemicals and new compound patenting.*

Research limitations. *The paper focuses on a specific class of toxic inventions, while it does not cover the use, production, and trade of each invention. Also, the paper focus only on a narrow class of toxic inventions, while an extension to other toxic chemicals could be feasible and it could also improve the generalizability of the results.*

Managerial implications. *The paper shows the importance of investigating what "boils in R&D labs" as a predictor of future potential environmental threats. Aside, it offers opportunities to theorize about corporate deviance and strategic decoupling in the context of sustainable transition processes.*

Originality of the paper. *The paper contains new methods for tracking the toxicity of patents in the context of chemical inventions, as well as sight on the evaluation of regulatory initiatives aimed at sustainable development.*

Keywords: *Environmental regulation; Firms' innovation; Compound patenting; New Compound patenting.*

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1. Introduction

There is a lot to worry about climate change, but bioscientists have one specific concern: the revolatilization of persistent organic pollutants (POPs) following the melting of polar ice (Nizzetto *et al.* 2010; Ma *et al.* 2011; Rigét *et al.* 2019). POPs are defined as ‘chemical substances that persist in the environment, bio-accumulate through the food chain, and pose a risk of causing adverse effects to human health and the environment’ (Fitzgerald and Wikoff 2014). The reason why there is so much concern about their revolatilization in the atmosphere is that they are highly hazardous: they cause cancer, damages to the immune and nervous systems, and they are highly poisonous for human beings, animal species and the environment at large (Kodavanti, Royland, and Sambasiva Rao 2014). For this reason, following the recommendation of the Intergovernmental Forum on Chemical Safety (IFCS) and the International Programme on Chemical Safety (IPCS), a first group of a hazardous POPs, also known as the ‘Dirty Dozen’ (namely: Aldrin, Chlordane, DDT, Endrin, Heptachlor, Hexachlorobenzene, Mirex, Pentachlorobenzene, Toxaphene, and Polychlorinated Biphenyls (PCBs); Polychlorinated dibenzo-p-dioxins (PCDD/F)), were banned or their use was severely restricted starting from 2001 by an international treaty - the Stockholm Convention. The treaty was signed between 2001 and 2002 by 153 countries worldwide and it was progressively ratified in the following years (most ratifications occurred between 2001 and 2007). This global ban has mitigated concerns about these hazardous chemicals at least up until very recently when it became clear that they would re-volatilize in the atmosphere as a consequence of melting Antarctic ice.

Yet, while most research has addressed the legacy of POPs, very little is known about their future. Are these chemicals and their knowledge really disappearing? Are companies and other inventing organizations conducting research and development (R&D) programs around those compounds? More specifically, beside banning use and production, has the Stockholm Convention also impacted on the way firms’ patent POP-related inventions through time and across geographies? Despite the fact that a handful of countries has not yet ratified the treaty (including, e.g., the United States, Israel, Malaysia, and Italy), I consider The Stockholm Convention as a global treaty. This is because even in the case of lack of ratification, countries have often taken steps to regulate POPs production and use within their jurisdictions even prior to the Stockholm Convention. For instance, the US has implemented several measures that mirror the treaty’s regulations such as the agreement with Canada for the Virtual Elimination of Persistent Toxic Substances in the Great Lakes and the North American Agreement on Environmental Cooperation (NAAEC), which developed a regional initiative on the management of chemicals, including persistent organic pollutant. I consider the universe of POP-related patent applications from 1999 to 2010 amounting to 5,250 patent applications grouped in 624 DOCDB patent families. I then examine their disclosed groups of compounds to unpack temporal to unpack the role of environmental regulation on the rate of invention and compound production by chemical firms included in my sample.

2. Theory

2.1 Global environmental challenges and their regulation

The exposure of people and their ecosystems to environmental hazards is a classical ‘tragedy of the commons’ (Hardin 1968; Ansari, Wijen, and Gray 2013), and when these hazards have no borders but spread quickly across geographical space to become planetary problems, global regulation and governance is invoked as a necessary step to fix the problem. Global regulations and treaties may be successful or not. According to recent statistics, the 1987 Montreal Protocol has allowed for the dramatic decline in global ozone-depleting emissions, while the Kyoto Protocol (and subsequent related protocols) to reduce carbon dioxide (CO₂) emissions and the presence of

greenhouse gases (GHG) in the atmosphere have, to the date of writing, been unable to meet their targets. The reasons why countries and their organizations may fail to meet vital environmental goals are complex and manifold, but often governments are blamed for failing to seriously impose environmental regulations in their territories or jurisdictions, often despite having ratified or signed the relevant treaties (Bates 2008; Scherer and Palazzo 2011; Hart and Zingales 2017). Against this background, economists show that when national environmental regulations are strictly enforced, environmental pollution decreases (Shapiro and Walker 2018). Hence, when treaties are binding and regulations are strictly enforced by the national states, compliance on the side of companies is to be expected because the sanctions inherent in non-compliance are likely to be severe and discourage deviance from the norm. Bans may produce their effects in a short time (e.g., in the case of the Montreal Protocol, the production of new stocks of Chlorofluorocarbon (CFC) ceased in virtually all countries at around the same time) or take longer, but the expectation is that eventually they will lead to the discontinuation of the banned technology in its production and use.

2.2 Responses to banned technologies: hypotheses

In evolutionary perspectives, innovations have two dimensions: technical novelty and market selection, and firm innovative activities are aimed at developing novelty of economic value (Nelson 2009). The generation of technical novelty - driven by new knowledge and technology - leads to diversity and a better chance of market selection. In this search for technical novelty, firms can both explore new technological space and/or exploit prior knowledge (March 1991). The balance depends on the relative costs of exploration and exploitation and the ability to apply prior expertise towards future innovations. Exploration is costly and risky and, the balance with exploitation depends on their relative cost. The idea of induced innovation (Hicks 1963) recognizes that R&D is a profit-motivated activity and that the direction of innovation likely corresponds positively to the direction of increased relative cost. Environmental regulation can spur exploration reducing its relative cost. Scholars indicate that environmental regulation can spur firms' ability to innovate, by lowering the relative cost of exploration. That regulation can help direct towards more useful new product, processes or technologies (Fleming and Sorenson 2004). Thus, environmental regulation is theorized as allowing firms to enlarge their innovative outcomes. New knowledge occurs when new information is integrated and/or recombined with existing knowledge of the problem giving rise to breakthrough ideas and innovations (Schilling and Green 2011). In the chemical sector, environmental regulation can trigger the transformation process of existing chemical compounds and substances. In that context, my hypotheses suggest that, after a ban, companies and other inventing entities will take new 'explorative' innovation paths (March 1991) and therefore will make new knowledge around the regulated technologies. They will also potentially explore radically new technological trajectories (Dosi 1982), which I envisage will not build on the established technological knowledge. The general rationale for this is that the banned technological knowledge becomes a dangerous terrain for new investments, especially if the new technological developments draw - even if partially - on the banned technological knowledge that can be subject to future bans within the same or a different treaty. Hence, in a scenario of heightened uncertainty and risk following a global ban, I expect the following hypothesis to be supported:

Hypothesis 1 (a): Environmental regulation will increase overall inventive activity around regulated technologies

Hypothesis 1 (b): Environmental regulation will alter technological inventive strategies around regulated technologies

Both hypotheses assume that companies and other organizations conducting research around the regulated technologies are not malevolent entities and will therefore have agreed on the threats posed by their past discoveries and will seek to find ways to address them in the future, in order to

stop or minimize the noxious impacts on humans and the environment. The direction of their R&D efforts after the ban is also assumed to be the result of calculated strategic decisions in the face of a changing regulatory environment; such decisions are expected to be taken in order to both address social and environmental threats and to hedge against future losses in the case of more stringent regulatory measures.

3. Methods

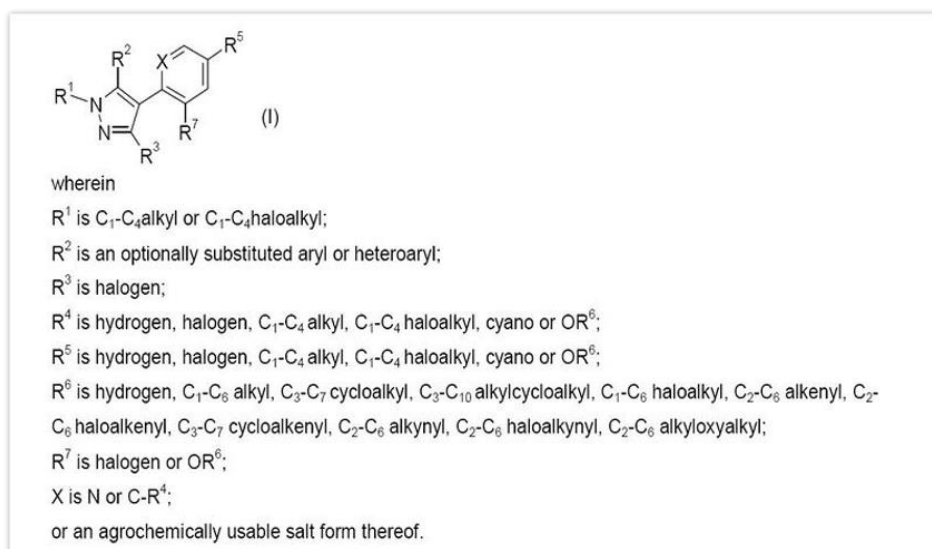
3.1 Data

In this study, I am interested in testing the impact of the Stockholm Convention on chemical patenting. To measure the effects of the environmental regulation I look for external indicators of early-stage R&D activity that could be both comprehensive across the industry and also accurate. In innovation and strategic management research, patent data are widely used and adopted measures of innovation and have been traditionally used to proxy R&D activities and knowledge creation of firms, research institutes and universities (Jaffe 1986; Jaffe, Trajtenberg, and Henderson 1993). Along these lines, I collect a novel dataset of chemical patents to test the technological search and innovation before and after the Stockholm Convention. The following section provides an introduction to chemical patenting by providing a more fine-grained description of the data collection process pursued in this study.

3.2 Chemical Patenting

To protect their chemical inventions, firms or other entities patents their newly invented compound or a new combination of compounds by way of Markush structure. Markush structures are characterized by a special place-holder structure called Markush structure to capture a set of compounds. Figure 2.1 below shows a Markush structure claiming a range of compounds.

Fig. 1: Example of Markush structure



Source: ChemAxon (2020)

In Figure 1, R1-R7 are placeholders that can accept different chemical compounds for each position. In this case, R1 has 2 options while R3 have only 1 option. Instead of listing all the possible combinations, the Markush structure captures this combinatorial set of compounds. A Markush structure is used in patent applications to define the scope of the chemical protection

sought in a patent document. Markush patents can try to capture a broad spectrum of compounds sometimes resulting into thousands of combinations. Markush patents are filed very early in the discovery stage where a firm makes general claims for a number of compounds without revealing the identity of the exact compound or compounds it is pursuing. In chemical industry, Markush patents are considered the starting point where firms begin to claim intellectual property rights by planting ‘flags’ in chemical space (Southall and Ajay, 2006). The compounds of interest are hidden among hundreds of other similar looking compounds with the same basic structures. An interesting feature of Markush patents is that they encapsulate the actual compounds made, and those that the firm or inventor plans to protect for future use - sometimes, running into the hundreds of newly invented compounds. Thus, these compounds within Markush patents represent the explorative effort undertaken by the firm or inventor in chemical field. These unique properties of Markush structures in patents make them extremely useful for analysing the evolution of technological search and innovation by firms. In this study, I exploit these unique features of Markush structures in patents to measure R&D activity and track search trajectories over time.

3.3 Data collection

I rely on two main databases: the chemical database of the European Molecular Biology Laboratory SureChEMBL and the EPO-PATSTAT. SureChEMBL is a publicly available large-scale database (Papadatos *et al.* 2016) which has the unique feature of providing comprehensive compound-patent association maps and related Markush structures in patent claims. The SureChEMBL database provides also information on chemical compound international identifiers (i.e., SureChEMBL identifier, SMILES or standard InChIKey) that allow to precisely search all the patents related to a specific compound. To retrieve all the patents associated to each POP, I use one or multiple CAS Registry Number identifiers related to POPs. Most importantly, the SureChEMBL database allows us to identify all patents that cite a POP in its claims, which are the extent (i.e., the scope) of the protection sought in a patent application (Kuhn and Thompson 2019; Bekkers, Martinelli, and Tamagni 2020; Jayaraj and Gittelman 2018; Marco, Sarnoff, and de Grazia 2019) described by way of Markush structures.

For the study, I am interested in capturing effects of the Stockholm Convention on chemical patenting and needed a sample set that included pre-and post-patents of POPs (between 2001-2004). Though the Stockholm Convention was signed by in 2001, its ratification by most of the signatory countries were not completed until 2004. I restricted the search for patent applications filed between 1991 and 2010 to cover a window of time broad enough to measure pre-post effects of the Convention. This resulted in a dataset of 5,240 patent records, comprised of 1,026 granted patents and 4,214 patent applications.

3.4 Sample selection

The search in SureChEMBL identifies 1,113 POP-related patent applications at European Patent Office (EPO), United State Patent Office (USPTO), Japan Patent Office (JPO), and World Intellectual Property Organization (WIPO) between 1991 and 2010. I decided to focus on patent applications because they give a window onto the exploratory efforts of assignees, unlike granted patent, which only represent a small percentage of the filed applications. Some of the retrieved patent applications might protect the same invention in multiple legislations among the four available in the ChEMBL database. To avoid double or multiple count, I focus our analysis at the unique DOCDB patent family level. I then use the EPO-PATSTAT (version Autumn 2018) database to identify the DOCDB patent families for all the POP-related patent applications retrieved from the ChEMBL database. The final set includes 624 unique DOCDB patent families including 5,240 patent applications filed in 75 patent authorities of which 233 (2.52%) related to Aldrin, 840 (9.08%) related to Chlordane, 1,044 (11.29%) related to Dieldrin, 1,072 (11.59%) related to Endrin, 759 (8.21%) related to Heptachlor, 2,348 (25.39%) related to Hexachlorobenzene, 328 (3.55%)

related to Mirex, 29 (0.31%) related to Polychlorinated Biphenyls (PCBs), 801 (8.66%) related to DDT, 30 (0.32%) related to Pentachlorobenzene and 624 (19.07%) related to polychlorinated dibenzo-p-dioxins.

Assignees were extracted from patent records and stored separately. Assignees have a name and location associated with them. Each assignee is categorized into a separate category: firms, individual inventors and universities. This classification process yielded 5,994 firms, 1,382 individual inventors and 327 universities. For the analysis, only firm were selected and does not include any collaborations between firms or between academia-industry.

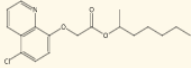
3.5 Identification strategy

Throughout interviews to chemistry researcher and patent examiners I tried to understand how to identify firm's patenting strategies in relation to a specific chemical compound. Chemical patents within their Markus structures would normally disclose the compound chemical structure with specific keywords that indicated the search strategy used to make the compounds. To identify the presence of POP related compounds, SureChEMBL provides a human curated field (see Figure 2) which translates the compound name disclosed in the Markus structure into international chemical identifies of the compound structures as the CAS Registry Numbers, or SMILES or InChIKey. Using this combined data, the patent claim section from the SureChEMBL were scanned and downloaded for this purpose.

Fig. 2: Identification strategy

Key Substances in Patent

CAS RN
99607-70-2D

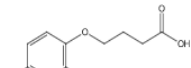


salts or esters, mixts. contg,

Analyst Markup Locations (1)

Page 21

CAS RN
94-81-5D

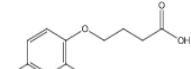


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Analyst Markup Locations (1)

Page 21

CAS RN
94-82-6D

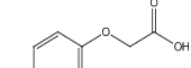


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Analyst Markup Locations (1)

Page 21

CAS RN
94-74-6D



salts or esters, mixts. contg,

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[0156] In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

[0157] As various changes could be made in the above compositions, methods and processes without departing from the scope of the invention, it is intended that all matter contained in the above description and shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

[0158] Having described the invention in detail, it will be apparent that modifications and variations are possible without departing from the scope of the invention defined in the appended claims.

1. A herbicidal concentrate composition comprising microcapsules dispersed in an aqueous liquid medium, wherein the microcapsules comprise a core material comprising an acetamide herbicide and a shell wall comprising a polyurea encapsulating the core material, and wherein the composition has an acetamide herbicide concentration on an active ingredient basis of at least about 40 wt. % and a weight ratio of acetamide herbicide to shell wall that is at least about 12:1.

2. The composition of claim 1, wherein the composition contains no more than about 15 wt. % of unencapsulated additives, excluding water and any co-herbicide(s).

3. A herbicidal concentrate composition comprising microcapsules dispersed in an aqueous liquid medium, wherein the microcapsules comprise a core material comprising an acetamide herbicide and a shell wall comprising a polyurea encapsulating the core material, and wherein the composition has an acetamide herbicide concentration on an active ingredient basis of at least about 40 wt. % and contains no more than about 15 wt. % of unencapsulated additives, excluding water and any co-herbicide(s).

4. The composition of claim 3, wherein the total concentration of unencapsulated additives, excluding water and any co-herbicides, is from about 0.1 wt. % to about 15 wt. of the composition.

5. The composition of claim 3, wherein the acetamide herbicide concentration on an active ingredient basis is from about 40 wt. % to about 60 wt. %.

6. The composition of claim 1, wherein the acetamide herbicide concentration on an active ingredient basis is from about 40 wt. % to about 60 wt. %.

7. (canceled)

8. The composition of claim 1, wherein the composition

28. The composition of claim 1, wherein the acetamide herbicide comprises at least one herbicide selected from the group consisting of acetochlor, alachlor, butachlor, butenachlor, delachlor, diethatyl, dimethachlor, dimethenamid, dimethenamid-P, mefenacet, metazachlor, metolachlor, S-metolachlor, napropamide, propachlor, pyramide, propachlor, propisochlor, prynachlor, terbuchlor, thenylchlor and xylachlor, salts and esters thereof, and combinations thereof.

29. (canceled)

30. (canceled)

31. The composition of claim 1, wherein the acetamide herbicide comprises acetochlor.

32. (canceled)

33. (canceled)

34. The composition of claim 1, wherein the core material further comprises a safener wherein the safener is selected from the group consisting of furilazole ((RS)-3-(dichloroacetyl)-5-(2-furanyl)-2,2-dimethyl-1,3-oxazolidine 95%); AD 67 (4-(dichloroacetyl)-1-oxa-4-azaspiro[4,5]decane); benoxacor ((RS)-4-dichloroacetyl-3,4-dihydro-3-methyl-2H-1,4-benzoxazine); buquintocet-mexyl ((5-chloroquinolin-8-yloxy)acetic acid); cyflumetrinil ((Z)-cyanomethoxyimino(phenyl)acetonitrile); cyprosulfamide (N-[4-(cyclopropylcarbamoyl)phenylsulfonyl]-o-anisamide); dichloramid (N, N-diallyl-2, 2-dichloroacetamide); dicyclonon ((RS)-1-dichloroacetyl-3,3,8a-trimethylperhydropyrrolo[1,2-c]pyrimidin-6-one); dietholate (O,O-diethyl O-phenyl phosphorothioate); fenclorazole-ethyl (1-(2,4-dichlorophenyl)-5-trichloromethyl-1H-1,2,4-triazole-3-carboxylic acid); fenclorim (6-dichloro-2-phenylpyrimidine); flurazole (benzyl 2-chloro-4-trifluoromethyl-1,3-thiazole-5-carboxylate); flurofenim (4'-chloro-2,2,2-trifluoroacetophenone (EZ)-O-1,3-dioxolan-2-ylmethoxyimino); isoxadifen (4,5-dihydro-5,5-diphenyl-1,2-oxazole-3-carboxylic acid); mefenpyr ((RS)-1-(2,4-dichlorophenyl)-5-methyl-2-pyrazoline-3,5-dicarboxylic acid); mephenate (4-chlorophenyl methylcarbamate); MG 191; naphthalic anhydride; oxabertinil ((Z)-1,3-dioxolan-2-ylmethoxyimino(phenyl)acetonitrile); isoxadifen (4,5-dihydro-5,5-diphenyl-1,2-oxazole-3-carboxylic acid); cyprosulfamide; salts and esters thereof, and mixtures thereof.

35-44. (canceled)

45. The composition of claim 1, wherein the composition further comprise at least one co-herbicide and wherein the

Source: SureChembl Database

4. Research design

4.1 *Dependent variables*

Number of compounds in patent claims: Each compound listed in a patent claims is a chemical entity with a unique chemical structure. These chemical compounds compose the invention sought in the patent document and substantiate patent claims. Hence, a set of compounds in a patent indicate the firm's search activity in within the chemical field and the intent to protect a portion of the 'chemical space'. The number of compounds encoded in chemical patents is then a factor of explorative search effort, dedicated resources and strategic intent of the firm and inventors (Drews 2000; DiMasi *et al.* 2010). A lot of compounds in patent claims imply large search efforts and knowledge flows within the firm (Jaffe and Trajtenberg 1999; Henderson and Cockburn 1996). Thus, number of patented compounds provide a quantitative representation of the intensity of search effort and can be proxied as a measure of chemical innovation.

Number of newly invented compounds in patent claims: Each compound listed in a patent claims can be known to the state of the art (i.e., previously claimed along with other chemical compounds) or introduced for a first time in a chemical patent. In this case, the sought of the intellectual property protection by firms cover a complete brand-new chemical space in which all the combinations (i.e., the new compounds along with other compounds) result to be new for the state of the art. Hence, a set of newly invented compounds in a patent indicate the firm's search activity in within the chemical space and the intent to protect a completely new region of chemical space. Thus, the number of newly invented patented compounds provide a fine-grained representation of the intensity of the firm's search efforts and can proxy innovation novelty.

4.2 *Difference-in-difference estimation*

Difference-in-Differences (DID) estimations are used to study the role of interventions like economic policies and events in natural experiments. This statistical technique analyses the differential effect of the intervention or treatment on a treatment group and compares it to a control group that is not exposed to the treatment (Angrist and Pischke 2009). A common experimental setup is observing two groups over two-time periods, where the first group is exposed to treatment in the second-time period, while the control group is not exposed to the treatment the entire period. To eliminate biases in second time period comparisons due to trends or inherent differences, the average gains in the control group is subtracted from the average gain in the treatment group.

To estimate only the effect of the Stockholm Convention on the number of chemical compounds patented and in the number of newly invented chemical compounds using a difference-in-differences approach, I rely on control set of unregulated chemical patents sharing similar characteristics but not impacted by Stockholm Convention.

4.3 *Control group*

To investigate whether and to what extent the increase in compound patenting as well as the increase in the newly invented compounds of POP-related patents is a mirror of an increase in the compound increase of patents that share similar characteristics (except disclosing POPs in patent claims) I rely on a control group. The control group is generated through the exact matching of some observable characteristics such as: the filing year, the IPC class (4 digit), the granting status, and the application through PCT (Patent Convention Treaty).

For the difference-in-differences estimation, I focus on a subset POP-related patents. Countries can differ in access to new technologies, scientific and human resources, and organizational cultures. To control for these exogenous factors that could bias the analysis, I select only patent application filed through PCT (Patent Convention Treaty) filed at the European Patent Office (EPO). The European Union played a pivotal role in the Stockholm Convention as it was one of the

promoters and decided to implement the convention by eliminating the use of POPs rather than restricting it. Similarly, the control group is also comprised of patents filed at the EPO. The European Union is also the second worldwide largest market for chemicals and firms interested in this market would typically file patents here (Ahuja and Morris Lampert 2001). Restricting the sample to the EPO patents maintains consistency, reliability and comparability in factors like accessibility to chemistry technologies and resources needed for technological search. For each POP-related patent I match up to two controls with the described similar characteristics and no POP in their claims. For 322 POP-related patents, I identify 852 control patents.

4.4 Model

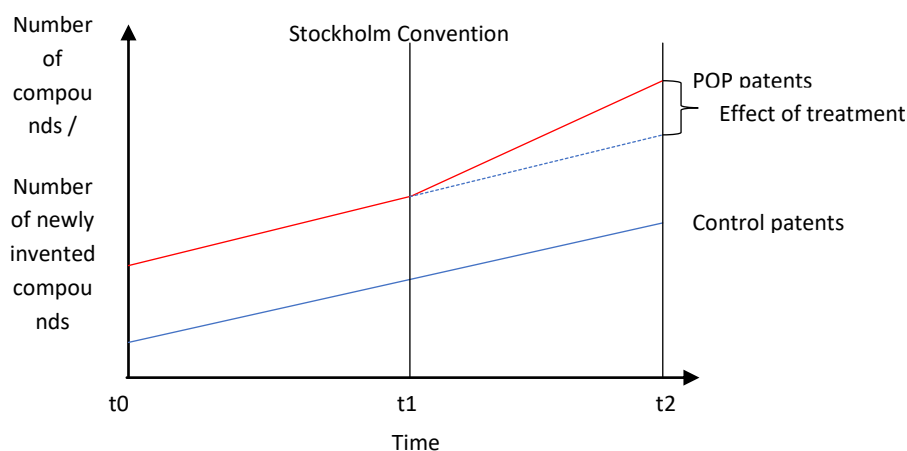
The generic difference-in-differences (DID) model is specified as:

$$y = \beta_0 + \beta_1 B + \delta_0 d2 + \delta_1 d2.dB + u$$

where y is the outcome variable (number of patented compounds / number of patented newly invented compounds), $d2$ is a dummy variable for the second time period (post-Stockholm Convention), the dummy variable dB captures differences between treatment and control groups before the second time period (treatment). The coefficient of interest is $\delta_1 d2.dB$. The difference-in-differences estimate is:

$$\delta_1 = (y_{(B,2)} - y_{(B,1)}) - (y_{(A,2)} - y_{(A,1)})$$

Fig. 3: Experimental setup to test the effect of the Stockholm Convention on the number of patented compounds and on the number of newly invented compounds



Legend

t0-t1 = pre-intervention period (1991-2000)

t1 = intervention (2001 Stockholm Convention)

t1-t2 = post-intervention period (2001-2010)

Source: Author own elaboration

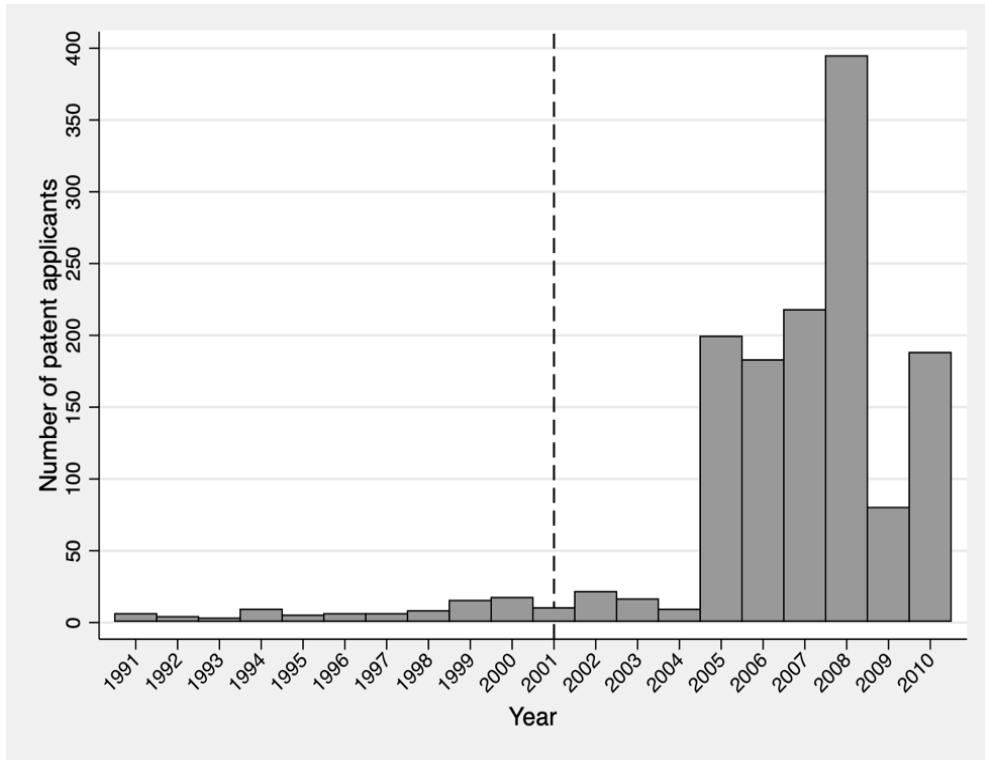
Therefore, Estimation of Stockholm Convention Effect = (POP compounds - Control compounds) post-Convention - (POP compounds - Control compounds) pre-Convention.

4.5 Results

Changes in firm patenting activity are shown in Figures 4-6. In Figure 4, number of firms between 1991-2010 goes up exponentially indicating an increase in firms engaged in POP-related patent activities. Figure 5 shows an increase in firm patenting between 1991-2010. To capture the rate of inventive activity among chemical firms, I calculated an average score (total patents per

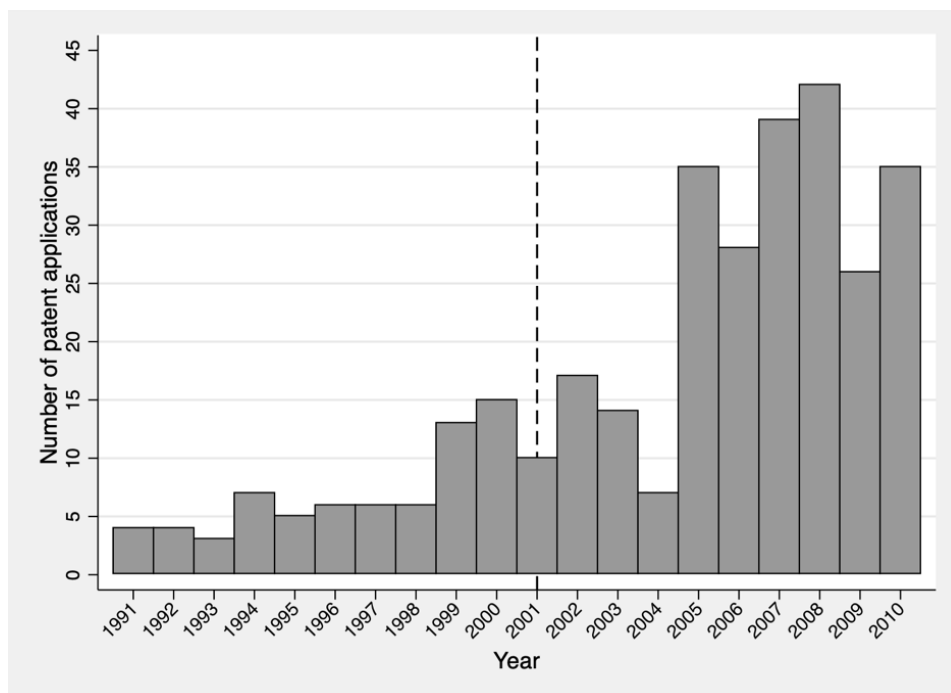
year/total unique firms per year to account for the overall industry inventive activity across time. The trend line is shown in Figure 6. where I observe steep increase over the 10-year time period which followed the signature of the Stockholm Convention. In sum, after the Stockholm Convention I observe more patenting activity, a greater number of firms engaged in POP-related patents and overall inventive activity increasing across the industry (Figures 4-6), thus supporting Hypothesis 1(a).

Fig. 4: Number of POP patent applicants by year



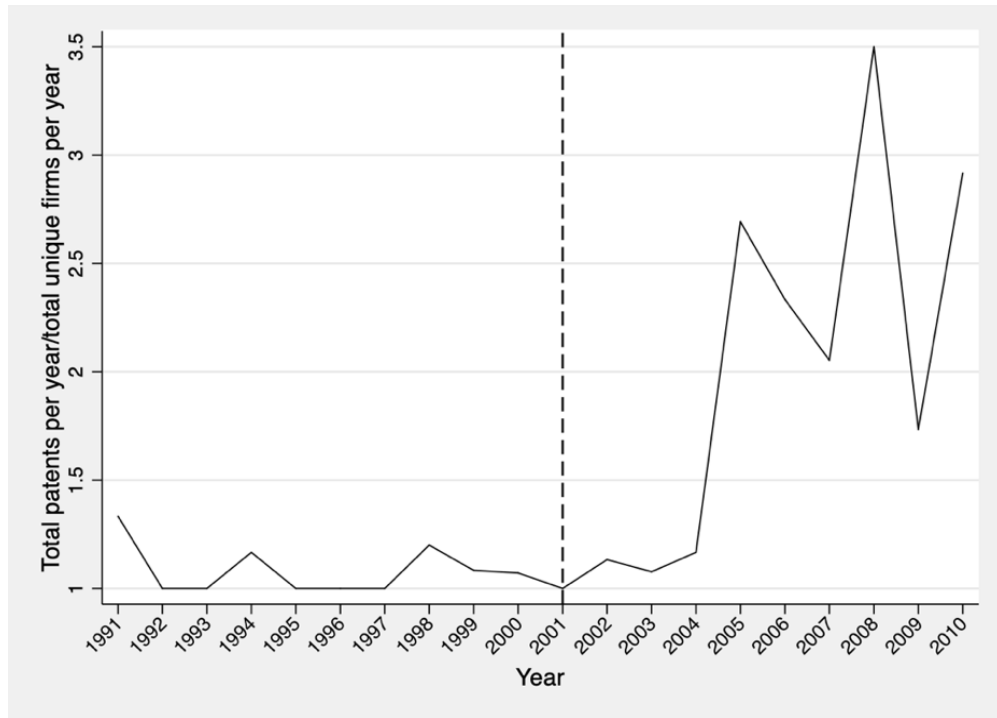
Source: Author own elaboration

Fig. 5: Number of patent POP patent application by year



Source: Author own elaboration

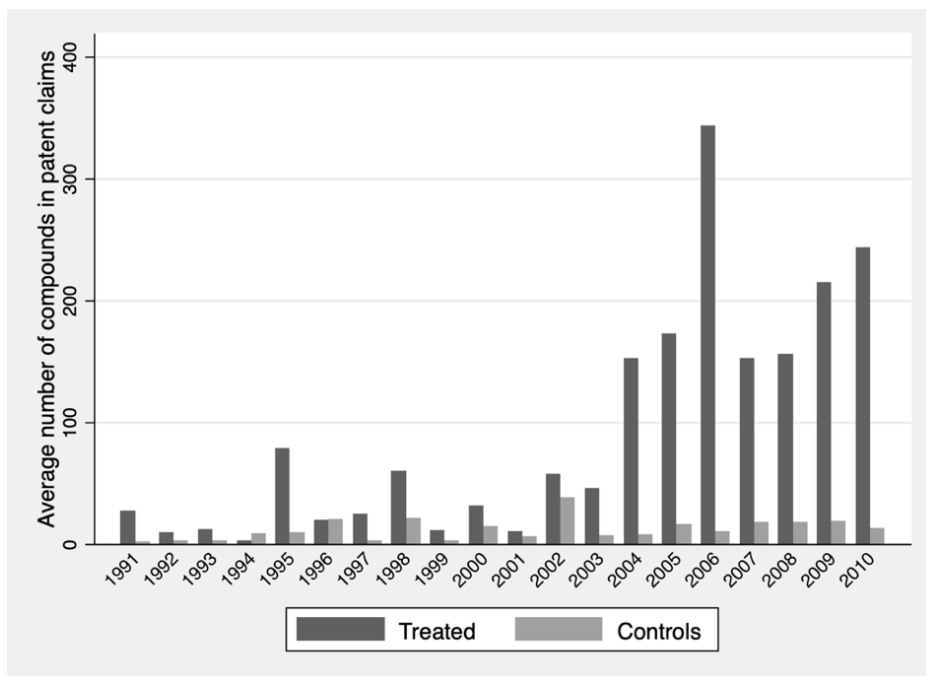
Fig. 6: Patents per year/firms per year



Source: Author own elaboration

Figure 7 shows the number of compounds for POP-related patents and Control patents. The widening of the gap between the two becomes more pronounced after the signature of the Stockholm Convention in 2001.

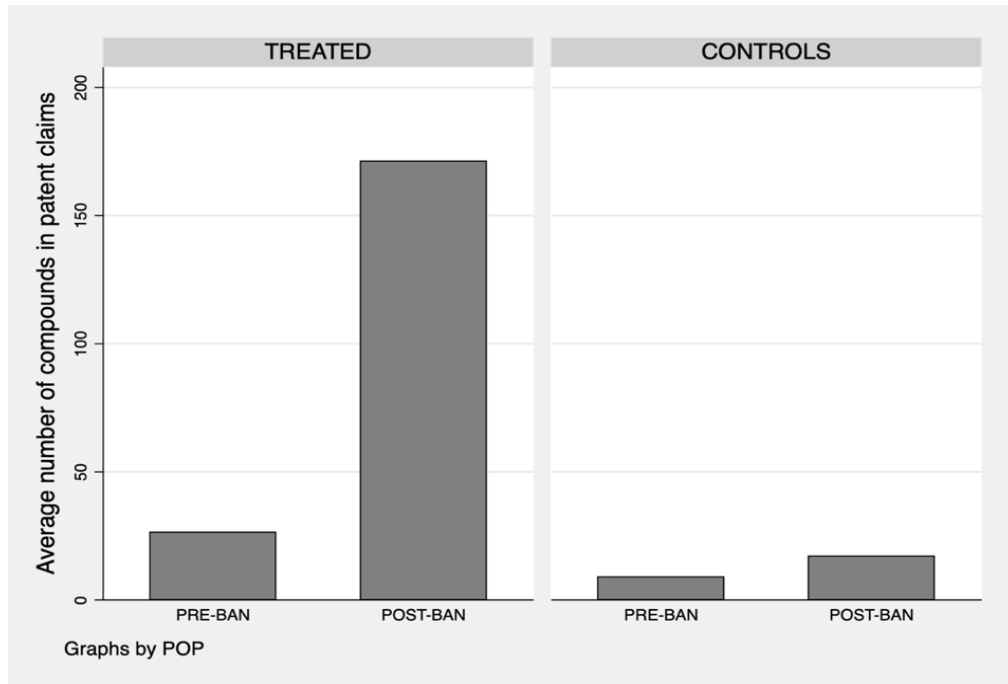
Fig. 7: Evolution of patented compounds (Treated and Controls)



Source: Author own elaboration

Figure 8 points out an interesting trend - the number of compounds per patents are consistently higher for POP-related patents, and the gap between treated and controls widens after the Stockholm Convention.

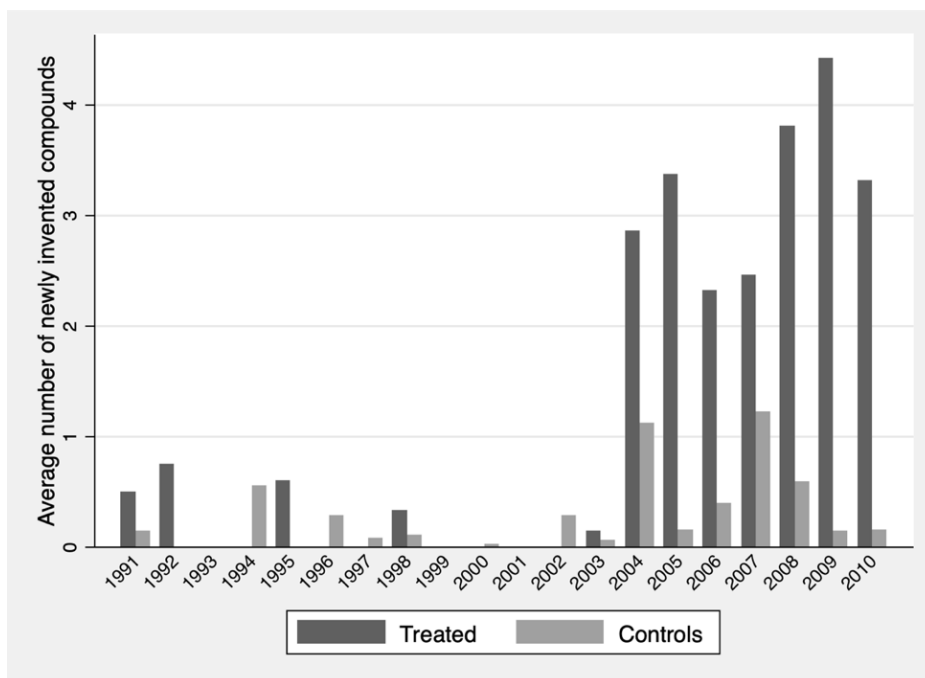
Fig. 8: Average number of patented compounds (Treated and Controls)



Source: Author own elaboration

Figure 9 shows the number of newly invented compounds for POP-related patents and Control patents. Even in this case, the widening of the gap between the two after the signature of the Stockholm Convention becomes more pronounced.

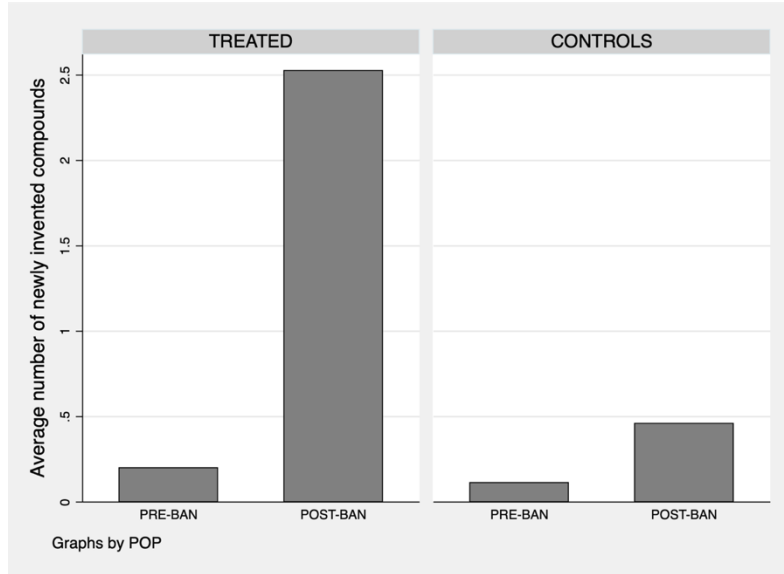
Fig. 9: Evolution of newly invented patented compounds (Treated and Controls)



Source: Author own elaboration

Figure 10 points out shows the number of newly invented compounds per patents are consistently higher for POP-related patents, and the gap between treated and controls widens after the Stockholm Convention.

Fig. 10: Average number of newly invented patented compounds (Treated and Controls)



Source: Author own elaboration

Tab. 1: Descriptive statistics for Treated and Controls

	Treated	Controls
Patent Priority Application Country	European Patent Office (EPO)	European Patent Office (EPO)
Time Period	1991-2000	2001-2010
Observations	322	852
Compounds in patent claims	Min: 1	Min: 1
	Max: 6,287	Max: 462
	Mean: 145.87	Mean: 15.28
	Std. Dev.: 386.47	Std. Dev.: 37.49
Newly invented compounds in patent claims	Min: 0	Min: 1
	Max: 107	Max: 99
	Mean: 2.18	Mean: 0.39
	Std. Dev.: 7.09	Std. Dev.: 3.80

Tab. 2: Difference-in-differences estimates for the effect of the Stockholm Convention on the number of patented compounds and on the number of newly invented compound

Treatment period	2001			
	# of compounds		# of newly invented compounds	
Variables	-1 OLS Fixed Effects	-2 OLS	-3 OLS Fixed Effects	-4 OLS
<i>POP#POST_BAN</i>	89.98*** (24.82)	153.65*** (31.16)	1.23** (0.68)	2.36*** (0.54)
<i>POST_BAN</i>	-20.29*** (6.34)	6.84 (17.09)	-0.04* (0.37)	0.35** (0.17)
<i>POP</i>	8.76** (3.74)	14.92 (27.29)	0.25* (0.59)	0.01* (0.09)
Constant	-5.10** (1.99)	9.83 (15.25)	-0.29 (0.33)	0.11** (0.06)
Observations	1,174	1,174	1,174	1,174
R-squared	0.1751	0.1045	0.0179	0.0412

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Standard errors clustered at firm level.

Table 2 (Continued): Difference-in-differences estimates for the effect of the Stockholm Convention on the number of patented compounds and on the number of newly invented compound

Treatment period	2004			
	# of compounds		# of newly invented compounds	
Variables	(5) OLS Fixed Effects	(6) OLS	(7) OLS Fixed Effects	(8) OLS
POP#POST_BAN_1	103.23*** (11.37)	163.66*** (33.65)	1.82*** (0.60)	2.74*** (0.65)
POST_BAN_1	-24.11*** (6.11)	3.10 (2.77)	0.04 (0.32)	0.24 (0.20)
POP	10.58 (9.18)	26.55*** (7.59)	0.03 (0.48)	0.04 (0.17)
Constant	-4.70 (5.06)	13.15*** (2.30)	-0.35 (0.26)	0.22** (0.08)
Observations	1,174	1,174	1,174	1,174
R-squared	0.1977	0.1146	0.0255	0.0487

Note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. Standard errors clustered at firm level.

Legend

POP: Dummy for treatment (1 = POP patents)

POST_BAN: Dummy for post intervention period (1 = post 2001)

POP#POST_BAN: Interaction term for Treatment and Post-intervention period (Diff-in-Diff estimator)

POST_BAN_1: Dummy for post intervention period (1 = post 2004)

POP#POST_BAN_1: Interaction term for Treatment and Post-intervention period (Diff-in-Diff estimator)

Table 2.1 and 2.2 show respectively descriptive statistics and results for the Difference-in-Differences estimation. In Model 1, the difference-in-differences estimator (POP#POST_BAN) is calculated using Ordinary Least Squares (OLS) regression with firm fixed effects and the standard errors clustered for robustness at firm level for the intervention time period 2001. The difference-in-difference estimate for the effect of the 2001 signature of the Stockholm Convention is 89.98. To check whether these effects are consistent even after the ratification of the Stockholm Convention, Model 5 measures the effect for the 2004 intervention period. Results are similar and statistically significant. This implies that controlling for the independent effect of similar and unregulated chemical inventions (i.e., the Control patents), POP-related patents accounted nearly for 90 more compounds for each patent. These results are statistically significant and consistent with Model 2 and 6 (run without fixed effects). This implies that the Stockholm Convention increased compound output by 90 compounds per patent after the signature of the Stockholm Convention (2001), and by 160 compounds per patent after the ratification of the Stockholm Convention (2004).

As for the number of newly invented compounds, Model 3 estimates for the effect of the 2001 signature of the Stockholm Convention while Model 7 measure the effects of the ratification of the Convention in 2004 using Ordinary Least Squares (OLS) regression with firm fixed effects and the standard errors clustered for robustness at firm level. Results are statistically significant and consistent with Model 4 and 8 (run without fixed effects) suggesting that the Stockholm Convention increased the number of newly invented compounds by 2 compounds per patent in after the 2001 intervention period, and by 4 compounds per patent after the 2004 intervention period. Coupled, these results support Hypothesis 1(b).

5. Conclusions

Persistent Organic Pollutants are the first chemicals to be globally banned by the 2001 Stockholm Convention. Attention to their noxious impact has only recently revamped because of their re-volatilization tied to climate change. However, while the environmental regulation was designed to forbid future production and use of these chemicals, it did not directly regulate the R&D processes underpinning the banned technologies, perhaps based on the presumption that these would have been phased out too. Using a novel dataset of chemical patent applications, I find that

environmental regulation as the Stockholm Convention is correlated with an increase in the number of chemical patents, chemical compounds disclosed in patent claims and in the number of newly invented compounds. These findings point to the role of environmental regulation as catalysts in knowledge recombination, focusing search processes and enabling firms to explore more of the technological landscapes. While most extant research point out the role of environmental regulations on the invention of new or improved products processes there has been no systematic empirical analysis of how the processes of search and innovation on existing and regulated technologies. Throughout this study, I tried to open the black box of chemical inventions using a novel dataset of existing and potentially polluting inventions that have not been used previously in management research. I proposed that the environmental regulation facilitated the search and innovation making compound production more intensive - resulting in more inventive activity. The results support hypotheses 1a and 1b.

These results also support prior studies on the role of environmental regulation and technical change. By showing a significant effect on the production of compounds in the time period 1991-2010, this results empirically support theoretical models on the role of environmental regulations on exploration and innovation. The significant effect of the Convention on compound patenting and the increase in the newly invented compounds support prior work on the idea that environmental regulations accelerate the rate and intensity of technological innovation.

Along these lines, the environmental regulation as the Stockholm Convention acts as a form of complementary asset that allowed firms to change their innovation strategies (Teece 1986). The separate effect of the Stockholm Convention (i.e., 90 + compound per patent and 2 + newly invented compound per patent) is supported by the difference-in-difference estimations controlling for the effect of similar technologies.

From a policy perspective, this result is interesting as the environmental regulation shows a stronger and separate effect on compound patenting and newly invented compound production. This is due to the fact that the regulation opens up new and unexplored territories in chemical field. Thus, regulatory efforts aimed at protecting humans and ecosystems from polluting technologies led to more exploration of chemical space, increased novel compound output per patent - in essence, creating conditions ripe for technological innovation. Understanding the economic impact of environmental regulations and how they influence innovation processes is important for public policy, R&D management and firm strategy. By linking environmental regulations with industry innovation, this empirical analysis sheds new light on important but largely unexplored questions in the literature on technological search. These results reveal an interesting finding: environmental regulations not only increase the rate of invention, but also impact the nature of technological search and underlying strategies, suggesting that regulations can enhance the quality of industry innovation.

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Artificial intelligence and big data in family firms: facing the preservation of socio emotional wealth

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Abstract

Framing of the research. *The impact of family involvement on strategic decisions is particularly relevant and asks for a deepening both at the theoretical and empirical level. The Socio-emotional wealth (SEW) lens is useful to appreciate this impact, arguing that families refrain from making decisions that are actually positive for the business because they fear the loss of their position in the business and in their image and reputation with their stakeholders.*

Purpose of the paper. *The paper examines whether, based on SEW, family firms differ from non-family firms in their propensity to innovate in artificial intelligence (AI) and big data. We focus on AI and big data, as their consideration allows to evaluate the effects of automation more broadly. The use of SEW leads to the hypothesis that family firms differ in three needs: care for employees, reputation of the family and the firm in the territory, and social responsibility.*

Methodology. *The empirical analysis is based on a sample of 4,150 Italian firms.*

Results. *Consistent with the SEW, family firms are less inclined to innovate in AI and big data.*

Research limitations. *The extension to other national contexts than Italy could reveal the influence of institutional aspects (relationship among family-ownership-firm) that could not be highlighted by our survey.*

Managerial implications. *Our work has highlighted the critical issues that family firms face when deciding to innovate in the technologies considered.*

Originality of the paper. *This study is the first investigation that, based on SEW, examines at empirical level the factors that influence a family firm's choice to innovate in AI and big data. We have shown that it is crucial to consider the type of innovation (specific technology) because it can generate different non-economic considerations and thus different strategic decisions.*

Keywords: *Innovation; Artificial intelligence; Big data; Family firms; Socio Emotional Wealth*

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1. Introduction

The impact of family involvement on strategic decisions is particularly relevant (Kallmuenzer *et al.*, 2018) and asks for a deepening both at the theoretical and empirical level. The Socio-emotional wealth lens is particularly useful in order to appreciate this impact, arguing that families refrain from making decisions that are actually positive for the business because they fear the loss of their position in the business and in their image and reputation with their stakeholders. In this paper, we aim to advance our knowledge on the family business strategic decision to develop innovation in artificial intelligence (AI) and big data referring to the SEW lens. We focus on AI and big data, as their consideration allows to evaluate the effects of automation more broadly (Carbonero *et al.*, 2018). These technologies negatively impact on middle- and high-skilled workers (Bessen *et al.*, 2020; Blanas *et al.*, 2019).

Literature recognises innovation as a very important strategic decision, especially for most growth-embarking firms (Segarra and Teruel, 2014) as it enables firms to compete and survive (Aziz and Samad, 2016; Udriyah *et al.*, 2019). Further, we consider how AI and big data are rapidly diffusing worldwide (Schwabe and Castellacci, 2020) and have now become essential for organisational survival since they are a source of competitive advantage (Acemoglu *et al.*, 2020). Nevertheless, at the same time, these technologies are receiving increasing attention in the literature. In fact, they may increase firm productivity (Acemoglu *et al.*, 2020; Bessen and Righi, 2019), but also significantly decrease firm employment (e.g., Bonfiglioli *et al.*, 2020; Jung and Lim, 2020) and negatively impact employees' satisfaction and well-being (Schwabe and Castellacci, 2020).

SEW suggests that non-economic outcomes are at the centre of FFs' consideration and we believe that FF's decision making in developing innovation in AI and big data is an example. SEW refers to the stock of affect-related value that family members receive from their position in a business (Berrone *et al.*, 2012). Following SEW, FFs may be fostered to innovate in AI and big data as they can obtain an increase in firm productivity and a competitive advantage. However, at the same time, FFs may be reluctant to innovate in these technologies given that the negative consequences (i.e., decrease in firm employment and in employees' satisfaction and well-being) may cause the disappointment of key stakeholders (particularly, employees) and ruin the close relationship with them. Being primarily motivated by preserving SEW, FFs will eschew such losses: they prefer to forego financial gains to protect SEW thus losing stimuli in making innovation in AI and big data technologies. In contrast, non-FFs are only motivated by financial returns, and consider non-economic side effects as no more than undesirable, yet unavoidable consequences of innovation in these technologies. When making this strategic decision, FFs are in fact particularly involved regarding three main aspects: the family's feeling to care about their employees with particular regard to their level of satisfaction and well-being; the inner pride of building and maintaining the reputation of the family and the firm; and the inner feeling to be socially responsible.

Despite the importance and consequences of innovating in AI and big data, research has so far not considered how FFs deal with this type of innovation. This analysis is valuable as for FFs the decision to innovate in AI and big data is very difficult given its positive and negative consequences and its impacts on SEW. To fill this gap, this study aims to answer the following research question: *Do FFs support the strategic decision to innovate in AI and big data?*

To answer this research question, we draw from the literature on automation, trying to reinterpret the results from the perspective of SEW. We argue that firm strategic decisions regarding innovation in AI and big data are particularly difficult given that the positive (economic) and negative (social and non-economic) consequences must be carefully assessed. Due to their peculiarities, those aspects become the main matter in the case of FFs and influence their strategic decision to innovate in AI and big data.

Given the premises, the analysis consists of a regression based on a database of 4,150 Italian firms and aims to understand the propensity to innovate in AI and big data technologies of FFs in comparison to non-FFs.

This paper contributes to previous literature in two ways. First, we showed that when analysing how FFs take strategic decisions regarding innovation, it is fundamental to consider the type of innovation (i.e., specific technology) as it may generate different strategic decisions. Second, we showed that in FFs the strategic decision to innovate in AI and big data is influenced by both economic and non-economic goals. The contributions to the literature are further detailed in the concluding section.

The remaining part of the paper is structured as follows. Section 2 presents the theoretical background of our study and in particular describes the importance of SEW in FFs and the consequences of innovation in AI and big data in the light of SEW theory. On the basis of these strands of literature, the development of hypotheses is presented. Section 3 describes the methodology adopted for the analysis. Section 4 shows the results of the study. Finally, Section 5 is devoted to conclusions.

2. Theoretical background

2.1 FFs' strategic decisions and the balance between economic and non-economic goal: the SEW lens

SEW lens relates to the affect-related value that family members obtain from their position in the firm (Berrone *et al.*, 2012) and posits that family principals are primarily motivated by preserving their SEW (Berrone *et al.*, 2012). To date, SEW has been used to explain FFs investment decisions and, to a lesser extent, performance differences between FFs and non-FFs (Cruz *et al.*, 2012; Gómez-Mejía *et al.*, 2011; Schepers *et al.*, 2014).

To preserve the family wealth, the strategic decision making of the FFs balances the goals of the family and those of the firm (Nordqvist *et al.*, 2008). In addition to financial goals, FFs pursue non-economic and family-centric motives such as emotional preferences and social obligations that guide family behaviour (Cennamo *et al.*, 2012; Chrisman *et al.*, 2012; Miller and Le Breton-Miller, 2014). The family goals may dominate economic ones (Kotlar and De Massis, 2013) and non-economic outcomes may be preferred over financial returns (Berrone *et al.*, 2010).

FFs attribute a higher value to the relational and social capital (Famoso *et al.*, 2015) in comparison to non-FFs, create closer relationships to stakeholders, and give more importance to their social responsibility (Van Gils *et al.*, 2014). Strategic decision making in FFs is thus affected by the social ties of the FF and its identification (Kallmuenzer *et al.*, 2018). Relevant stakeholders include both internal actors (e.g., firm employees) and the external environment (e.g. the social, economic, competitive, and technological forces) (Ibrahim *et al.*, 2001; Mustakallio *et al.*, 2002). This behaviour enables family members to gain several social and affective endowments, such as the ability to enhance the reputation of the family in the community and the ability to exploit the resources of the firm for the benefit of the entire family (Miller and Le Breton-Miller, 2014).

SEW is also tied to the social context in which FFs operate (Bird and Wennberg, 2014). FFs hold profound roots in their country and are tied to regional communities (Bird and Wennberg, 2014). Investments in the community offer continuity and an abundance of goodwill toward the family (Miller and Le Breton-Miller, 2014). Family principals also derive SEW utility from the community and thus FFs prefer preserving "community SEW" (Kurland and McCaffrey, 2020: 2).

Given the strong ties that link family to the community, the kind of relationships that FFs establish with the local constituencies affect SEW. Moreover, since decisions are assessed in reference to changes in SEW, FFs will take the utility of stakeholders into account and will pursue the welfare of those who surround them, even if there are no obvious transactional economic gains for doing so (Berrone *et al.*, 2010). In sum, as SEW extends beyond the boundaries of the family to

embrace the local community, non-economic consequences of automation are weighed more than financial gains.

2.2 Innovation in AI and big data: positive and negative aspects in light of the SEW

The decision to innovate in AI and big data is particularly difficult given the negative and positive consequences that may generate non-economic concerns. These technologies may decrease firm employment (e.g., Bonfiglioli *et al.*, 2020; Jung and Lim, 2020) and employee's satisfaction and well-being (Schwabe and Castellacci, 2020), despite the fact that they can increase firm productivity (e.g., Acemoglu *et al.*, 2020; Bessen and Righi, 2019). All the exposed consequences may have an impact in terms of SEW and then in the choice to innovate in automation by FFs.

AI and big data impact employment with two opposing effects: a substitution effect, as they substitute workers in performing work activities or increase labour productivity; a compensation effect, i.e., the indirect effects that mitigate the initial reduction of employment (Acemoglu and Restrepo, 2019a). The final impact could still be a net decrease in employment (Acemoglu and Restrepo, 2019b).

While according to some studies, investments in AI and big data have a small positive impact on firm employment (Bessen and Righi, 2019), other studies find that AI is associated with job destruction and a negative effect on hiring both at the firm and plant level (Acemoglu *et al.*, 2020; Hunt *et al.*, 2022).

The possible negative impact on employment may generate SEW losses such as the fear of ruining the relationship with workers and that of losing firm reputation.

AI and big data could affect non-pecuniary aspects that shape employees' well-being (Kaplan and Schulhofer-Wohl, 2018; Schwabe and Castellacci, 2020) such as expectations, job prospects, career satisfaction, mental health and stress (Brougham and Haar, 2018). When a firm considers the adoption of automation technologies, employees begin to fear that they may become unemployed and face financial difficulties (Schwabe and Castellacci, 2020). Such uncertainty reduces job satisfaction (Erdogan *et al.*, 2012; Schwabe and Castellacci, 2020) as employees perceive themselves to be undervalued and unappreciated by the employer (Brougham and Haar, 2018; Meyer *et al.*, 1993). Long-term job insecurity can also negatively affect an employee's mental health and increase the probability of psychological stress, nervousness and burnout (Abeliansky and Beulmann, 2019; Chen *et al.*, 2004; Dekker and Schaufeli, 1995).

We believe that the negative consequences on employees' satisfaction, commitment and well-being may decrease the SEW in the firm.

Studies that analyse the effect on productivity find that AI and big data have a smaller positive impact on firm productivity, which has been quantified at about 5% on average (Bessen and Righi, 2019).

The possibility of increasing firm productivity has a positive impact on the economic aspect of the strategic decision making.

2.3 Hypothesis development

The decision to innovate enables firms to compete and survive (Olson *et al.*, 2006) and to acquire, increase and maintain a competitive advantage over competitors (Aziz and Samad, 2016; Udriyah *et al.*, 2019). However, this decision implies risks and uncertainty and requires many financial and human resources and time (Chrisman *et al.*, 2015). This creates both gain and loss outcomes, which are taken into account by decision makers (Gómez-Mejía *et al.*, 2014).

Family-specific antecedents that affect innovation should therefore be considered (Calabrò *et al.*, 2019). Related literature provides some conflicting results. According to some studies, the involvement of family members in decision making make decisions linked to firms ambidexterity (Lubatkin *et al.*, 2006): based on other studies, family involvement is detrimental to innovation

(Kotlar *et al.*, 2014; Sanchez-Famoso *et al.*, 2017). The specificity of the families as decision makers affect also the strategic decision to innovate in AI and big data.

To develop our hypothesis, three main reasons rooted in socio-emotional wealth preservation are considered: the care for the satisfaction and well-being of the employees; the inner pride of building and maintaining the reputation; the inner feeling to be socially responsible.

The first aspect regards the desire to take care of the employees by limiting layoffs due to automation (e.g., Bonfiglioli *et al.*, 2020; Jung and Lim, 2020) and ensuring satisfaction and well-being (Schwabe and Castellacci, 2020). In FFs, employees are considered part of an extended family and FFs tend to adopt a communal and relational approach with them (Christensen-Salem *et al.*, 2021) FFs are strongly committed to employment stability (Stavrou *et al.*, 2007) and avoid decisions that may harm their employees (Christensen-Salem *et al.*, 2021). Thus, we acknowledge that FFs generally tend to display intense employee concern and loyalty and therefore there are family concerns on the consequences of innovation in AI and big data given the fear of ruining the relationship with employees (Kaplan and Schulhofer-Wohl, 2018; Schwabe and Castellacci, 2020).

Given the negative consequences of innovation in AI and big data on employees, FFs will limit innovation in automation compared to non-FFs.

The second aspect regards the pride and the risk of losing the firm and the family's reputation. FFs care for their reputation in the community (Kellermanns *et al.*, 2012; Miller and Le Breton-Miller, 2005) and adopt a proactive stakeholder engagement, i.e., they anticipate the needs of stakeholders and perform activities that proactively engage them (Laplume *et al.*, 2008). Firms can enhance the welfare of their stakeholders by adopting practices and activities that improve the relationship with them (Cennamo *et al.*, 2012). This enables FFs to obtain economic benefits and increase reputation and legitimacy (e.g., Laplume *et al.*, 2008; Surroca *et al.*, 2010).

Proactive stakeholder engagement may be directed at internal stakeholders (e.g., employees) to increase control and legitimacy, gain trust and improve firm image and reputation (Cennamo *et al.*, 2012). Proactive stakeholder engagement may also be directed at external stakeholders (e.g., the local community) if close and meaningful personal relationships exist (Brickson, 2005, 2007) and the aim is to gain endorsement (Cennamo *et al.*, 2012). Proactive stakeholder engagement is directed at both internal and external stakeholders when the aim is to improve firm image, reputation and social capital (Cennamo *et al.*, 2012).

The negative consequences of AI and big data on job satisfaction and insecurity, may cause a feeling of losing family and firm reputation and image and induce FFs to limit innovation in automation compared to non-FFs.

The third aspect regards social responsibility and the recognition as an actor that plays a positive role in society. The family influence in decision making can produce more socially responsible decisions and actions (Berrone *et al.*, 2010; Dyer and Whetten, 2006) with the aim to help, protect or increase the welfare of other people (Grant, 2007) and solve social problems that exceed the scope of their firm (Westley and Vredenburg, 1991). Due to the interest of FFs in social ties within and beyond the boundaries of the firm (Berrone *et al.*, 2012), the external environment strongly affects the strategic management of FFs (Kallmuenzer *et al.*, 2018).

Since the negative impact of AI and big data on firm employment and on employees' satisfaction, commitment and well-being are a matter of social responsibility, innovation in these technologies may affect the SEW and is thus limited.

In sum, FFs' SEW (i.e., the family's feeling to care for employees, the inner pride related to family and firm reputation, and the inner feeling to be socially responsible) influences the strategic decision to innovate in AI and big data. We thus hypothesize that:

Hypothesis: Due to SEW, FFs will limit innovation in AI and big data more than non-FFs.

3. Method

3.1 Sample and data

The sample for the analysis comprises 4,150 Italian firms, both FFs and non-FFs. Italy represents an interesting context for this analysis in terms of both the presence of FFs and the adoption of AI and big data technology (Baltrunaite *et al.*, 2019). In fact, Italian firms lag behind in the adoption of these technologies due to the characteristics of the Italian production structure (Bruno and Polli, 2017; Codogno, 2009), the family structure of firms (Bugamelli *et al.*, 2012), and the institutional context (Sestito and Torrini, 2019).

For sample selection, we considered all the Italian firms that registered at least a patent in AI or big data and are currently active. The choice of the control sample was made at random and χ^2 tests on the distribution of firms confirmed that the selected firms are representative of the population of Italian firms.

The dataset, which refers to the year 2019, results from three datasets: EPO-PATSTAT, Aida (Bureau Van Dijk) and Reprint. Information on patents is extracted from the EPO Worldwide Patent Statistical Database (EPO-PATSTAT). Patents related to AI and big data and filed by firms based in Italy were selected based on patent codes retrieved from these papers: Fujii and Managi (2018), IPO (2014), Martinelli *et al.* (2019), Webb *et al.* (2018) (Table 1).

Tab. 1: Patent codes regarding automation

Technology	Patent codes	Source
Artificial intelligence	A61B, G06K, G06N, G06N20, G06N3, G06N5, G06N7/00, G06N99/00, G06T, G16C20/70	Fujii and Managi (2018) IPO (2019) Martinelli <i>et al.</i> (2019) Webb <i>et al.</i> (2018)
Big data	G06F, G06F12/00, G06F15/16, G06F15/173, G06F17/00, G06F19/00, G06F7/00, G06Q10/00, G06Q30/02, H04L, H04L29/08	IPO (2014) Martinelli <i>et al.</i> (2019) Webb <i>et al.</i> (2018)

Source: our elaboration from Fujii and Managi (2018), IPO (2014), Martinelli *et al.* (2019), Webb *et al.* (2018)

From the AIDA (Bureau van Dijk) database information about firm identification (e.g., location, year of foundation, sector), financial situation and the ownership structure (i.e., family name of each board member and shareholder together with their ownership share) was derived.

The two databases - EPO-PATSTAT and Aida (Bureau Van Dijk) - were merged following a procedure similar to that proposed by Lotti and Marin (2013). To solve the inconsistency in the data regarding patents¹ and obtain the list of firms to be considered, these authors suggest to follow these steps: harmonize the list of applicants in EPO-PATSTAT and the list of firms in Aida; harmonize addresses in both lists; identify the exact matches by checking both firm name and address; identify duplicate matches.

Finally, information regarding the multinational status of the company was added through the database Reprint, which provides data on outward FDIs made by Italian firms since 1986.

3.2 Variables and measures

The sources and definitions of the variables used are shown in Table 2.

¹ This inconsistency is due to these main reasons (Lotti and Marin, 2013): the names of applicants and inventors are collected under different name conventions; previous applications are not considered when adding a new applicant or inventor; a unique identifier is absent; other information such as addresses are not standardized.

Tab. 2: Definitions and sources of the variables used in the empirical analysis

Variable	Definition	Source
Dependent variables		
Innovation	Dummy variable equal to 1 if the firm holds at least a patent and 0 otherwise	EPO-PATSTAT
Innovation in AI and big data	Number of patents inartificial intelligence and big data registered by the firm	EPO-PATSTAT
Independent variable		
Family firm	Dummy variable equal to 1 either if a non-listed firm is majority owned by the family, or if no less than 20% of a listed firm is owned by the family; and 0 otherwise	AIDA
Control variables		
Firm size	Logarithm of domestic sales	AIDA
Large firm	Dummy variable equal to 1 if the firm is a large firm	AIDA
Firm age	Logarithm of number of years since firm foundation	AIDA
MNE	Dummy variable taking the value 1 if the firm is part of a multinational group or has foreign subsidiaries, 0 otherwise	REPRINT
ROI	Net income on investment	AIDA
ROE	Net income on equity	AIDA
Risk	Standard deviation of return on assets on the last five years	AIDA
Liquidity ratio	Liquidity ratio, calculated as the ratio of current assets (net of inventory) and current liabilities	AIDA
Leverage	Debts on equity	AIDA
Fixed assets	Fixed assets (euro, millions)	AIDA
Gross investments	Annual growth rate in fixed assets	AIDA
Labour costs	Labour costs (euro, millions)	AIDA
Value added	Value added per employee (euro, thousands)	AIDA
North	Dummy variable equal to 1 if the firm is located in North Italy	AIDA
Industry	Categorical variable describing the industry in which the firm operates, with these levels: "Pavitt science based", "Pavitt specialised suppliers", "Pavitt scale and information intensive", "Pavitt suppliers dominated", "Pavitt other"	AIDA

Dependent Variable. The dependent variables are *Innovation* and the variable *Innovation in AI and big data*. In line with previous studies, *Innovation* is considered with a dummy variable equal to one if the firm holds at least a patent (Acs *et al.*, 2002; Katila, 2000). *Innovation in AI and big data* is measured with the count of patents registered by the applicant firm in these technologies.

Independent Variable. Previous studies suggest classifying a firm as FF by considering the amount of family control, i.e., the fraction of equity owned by the family (e.g., Lee, 2006; Littunen and Hyrsky, 2000). Coherently, *Family firm* is a dummy variable equal to 1 if the family owns at least 50% of the equity if the firm is non-listed or at least 20% of the equity if the firm is listed; if not, the dummy variable is equal to 0 (Anderson and Reeb, 2003; Cascino *et al.*, 2010).

Control Variables. Control variables regard firm-specific characteristics. *Firm size* is measured as the logarithm of domestic sales, while *Large firm* is a dummy variable equal to 1 if the firm is a large firm (Pantea *et al.*, 2017). *Firm age* is given by the logarithm of firm age (Hölzl, 2014). Firm size and age are included as they influence the propensity to innovation (Bannò, 2016). We control for the internationalization of the firm, considered through a dummy variable *MNE*. Multinational firms have greater knowledge and can better capitalize on investments in innovation (Kafouros *et al.*, 2008; Kotabe *et al.*, 2002). Since the propensity for innovation is associated with the profitability of the firm, related control variables are included in the analysis (Hanel and St-Pierre, 2002). Firm profitability is considered through the variables *ROI* (i.e., return on investment) and *ROE* (i.e., return on equity). A measure of risk is also included in the analysis; *Risk* is given by the standard deviation of return on assets in the previous five years (Miller and Chen, 2004). Since the availability and the cost of capital can limit the ability of firms to invest in innovation, we control for the variable *Liquidity ratio* measured as the ratio of current assets and current liabilities (Goodstein and Boeker, 1991) and the variable *Leverage* computed as debt on equity (Simerly and Mingfang, 2000). *Fixed assets* and *Gross investments*, which is given by the annual growth rate in fixed assets (Van Roy *et al.*, 2018), are included. The variables *Labour costs* and *Value added per employee* are also considered (Bannò, 2016). The geographical area in which the firm operates is

considered as the context can affect both the strategy and the performance of firms and a dummy variable *North* equal to 1 if the firm is located in North Italy (Bannò *et al.*, 2015; Wright *et al.*, 2007). Finally, the type of industry is included based on the Pavitt Taxonomy with the aim to capture the structural differences among industries (Pavitt, 1984).

3.3 The econometric models

Since only firms that innovate may hold a patent in AI and big data, the two-stage procedure proposed by Heckman (1976, 1979) is adopted to test our hypothesis. Specifically, the first-stage selection equation estimates the probability of a firm innovating, while the second-stage regression estimates the number of patents registered in AI and big data conditional on the results obtained in the first stage. Formally, the equations are defined as follows:

First stage equation:

Innovation = *f* (*Family firm, Firm dimension, Firm age, Multinational enterprise, ROI, Labour costs, Productivity, Gross investments, Slack resources, North, Industry*)

Second stage equation:

Innovation in AI and Big data = *f* (*Family firm, Large firm, Firm age, ROE, Risk, Liquidity ratio, Leverage, Fixed assets, North, Industry*)

4. Results

4.1 Descriptive statistics

Table 3 reports the means and standard deviations for the explanatory variables both for the whole sample (Panel A) and for the two subsamples of FFs and non-FFs (Panel B)².

Tab. 3: Descriptive statistics

Variable	Panel A Full sample (4,150 firms)				Panel B			
	Mean/%	Std. Dev.	Min	Max	Family firms (2,538 firms, 61%) Mean/%	Std. Dev.	Non-family firms (1,612 firms, 39%) Mean/%	Std. Dev.
Innovation	0.50	0.50	0.00	1.00	0.49	0.50	0.51	0.50
Innovation in AI and big data	0.51	7.94	0.00	475	0.24	0.30	0.93	0.99
Family firm	61.16%	0.49	0.00	1.00	-	-	-	-
Firm size	6.83	1.21	0.00	10.45	6.79	1.13	6.89	1.33
Large firm	12.82%	0.33	0.00	1.00	10.68%	0.31	16.19%	0.37
Firm age	1.43	0.25	0.48	2.19	1.45	0.24	1.40	0.28
MNE	37.52%	0.48	0.00	1.00	36.45%	0.48	39.21%	0.49
ROI	6.28%	9.46	-29.72	29.71	6.47%	9.01	5.98%	10.11
ROE	6.54%	22.99	-144.23	109.26	6.86%	21.15	6.02%	25.62
Risk	4.52	11.47	0.03	327.88	4.12	11.59	5.15	11.25
Liquidity ratio	1.53	1.35	0.02	9.91	1.51	1.33	1.57	1.40
Leverage	1.48	16.99	-294.84	742.50	1.55	15.18	1.38	19.52
Fixed assets	102.57	1311.00	0.00	56892.57	41.39	388.46	198.90	2042.94
Gross investments	138.15%	6794.33	-100.00	435798.56	197.53%	8674.10	44.66%	621.71
Labour costs	11.71	61.68	0.00	2002.00	7.78	36.76	17.90	87.22
Value added	105.71	1391.01	-3159.07	88708.12	76.65	173.82	151.48	2220.85
North	71.61%	0.45	0.00	1.00	69.86%	0.46	74.38%	0.44
Pavitt science based	12.43%	0.33	0.00	1.00	9.38%	0.29	17.25%	0.38
Pavitt specialised suppliers	27.40%	0.45	0.00	1.00	25.73%	0.44	30.02%	0.46
Pavitt scale and information intensive	11.88%	0.32	0.00	1.00	12.29%	0.33	11.23%	0.32
Pavitt suppliers dominated	39.30%	0.49	0.00	1.00	43.50%	0.50	32.69%	0.47
Pavitt other	8.99%	0.29	0.00	1.00	9.10%	0.29	8.81%	0.28

Exactly half of the firms in the full sample hold at least one patent and there is no difference between FFs and non-FFs regarding the propensity to patent. On average, firms in the full sample

² The correlation matrix, available upon request, shows the acceptable correlation indexes (Greene, 2003).

registered 0.51 patents in AI and big data. While FFs hold on average 0.24 patents in AI and big data, non-FFs hold 0.93 patents.

In the sample considered, 61.16% of firms are FFs according to the Italian distribution. Non-FFs are larger than FFs while firm age is similar. 37.52% of firms in the full sample have a multinational status; this percentage is slightly higher in the case of non-FFs (39.21%). Further differences emerge when analysing the other control variables except for location and type of industry.

4.2 Empirical findings

Table 4 shows the regression results for the models developed.

Tab. 4: Regression results

	First stage		Second stage	
	Coeff.	Std. err	Coeff.	Std. err
Family firm	0.1097 ***	(0.0436)	-0.8536*	(0.5127)
Firm size	0.1465 ***	(0.0199)		
Large firm			1.3456 **	(0.6399)
Firm age	-0.0017 *	(0.0012)	-0.0038	(0.0147)
MNE	0.4951 ***	(0.0471)		
ROI	-0.0027	(0.0022)		
ROE			-0.0013	(0.0101)
Risk			-0.0053	(0.0253)
Liquidity ratio	0.0073	(0.0154)	-0.0741	(0.0784)
Leverage			-0.0348	(0.0784)
Fixed assets			0.0001	(0.0001)
Gross investments	0.0001	(0.0000)		
Labour costs	0.0001 ***	(0.0001)		
Value added			-0.0001	0.0001
North	0.4279 ***	(0.0486)	0.0514	(0.6554)
Pavitt science based	1.0304 ***	(0.0946)	1.3550	(1.2801)
Pavitt specialised suppliers	0.7839 ***	(0.0838)	-1.2238	(1.2055)
Pavitt scale information intensive	0.4472 ***	(0.0940)	-1.0960	(1.3088)
Pavitt suppliers dominated	0.0336	(0.0799)	-0.2686	(1.1963)
Observations	4,150			
Rho	-0.1624	(0.0414)		
Sigma	11.155	(0.1795)		
Lambda	-1.8126	(0.4718)		

Standard errors in parentheses. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Family firm has a positive and significant impact ($b = 0.1097$, $p < 0.01$) on firm innovation (First stage). Instead, *Family firm* has a negative and significant impact ($b = -0.8536$, $p < 0.10$) on firm innovation in Ai and big data (Second stage). Our hypothesis is thus confirmed: FFs tend to innovate in AI and big data less than non-FFs.

Firm size has a positive and significant impact on the propensity to innovate ($b = 0.1465$, $p < 0.01$, First stage), while *Large firm* has a similar but larger impact on innovation in automation ($b = 1.3456$, $p < 0.05$, Second stage). *Firm age* has a negative significant impact on a firm's innovation ($b = -0.0017$, $p < 0.10$, First stage), while a non-significant one on the probability to innovate in Ai and big data. The multinational status of the firm increases its propensity to innovate ($b = 0.4951$, $p < 0.01$, First stage). Generally, indexes related to the economic and financial situation of the firm do not have a significant impact on its propensity to innovate and innovate in AI and big data. The only exceptions are *Labor costs* that has a small positive effect on the propensity to innovate ($b = 0.0001$, $p < 0.0001$, First stage). The variables *North* and those describing the industry have positive and significant impact in the first stage and not significant in the second one.

As robustness checks, we examined the impact by distinguishing the two types of technologies, i.e., AI and big data. The results obtained are consistent with the previous ones. *Family firm* has a

negative impact on both types of innovation. More in detail, the impact of *Family firm* is smaller in the case of innovation in AI ($b = -0.2321$, $p < 0.10$; Second stage) and larger and significant as regards innovation in big data ($b = -0.612$, $p < 0.01$; Second stage). Our hypothesis is thus confirmed also when distinguishing for the two types of technologies.

5. Conclusions

The existing literature on AI and big data has primarily focused on their consequences on employment, the well-being of employees, and the productivity of firms. Our study builds on this literature by analysing the specific case of family firms' strategic decision to innovate in AI and big data in FFs. Specifically, based on SEW, our study examined the effect of family involvement confirming the complexity of this choice (De Massis *et al.*, 2013; Dibrell and Memili, 2019). In this study, we showed that when analysing how FFs take strategic decisions regarding innovation, it is fundamental to consider the type of innovation (i.e., specific technology) because it may generate different goals in the family decisors and thus different strategic decisions. In the case of innovation in AI and big data, we showed that the possibility of achieving productivity gains is neglected, while the negative impacts of AI and big data in terms of lower firm employment and employees' satisfaction and well-being is instead highly regarded. This should be considered a first relevant contribution in both the family business literature and the innovation literature.

As a second contribution, using the SEW lens, we end with some useful and interesting explanations for the propensity to innovate in AI and big data. Our results showed that in FFs the decision to innovate in AI and big data is not solely influenced by the traditionally analysed (mainly economic) aspects, but on the contrary, also on non-economic goals. Specifically, in the case of innovation in AI and big data, the impact on three main reasons rooted in SEW preservation are relevant: the care for the satisfaction and well-being of the employees; the inner pride of building and maintaining the reputation; the inner feeling to be socially responsible.

Our study has policy and managerial implications. Evidence from our study could be used to design public policies that promote the invention and application of AI and big data by helping firms carefully evaluate the positive and negative aspects and overcome any resistance due to the influence of SEW on strategic decision-making, an aspect that is particularly relevant in FFs. From a managerial point of view, our study highlighted the critical issues that firms must consider when making strategic decisions to innovate in AI and big data.

Further research is still necessary to analyse how SEW affect strategic decisions in FFs. First, regarding innovation, we call for future investigations that consider how different types of innovation (i.e., specific technology) may generate different emotions and goals in the (family) decision makers and thus different strategic decisions both for family and non-family firms. For innovations other than the one in AI and big data, aspects other than the impact on employees, the community and stakeholders might be relevant.

Second, we consider that different goals may arise among heterogeneous family firms. FFs present, for example, heterogeneity in terms of ownership configurations, board composition and number of generations involved. Accordingly, those characteristics may create differences in terms of SEW and in terms of non-economic goals (Miller and Le Breton Miller, 2014). This aspect needs further investigation.

Finally, future investigation should gauge how family concern for employees, community, and stakeholders may affect other strategic decisions (e.g., internationalization, product diversification). In fact, for some strategic decisions family concern for employees, community, and stakeholders may not be relevant and thus not influence the choice.

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