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italian journal of management

sinergie

Vol. 41
Issue 2

MAY-AUG
2023

Boosting knowledge & trust for a sustainable business

Selected papers from Sinergie-SIMA 2022 Conference
Bocconi University, Milan - June 30th and July 1st 2022

Italian Society of MANAGEMENT

FONDAZIONE CUEIM

Official Journal of Italian Society of Management

Vol. 41, Issue 2, 2023 ISSN 0393-5108 ISSN 2785-549X

sinergie

italian journal of management

Official journal of Italian Society of Management

VOL. 41 ISSUE 2 N. 121	**Boosting knowledge & trust for a sustainable business**	MAY-AUG 2023

Sinergie Italian Journal of Management is a peer-reviewed scholarly publication focusing on the principal trends in management studies.

Formerly *Sinergie rivista di studi e ricerche*

Published quarterly

Founded in 1983

ISSN 0393-5108 - ISSN 2785-549X

Open access at *www.sijm.it*

Indexed in Scopus (as from 2021), Google Scholar, ACNP, ESSPER

Sinergie Italian journal of management is published by Fondazione CUEIM, a foundation aiming to carry out and to promote scientific research, especially in the fields of business administration and of organizations management, both profit and non profit.

Sinergie Italian journal of management is the official journal of SIMA, the Scientific Society of Italian Professors of Management, whose aim is to contribute to the development and dissemination of management knowledge in the academic, economic and social fields, on an excellence basis.

The editing activity is sponsored by Consorzio Universitario di Economia Industriale e Manageriale - CUEIM - www.cueim.it

Peer reviewed journal

Journal accredited by AIDEA

Questa testata è associata a USPI Unione Stampa Periodica Italiana

Sinergie Italian Journal of Management
Via Interrato dell'Acqua Morta, 26
37129 Verona (VR), Italy
Tel. +39 045 597655
www.sijm.it

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italian journal of management
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Original Research Papers

Useful information for readers and authors

Aphorisms

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italian journal of management
Vol. 41, Issue 2, 2023

1. *Take rest; a field that has rested gives a beautiful crop.*
   (Publio Ovidio Nasone)

2. *Smile, breathe and go slowly.*
   (Thích Nhat Hạnh)

3. *There is more to life than increasing its speed.*
   (Mahatma Gandhi)

4. *Act as if what you do makes a difference. It does.*
   (William James)

5. *It is never too late to be what you might have been.*
   (Mary Anne Evans)

sinergie
italian journal of management

ISSN print 0393-5108
ISSN online 2785-549X
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Creating value in management academies

Alberto Pastore - Marta Ugolini

Dear readers of the *Sinergie Italian Journal of Management*,

our management scholars community is currently faced with some challenges of great importance that are inherent in the mechanisms that influence our ability to create value.

Thanks to the work of our academic societies, in recent years we have consolidated our identity and defined our reference principles and objectives: to create value for society and the economy, (in terms of relevance and impact); through research, teaching, third mission and service activities; within a system characterized by ethics, transparency, merit; in an international context that still pays attention to enhancing the specificities and culture of our country; in full synergy with all stakeholders, i.e.companies, institutions, civil society.

These are the principles and goals that guide us, but the path is fraught with obstacles and we are moving within a very complex system.

In recent years, the academic communities of management scholars in Italy and abroad are facing essential issues, chief among which are the crisis in the credibility of knowledge produced in management, due to factors of relevance and integrity, and the need to improve evaluation systems and consequently incentive systems.

There are several international organizations that have recently focused on these problems and their proposed solutions. It is very important for these analyses and the resulting recommendations to be taken up by the various national academic communities and for individual scholars to become aware of them. To date, there is still a gap in awareness on this issue. To fill this gap, we hereby draw attention to IFSAM, RRMB, DORA, which are some of the most interesting sources.

IFSAM is the International Federation of Scholarly Associations of Management, with 23 member academies from all continents, including SIMA. Among its activities, IFSAM produces Policy Statements offering guidelines on the most relevant issues affecting the management academy. In this area, when faced with issues concerning the direction and evaluation of research activities, IFSAM identifies a number of recommendations in its recent "Position Statement on management research": "direct research on relevant issues in order to create economic and social value; acknowledge researchers for the value of their scientific production; promote and support scientific journals owned and managed by academic societies; value publications such as research books, research-based didactic books, as well as journals with regional impact; value contributions to management practice and society in the same way as scientific contributions to the development of informal knowledge; promote a perspective on the evaluation of management research that is pluralistic and contextualized"[1].

[1] IFSAM Position Statement on management research, www.ifsam.org

RRBM Responsible Rersearch for Business Management is a network that was established in 2018 to address the challenges of producing credible management knowledge that is ultimately useful in tackling problems that are important for businesses and society. Responsible research ensures the production of credible knowledge that can be used to inform progressive government policies and promote positive business and management practices. Also in 2018, RRMB's Positioning Paper was published, and emphasized that responsible research depends on a complex network (composed of researchers, journals, editors, faculty evaluation committees, senior faculty, deans, funding and evaluating agencies, school or university ranking publishers, business school academies and associations, practitioners and policymakers). According to RRMB, this network must "support, recognize, and reward the following seven principles in a coordinated fashion.

1. Service to Society: Development of knowledge that benefits businesses and the broader society, locally and globally, for the ultimate purpose of creating a better world.
2. Valuing Both Basic and Applied Contributions: Contributions in both the theoretical domain to create fundamental knowledge, and in applied domains, to address pressing and current issues.
3. Valuing Plurality and Multidisciplinary Collaboration: Diversity in research themes, methods, forms of scholarship, types of inquiry, and interdisciplinary collaboration to reflect the plurality and complexity of business and societal problems.
4. Sound Methodology: Research that implements sound scientific methods and processes in both quantitative and qualitative, or both theoretical and empirical, domains.
5. Stakeholder Involvement: Research that engages different stakeholders in the research process without compromising the independence of inquiry.
6. Impact on Stakeholders: Research that has an impact on diverse stakeholders, especially research that contributes to better businesses and a better world.
7. Broad Dissemination: Diverse forms of knowledge dissemination that collectively advance basic knowledge and practice"[2].

DORA, The Declaration on Research Assessment established in 2012, has become a worldwide initiative covering all scholarly disciplines and all key stakeholders including funders, publishers, professional societies, institutions, and researchers. The declaration recognizes the need to improve the ways in which the outputs of scholarly research are evaluated. Within the Declaration, "a number of themes run through these recommendations:

- eliminate the use of journal-based metrics, such as Journal Impact Factors, in funding, appointment, and promotion considerations;

[2] RRMB Position Paper, www.rrbm.network

- assess research based on its own merits rather than on the basis of the journal in which the research is published;
- capitalize on the opportunities provided by online publication (such as relaxing unnecessary limits on the number of words, figures, and references in articles, and exploring new indicators of significance and impact)"[3].

As anticipated, thanks to the activities of the Academic Societies, the debate on these issues is high on the agenda even in our country. Within SIMA, an intense debate on the subject has been open for a number of years, which has led, among other things, to the production of a positioning paper on "The Profession and Career of the Management Scholar", which offers guidelines for the direction and evaluation of the activities of management scholars in research, teaching, third mission and service activities.

An important discussion in the community and with stakeholders took place at the successful 2023 Sinergie-SIMA Management Conference at the University of Bari and LUM University. In particular, important insights emerged from the panel discussion on "Quality and evaluation in the academic career: the current challenges of the scholarly profession" with contributions from Antonio Uricchio - President of ANVUR, Sandro Castaldo - President of IFSAM, Guido Cristini - Member of CUN Area 13, Alberto Pastore - Founding President of SIMA, Michele Pizzo - President of AIDEA, Alessandro Zattoni - President of EURAM. This meeting focused particularly on the evaluation system and its areas in need of improvement by aiming, on one hand, at ensuring transparency and merit - thus countering unethical behavior and opportunism, and on the other at directing its activity towards the production of value for society and the economy.

The discussion also made it possible to decline some operational proposals for the adjustment of evaluation and selection systems for scholars (e.g., breaking free from the hegemony of the research factor and enhancing other dimensions of the profession, introducing the test for the teaching assessment and the discussion of qualifications and curricula vitae during selections, measurement of real impact, activity for at least three years in the previous role before being eligible to qualiy for the next role) and for the system of evaluation of research performance (e.g. introduction of the discussion of publications during selections, replacement of median/ thresholds with appropriate productivity standards for NSQ evaluations (ASN), elimination of misuse of journal-centered bibliometric metrics).

As is well known, in the broad field of business studies, "political" action is carried out within the AIDEA, which has assumed the role of a second-level society formed by Scientific Societies in the field since 2018. Important results for Italian business scholars have been achieved in this sphere (e.g., establishment of sub-Gev 13/B, a specific organization with the intent of evaluating research performance for business academies). Two additional relevant guidance documents, which have been prepared by the AIDEA, will be released in the upcoming months. The first stems from the appreciation of the "The profession and career of the management

[3] DORA Declaration on Research Assessment, www.sfdora.org

professor" guidelines produced by SIMA.: The AIDEA, which fully valued the work that had been carried out by SIMA, decidd to produce a similar guideline entitled "The academic in economic-business disciplines: roles, criticisms, challenges and career evaluation" for the entire community of Italian business scholars. The second document is addressed to our institutional interlocutors and contains precise requests for action to improve the evaluation system at all levels.

Before concluding, we would like to draw attention to one more critical aspect of the research system, which concerns the role of academic journals and their publishing houses. The current problems in this regard are manifold. The system of communicating research results is actually constituted by an oligopoly of large publishers. Researchers are constrained by the dynamics of the "publish or perish" principle, so in order to ensure that their research is valued , they are compelled to deal with the available publication channels and adapt to their logic. In many cases, they are forced to incur publication costs, and the results of their research are not freely accessible to the entire community. Although the system opened up thanks to digitization and open access publications, additional problems related to the multiplication of erroneous and unethical research papers and to wasteful, or 'predatory', journals, emerged. Unfortunately, the line of reasoning behind publishing houses or specific publishing initiatives is often based on commercial, rather than scientific, principles. There are now numerous cases of editors and editorial boards of journals being forced to resign due to disagreements with the commercial policies of publishing houses. The extreme pathology in this regard is represented by predatory journals, which tend to become more and more widespread by appealing to the "publish-or-perish" sensibility of less capable researchers who are driven by necessity and opportunism.

As far as these issues are concerned, the orientation of international organizations is quite clear and favors the enhancement of Open Access journals, whose content is available free of charge, and where scholars publish free of charge, while being strongly directed from a scientific point of view by a Scientific Institution or Society, even within a regional context, at times. All these aspects characterize and may be found in the Sinergie Italian Journal of Management.

The process of dissemination of research results is valueable and can be carried out more properly if it is managed within an institutional and scientific system. Such a system should be supported financially and technically by public institutions, and managed scientifically by academic ones.

We have offered just a few thoughts on the challenges to Creating Value in Management Academies. Of course, the game is played at all levels: policies, rules, evaluation and incentive systems, funding, projects, scholarly and associative activities; at the four dimensions of the profession: research, teaching, Third Mission, service activities; at a national and international level; and involving institutional, academic, associative, and support actors. We all participate as individuals and as management scholars. We fortunately do a wonderful job, but let us not forget that we

have to contribute to the creation of value for society and the economy on a daily basis by operating with ethical sense, spirit of service, sense of community, and respect for all our stakeholders.

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sinergie
italian journal of management

ISSN print 0393-5108
ISSN online 2785-549X
DOI 10.7433/s121.2023.01
pp. 11-15

Best papers

Alternative platform-based market-entry models and strategies: a smart construction case study[1]

Received
15th February 2022
Revised
7th August 2023
Accepted
8th August 2023

Inka Lappalainen - Susanna Aromaa - Katri Valkokari
Arto Wallin

Abstract

Frame of the research. *Despite the expanded research and innovation activities related to smart construction, there remains a lack of empirical studies on the emergence of platform businesses and related market-entry models and strategies. Thus far, studies have focused more on the technologies themselves and on the single-firm level but less on platform-based value compositions at the ecosystem level.*

Purpose of the paper*. This study aimed to increase empirical understanding of the emergence of platform-based businesses from an ecosystem perspective and examine alternative market-entry models and strategies in smart construction.*

Methodology*. The empirical study is based on a longitudinal qualitative and multimethod case study conducted in Finland between September 2020 and December 2021.*

Results*. First, the results demonstrated the emergence of platform-based businesses from an ecosystem perspective and the 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. Furthermore, platform-based entry models seemed to embed several optional platform entry strategies. Third, the findings indicated the critical role of a clear visionary leader in orchestrating and facilitating a co-evolution process.*

Research limitations*. This empirical study is based on a single case study in an ongoing co-evolution state. Although the findings are tentative, they may open avenues for further studies.*

Practical implications. *This work provides a deeper understanding on the emergence and establishment of platform ecosystems in the field of smart construction. In particular, the adjusted conceptual frameworks may support ecosystem orchestrators and concerned actors when evaluating alternative market-entry models and strategies for further development.*

Originality of the paper. *This paper brings new empirical insights into the identified research gaps by demonstrating the emergence of platform businesses and ecosystem actors who are co-designing alternative platform-based market entry models and strategies in smart construction.*

Key words: platform business; entry models; entry strategies; smart construction; case study; digitalization

[1] *Acknowledgements.* The work was carried out in the KEKO project, funded by Business Finland. The authors would like to thank the interviewees for participating in the study and the whole project group.

1. Introduction

Digitalization has opened up new value creation opportunities throughout different industries. Indeed, the rapidly growing data and platform economy creates new innovation and value creation opportunities not only across industries but also beyond established linear value creation logics. Thus, the 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 digitalization trends and the use of advanced technologies that enable both improved efficiency and completely new value creation opportunities, the construction industry is struggling with significant productivity challenges worldwide. However, there are numerous 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). Furthermore, by enabling digitalization, the platform ecosystem approach can advance systemic changes that are crucial in tackling major challenges, such as sustainability in construction and the built environment (Lappalainen and Aromaa, 2021).

Despite the expanded research and innovation activities related to smart construction, there remains a lack of empirical studies on the emergence of platform businesses and related market-entry models and strategies. Thus far, studies have focused more on the technologies themselves and on 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). Furthermore, a broader view of strategy considerations in the context of platforms is lacking (Pussinen *et al.*, 2023; McIntyre & Srinivasan, 2016). Therefore, the present study aims to increase empirical understanding on the emergence of platform-based businesses from an ecosystem perspective and examine related alternative market entry models and strategies in smart construction. This work builds on theoretical debates and recent studies regarding platform ecosystem characteristics as well as platform-based market-entry models and strategies (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; Valkokari *et al.*, 2022; Pussinen *et al.*, 2023), with a particular focus on the construction industry.

This empirical study, which is based on a longitudinal qualitative case study conducted in Finland between September 2020 and December 2021, aimed to examine the emergence of platform-based businesses in smart construction and the establishment of multi-actor ecosystems and co-innovating platform-based (value) offerings toward co-designing alternative options for market entry. This paper focuses on alternative platform-based market-entry models and strategies in smart construction. In the next section, the theoretical background is presented, followed by the methodology and case description. The paper continues with a summary of the main results and ends with a discussion of the results and a presentation of the study's conclusions.

2. Theoretical Background

This work combines theoretical approaches to the study of critical platform ecosystem characteristics with market-entry models and strategies. To narrow the identified research gaps, we aimed to increase empirical understanding on the emergence of platform-based businesses from an ecosystem perspective and examine related alternative market-entry models and strategies in the field of smart construction.

2.1 Platform ecosystem definition

The concept of a "platform ecosystem" has been widely adopted by both researchers and practitioners in the rapidly growing field of data economy. Platform ecosystems are created around technological platforms that are typically owned or governed by platform leader(s) that connect multiple sides of markets, including users, advertisers, developers, and content providers, to facilitate value co-creation and capture (e.g., Aarikka-Stenroos and Ritala, 2017; Hein *et al.*, 2020; Wareham *et al.*, 2014). As platform ecosystems enable nonlinear and dynamic value creation and capture, they also challenge traditional, linear value creation logic, corporate governance models, rules, and relationships between products 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). Within this field, the roles of actors have changed, becoming more diverse in recent years. Furthermore, the entry of new players has also become critical. In this context, (organizational) actors must make a strategic decision to negotiate their roles in the emergent platform ecosystem either as owners or, alternatively, as financers, coordinators, producers, facilitators, or developers (Hein *et al.*, 2020; Lappalainen and Federley, 2021; Valkokari *et al.*, 2017). According to Jacobides *et al.* (2018), ecosystem emergence is enabled by modularity and complementarities. Moreover, the core of ecosystems constitutes combinations of modular complementarities and shared rules of operation (Ibid; cf. Thomas and Autio, 2020).

2.2 Critical characteristics for establishing a platform business

A platform functions as a coordination and control mechanism of a business 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 own resources, assets, and actors (Valkokari, 2015; Thomas and Autio, 2020; Xu *et al.*, 2018). *Nevertheless, what are the critical characteristics required for establishing and orchestrating a platform business?* In their systematic literature review of key platform elements, Sorri *et al.* (2019, p. 9) concluded that 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* (which also includes the main actors), *network effects,* and *governance* seemed to be highlighted in almost all core references in their literature review. Therefore, these were chosen as the focus areas of our empirical study.

Value creation potential and logic involve the identification of actor roles so that value can be created, along with the ways by which the beneficiaries' attraction and commitment can be obtained in a one-, two-or multisided platform within a target market. Furthermore, as a critical differentiation from linear business logic, the *core interaction and mechanisms of network effects* must be designed. Core interaction is defined as the exchange of value that attracts most users to interact on the platform, thus enabling expansion beyond the original core interaction over time to ensure competitiveness and growth (Parker *et al.*, 2016). In addition, "network effects refer to the impact that a number of users of a platform has on value created for each user" (Parker *et al.*, 2016, p. 17). Thus, 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.) To capture value, a revenue model for the platform must be carefully developed to achieve optimal and dynamic pricing (including other incentives) that can serve various actors (Lappalainen and Federley, 2021; Parker *et al.*, 2016).

Regarding *governance*, Hein *et al.* (2020) referred to three alternative archetypes of ownership: 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). A licensing platform and open source can be applied as alternatives to typical owner-based management models (e.g., Parker and van Alatyne, 2009; Parker *et al.*, 2016). 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* comprises both technical and collaborative/contractual mechanisms that enable the 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). It has been reported that the level of openness changes along with 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). Thus, modular architecture makes growing complexity manageable during the platform ecosystem lifecycle.

In addition to these critical elements, Tura *et al.*, (2018) in their comprehensive platform design framework, highlight the concept of *platform competition*, which includes design considerations of a platform's launch, competitiveness, *innovation*, and scalability. Competitiveness in a platform launch and diffusion is achieved by attracting, reaching out to, and maintaining critical mass against incumbent or other new players. As the complexity of a platform ecosystem heightens, increased openness becomes a necessity, calling for different governance mechanisms to balance 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). Interestingly, Isckia *et al.* (2020) demonstrated how platform owners build capabilities and orchestrate

the coupling process between the innovation part and the business development part of platform ecosystems. Consequently, the growth of a platform ecosystem may be very slow in the early phases of its lifecycle despite the fact that businesses based on digital platforms are associated with rapid growth potential (Pussinen *et al.*, 2023).

2.3 Platform entry strategies

Although platform strategies have been studied widely, there is a need to better understand and clarify optimal entry strategies. In their systematic literature review, Wallin *et al.* (2021) identified 22 platform entry strategies under four main categories: (1) Onboarding, (2) Offering, (3) Opportunistic strategies, and (4) Pricing (the least important but not a focus in this paper). *Onboarding strategies* relate to the sequence of entry and preferred user groups. These include entry strategies, such as one-sided launch or simultaneous on-boarding by building multi-sided participation incrementally, marquee users' or producers' strategies, targeting users with dual roles, micro-market launch, and the so-called producer evangelist (e.g., Wallin *et al.*, 2021; Parker *et al.*, 2016; Stummer *et al.*, 2018; Evans and Schmalensee, 2010). This means that a platform must be designed to encourage producers to bring their own customers as users to the platform (Parker *et al.*, 2016, 96). Entry strategies, such as standalone products or services, coring, seeding, or exclusivity agreement strategies, may also be built on the *platform offering* (e.g., Wallin *et al.*, 2021; Parker *et al.*, 2016; Stummer *et al.*, 2018).

Meanwhile, *opportunistic strategies* consist of entry strategies in which the entrant platform avoids huge upfront investments in value creation and captures value the incumbent ecosystem's resources (Karhu and Ritala, 2020). Karhu and Ritala (2020, p. 2) identified three alternative strategies: (1) copying parts of those resources (exploitation), (2) following the development cycle of key boundary resources (pacing), and (3) placing itself inside the platform (injection) (cf. the piggyback strategy mentioned by Parker *et al.*, 2016). Essentially, these strategies challenge and may change the winner-takes-all logic and dynamic that is typical in the platform business (Ibid). Overall, according to Wallin *et al.*, (2021) studies indicate that, in business practice, these entry strategies are typically 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 ecosystems: from generic to contextual frameworks

The emergence and co-evolution of platform ecosystems have mainly been studied theoretically or as ex-post studies of well-known global platform success stories (e.g., Isckia *et al.*, 2020; Sorri *et al.*, 2019). The most classical model of ecosystem co-evolution comprises the lifecycle 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), with an emphasis on ecosystem dynamics regarding value-creation vs. capture and collaboration vs. competition. Alternatively, Gawer (2014, p. 1246) presented an organizational continuum of technological platforms that features a corresponding organizational form, a set of accessible capabilities, and a corresponding type of governance for each degree of interface openness. By calling the framework a "continuum," Gawer (2014, p. 1246) demonstrated a kind of fluidity and the existence of possible evolutionary pathways between 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 transition from a radio-frequency identification (RFID)-centric focus to an Internet-of-things (IoT) focus. The latter enables a combination of data from different sources to facilitate 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) 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 broader than the construction industry itself and includes all other industries that play different roles in a continually adapting built environment, such as a smart city. Accordingly, the ingredients of 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, p. 42). Yet, they did not explicitly refer to a need for construction-related *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 and Aromaa, 2021.)

In summary, this study aimed to increase empirical understanding on the emergence of platform-based businesses from an ecosystem perspective and examine related alternative market-entry models and strategies in smart construction. The main research question is as follows: *What kinds 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 in the current work to empirically examine the emergence of the platform-based business ecosystem in the Finnish construction industry. The entire research process followed an abductive research approach, in which empirical and theoretical explorations were iteratively alternated and intertwined (Dubois and Gadde, 2002). The empirical research target was

related to the 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 to examine the emergence of a platform ecosystem in *smart construction*, from establishing a multi-actor ecosystem to co-innovating a platform-based (value) offering and co-designing alternative entry models and strategies for market entry. The case study is described in more detail in the later sub-section. The aim of the studied platform ecosystem was to offer a complete platform-based solution for the construction phase serving needs of different stakeholders, facilitating the smooth flow of the construction process. The platform aims to enable several activities that can help customers build efficiently, mainly by connecting infrastructure with the material and people flows. It is a private network solution that is easy to deliver and install, providing much-needed service for a variety of stakeholders the construction sites. The seven proof of concepts (POCs), presented in Figure 1, illustrate different applications provided by the proposed platform, such as data-based productivity analytics and real-time monitoring of site resources.

3.1 The empirical research process

We selected participative observation, two-phased thematic interviews, and a collaborative business design workshop as the research methods to study the emergence of a dynamic platform ecosystem in real time. The longitudinal case study was implemented between September 2020 and December 2021 (Table 1).

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 Second-round interview N=12	Nov 2020-Jan 2021 May-June 2021	Recordings, memos 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 observations (Hennink *et al.*, 2011) in weekly Teams meetings as a shared practice of the platform ecosystem actors provided a better understanding of co-innovation and co-evolution as dynamic and long-term processes and facilitated the testing of tentative assumptions along with 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. The participants included representatives from various involved actors, such as builders, suppliers, and equipment rental companies, in addition to system integrators, technology integrators,

connectivity providers, platform architecture developers, and data analytics and application specialists. In the first round, the themes of the interviews covered the following: (1) current and future challenges in the construction and building lifecycle, (2) value co-creation opportunities specified in use cases, and (3) expectations regarding collaborations. In the second round, the themes included the following: (1) co-innovation as a process and its 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. Most of the interviewees were involved in both interview rounds, but some changes occurred due to dynamic participation in the co-innovation processes. Prior to their participation, all interviewees signed an informed consent form, which included information about the purpose of the study and data confidentiality.

As this was a longitudinal iterative case study followed by an abductive research approach, in which empirical and theoretical explorations were iteratively alternated and intertwined (Dubois and Gadde, 2002), the analysis was conducted in several phases throughout the empirical research. The main unit of analysis was the platform ecosystem. Moreover, the raw empirical data were rich enough to cover several research focus areas and were already used in several publications (e.g., Lappalainen and Aromaa, 2021; Aromaa *et al.*, 2021). The qualitative data analysis, which was guided by the research questions, was also based on the main interview themes listed above and the selected theoretical approaches. In a more detailed case description, we presented previous phases and outcomes of the platform ecosystem emergence and related case studies (see Section 3.2).

Furthermore, during the empirical study, the researchers realized that the raw empirical interview data allowed for the examination and construction of *alternative platform-based market-entry models and strategies.* Therefore, the analysis of raw interview data was refocused from certain themes, such as "expectations toward collaboration," "co-innovation as a process and its outcomes," and "business opportunities and interests for a common platform ecosystem." For this analysis, the research question was specified. In addition, a supplementary literature review was conducted regarding critical platform ecosystem characteristics to construct alternative platform-based market-entry models and platform entry strategies. These concepts facilitated preliminary thematic classification in an iterative analysis of selecting, coding, and categorizing the data, as well as further elaborating conceptualization (cf. Sekaran and Bougie, 2016). 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 also presented these scenarios to the key ecosystem actors, who considered 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 an introduction, presentation of the customer case, step-by-step collaborative elaboration of the proposed five scenarios

(individually and within three groups), and a wrap-up among groups with a closing discussion. The researchers collected the scenario materials co-produced by the groups in the flip charts, along with memos from the groups and final discussions. These materials were utilized to finalize the comparison of five platform-based market-entry models and to compare them with entry strategies classified in the literature and presented in the theoretical background section.

3.2 Case description

The aim of the platform was to enable safe and smooth construction processes and to achieve 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, including solution developers, a builder, and a research partner. In addition, various actors joined the ecosystem activities throughout the co-innovation process.

The *co-innovation process and emergence of the platform ecosystem* were initiated by the system integrator (also serving as the key logistics solution provider), who took the orchestrator role and gathered critical actors. These participants represented different roles and specialized knowledge regarding building construction, the related materials' supply chains, and technology development. First, they focused on tracking and monitoring materials to improve material logistics in construction projects. However, due to the collaborative explorations, multiple use cases were co-created, thus 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, which were combined with the digital innovation platform for data storage and sharing among the developers involved. The developed technology infrastructure was then installed at a real building construction site as a physical experimental platform, thus enabling the technical and user experience (UX) validation of POCs. In addition, POC owners, researchers, and the orchestrator conducted evaluations covering technological, data, business, ecological, and UX perspectives.

The *main ecosystem outcomes* resulting from the co-innovation processes are summarized in Table 2.

The new business opportunities related to the seven POCs are summarized in Figure 1: (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.

As illustrated in Figure 1, the construction site smart infrastructure serves as the multi-layered basement for other POCs, thus benefiting different actors in complex and dynamic knowledge-intensive on-site and off-site activitiesthroughout construction projects and related supply chains. The business potential of each POC was evaluated as rather significant in terms of facilitating knowledge-intensive, real-time decision-

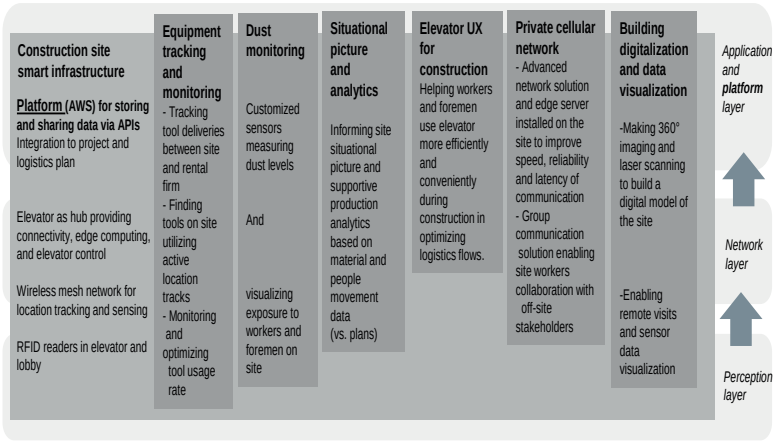
making, transparency, and communication among involved actors on-site and off-site (Aromaa *et al.*, 2021). According to several interviewees, even minor efficiency and productivity improvements can have considerable economic impacts on all involved actors (Ibid.). Moreover, the POCs based on complementariness form a *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 considered a *basis for differentiation and competitiveness*, even in the global construction market. However, as seen in Figure 1, there are also competitive solutions within the systemic platform-based value composition.

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 1) 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.

Fig. 1: Seven POCs posited in the IoT platform framework for the smart buildings

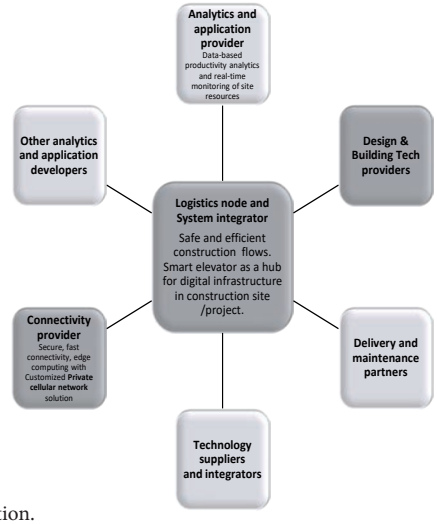


Source: Adjusted from Lappalainen & Aromaa, 2021, p. 11.

As part of the introduction to co-designing entry models in the collaborative workshop, the study participants were asked to specify critical ecosystem actors and related value offerings to ensure differentiation and

competitiveness in the selected target market. A simplified illustration of *the main actors and their roles in the platform-based value offerings* is presented in Figure 2, in which the participants were defined as having critical roles 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 boxes illustrate key actors, whereas the light gray boxes represent numerous partners, mainly SME companies. As can be seen, the logistics node/system integrator serves as an orchestrator of a co-innovation process and an establisher of a platform-based innovation ecosystem. This actor was also considered a natural orchestrator of the platform business ecosystem. Both the orchestrator and connectivity provider are established pioneering and global players with local networks and partners in the areas of marketing, sales, operations, delivery, and maintenance. Among the design and building tech partners, there may be some key partners related to the smart building lifecycle. Furthermore, some design tech partners were identified as critical for competitive value offerings; however, the current co-evolved ecosystem lacked the presence of such partners. Overall, high-level security as well as standardized ontology, modularity, and interoperability were defined as the critical design principles that would enable the technological architecture to produce competitive value offerings.

4. Results

In this section, the main results are presented to address the study's research question: *What kinds of alternative platform-based market-entry models and strategies can be identified in smart construction?* The empirical findings are also integrated into the key concepts and literature presented in the 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 throughout the co-innovation process. We call these "scenarios" because they are still rather general and emergent. These five scenarios were introduced during the co-design workshop, and the participants were asked for further elaboration regarding two aspects: (1) *which of these were the most relevant scenarios and (2) why and whether there were still other alternatives to explore.* Based on the analysis, the 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, namely, *Core interaction and network effects, Innovation potential, Openness (tech.+collab. architecture)* and *Governance*, which were presented previously in the section discussing the study's theoretical background.

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 *limited add-ons* by application developers	*Expanded* networked offering and related operations	Key partners' offering and related operations with *co-innovation potential*	*Joint* 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 *apps store -type platform* 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 *Joint innovation platform* with developer portal	Joint platform among ecosystem actors
Core interaction and network effects	None	Limited	Expanded	Limited	Maximum
Innovation potential	Limited	Limited	Expanded	Great	Maximum
Openness (tech.+collab. architecture)	Closed	Selectively open	Selectively open	Selectively open	Several levels of openness
Governance	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 in Table 3, the five alternative market-entry models vary in several critical ways. For example, Scenario 1 consists of key actors developing their current offerings by operating in their company-specific platforms with the necessary mutual (dyadic) interfaces. However, these platform decisions do not enable original core interactions (*data sharing and combining from multiple sources*) and mechanisms for network effects. Innovation potential is also highly limited due to the mainly dyadic

interfaces; 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 as company-specific platform models, which does *not support to build on those agreed differentiation factors*.

Scenario 2 has the same basis as Scenario 1, but in addition, the connectivity provider serves an apps-store-type platform for SMEs. Therefore, 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. In fact, even selective/limited SME engagement allows serving multiple users in construction projects and sites (with an apps store). However, Scenario 2 still lacks a comprehensive, platform-based value offering as the *main co-defined differentiation factor.*

In Scenario 3, steps toward achieving this type of value offering and platform-based value creation logic are taken when the selected SME partner and analytics and application developer also serve a *joint platform for key partners.* A shared platform enables building on core interactions (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.* In such a scenario, the owner of the platform comes from outside the original partners of the platform ecosystem initiative; however, the company has the valuable strategic and complementary capabilities needed for a competitive and differentiated value offering and market-entry model. A platform licensing model might be considered the relevant governance model among platform owners and other key actors (e.g., the system integrator and the connectivity provider).

Similarly, Scenario 4 consists of the same basis as Scenario 1 while also including a J*oint innovation platform*. This platform decision has great innovation potential and calls for selective openness in technical and collaborative boundary resources to facilitate developer (SME) engagement. However, the fundamental elements of a platform business, such as *core interaction and network effects*, may sometimes be limited in the innovation platform (and activities), especially when key actors launch outcomes in their company-specific offerings and platforms. As shown in Table 3, several alternative governance models for joint innovation platforms can be identified. Further investigations are needed, which is the most relevant model 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 interactions 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 required in terms of technical and collaborative boundary resources.

Among the workshop participants, there were *different views of the relevant market-entry scenarios.* In particular, most of them shared the view of the key partners' offerings, in which key partners operate in their company-specific platforms with necessary mutual (dyadic) interfaces and supplement company-specific offerings. Furthermore, many of the participants supported the idea of exploring two alternative options to enable developer involvement. Scenario 2, including the digital marketplace for SMEs, was considered an important aspect of business-model entry and competitive customer/end-user experience. Scenario 4, which included a joint innovation platform, was also proposed to enable mutual data sharing, experiments, and transparency, in addition to feeding business co-innovation. However, the participants shared the view that a *joint platform ecosystem was not a relevant market-entry alternative (Scenario 5), although it may still form a long-term vision.* Furthermore, the 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, distribution, installation, and maintenance, as summarized in Table 3. Cross-marketing and selling by key partners were mostly supported. This is because, as major global companies, they have established sales and marketing channels and direct customer relations (with 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 also supported. The participants also experienced difficulties in deciding on the optimal model when the offering was still under development. Although key global actors already possessed established channels and local partner networks for distribution and installation, the need for new specialized local partners was also identified.

4.2 Alternative platform-based market-entry strategies

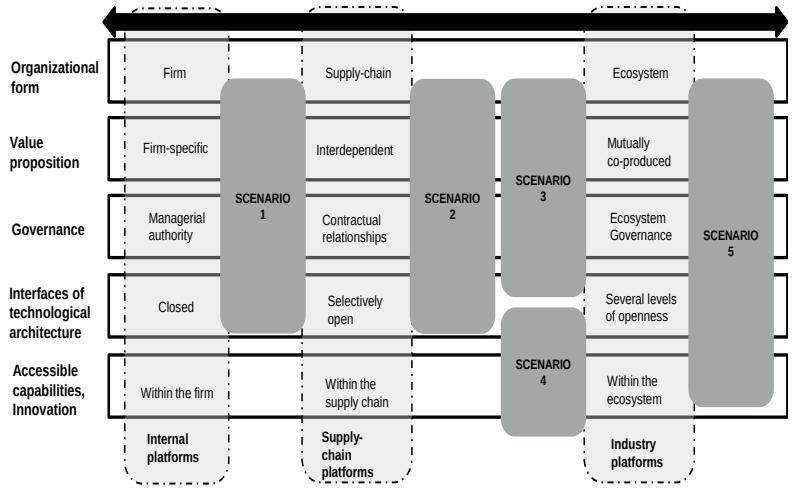
When reflecting on the results from market-entry models to platform entry strategies presented in the theoretical background section, the following interpretations can be made. First, the original vision of the platform ecosystem initiative investigated in the current study was based on *differentiation logic*, a typical concept applied in platform businesses (e.g., Karhu and Ritala, 2020). A complete and systematic 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* is known as the exclusivity agreement, where offering exclusive high-quality content can help [in] signaling positive prospects for the platform and accelerate a platform's growth (Wallin *et al.*, 2021;

Stummer *et al.*, 2018). However, these platform entry strategies seemed to be valid mainly in Scenarios 3 and 5, which were not supported by the workshop participants. Instead, the platform entry strategy focused on onboarding (also known as *producer evangelism*) fit with all five scenarios. This strategy stresses the role of producers in bringing their own customers to the platform (Wallin *et al.*, 2021; Parker *et al.*, 2016). Finally, the study participants strongly supported building on key partners' company-specific platforms with the necessary mutual (dyadic) interfaces and supplementing company-specific offerings (i.e., *Opportunistic strategies*). However, it is important to note that 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. Discussion

In Figure 3, alternative platform-based market-entry models are posited in the adjusted organizational continuum of technological platforms defined by Gawer (2014). This figure highlights the differences among the different scenarios, and 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*, that is, from firm-specific and supply-chain-type platform businesses toward eco-systemic models and strategies. These findings are aligned with previous studies, which also illustrate diverse and novel opportunities instead of mere path dependency (e.g., Gawer, 2014; Leminen *et al.*, 2018).

Fig. 3: Alternative scenarios for platform-based entry models in the integrative framework



Source: Adapted from Gawer, 2014, p. 1246.

The previous literature also supports our research findings, indicating that while platform ecosystem approaches in the construction industry are 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, p. 34) proposed this kind of "Platform over Platform" strategy as the most advanced entry strategy, in which "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".

In summary, first, the longitudinal empirical case study *demonstrated the emergence of platform-based businesses from an ecosystem perspective,* as well as the co-designing of related alternative market-entry models and strategies in the smart construction industry. The original platform ecosystem initiative in smart construction proved to have a very ambitious long-term vision and was challenged throughout the emergence of platform-based ecosystems. To enable novel data and platform business opportunities, there were complex issues to be solved beyond traditional industry borders as well as business and institutional logics. However, the basement was 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). These scenarios highlighted some variations in preferences among the key ecosystem actors. Furthermore, platform-based entry models seemed to embed several optional *platform entry strategies.* This finding is aligned with previous studies, which indicated that in actual 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 the identified and subsequently 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; Isckia *et al.*, 2020). Moreover, they could be seen not only as entry models but also as alternative development steps.

Fourth, the results indicated the critical role of the *clear visionary leader* in orchestrating and facilitating a co-evolutionary process from platform-based innovation toward a platform-based business ecosystem. As earlier platform ecosystem literature shows, platforms are typically established around a focal actor (e.g., Valkokari *et al.*, 2017; Hein *et al.*, 2020; Isckia *et al.*, 2020; Valkokari *et al.*, 2022). In the case study, the main focus was on the co-innovation process and the development of platform-based value offerings among ecosystem actors across traditional industry borders. Furthermore, the first initiatives for co-designing alternative market-entry models were taken to direct further development among key ecosystem actors-a process that revealed the crucial need for common strategic alignment and the guidance of a visionary leader or orchestrator.

6. Conclusions

This study aimed to increase *empirical understanding* on the emergence of platform-based businesses from an ecosystem perspective and examine related alternative market entry models and strategies in smart construction. In this study, such explorations were based on recent discussions on platform ecosystem characteristics as well as platform-based market-entry models and strategies. Regarding its *main theoretical implications,* the study brings forth new empirical insights into the identified research gaps by demonstrating the emergence of platform-based innovations of alternative platform-based, market-entry models and strategies in the smart construction industry from an ecosystem perspective. This study contributes to the literature by structuring and adjusting conceptual frames to analyze the identified alternative platform-based entry models and strategies.

As for the study's *practical implications,* a deeper understanding is provided regarding the emergence of a platform ecosystem in an establishment within the field of smart construction. In particular, the adjusted conceptual frameworks may support ecosystem orchestrators and actors involved in evaluating alternative market-entry models and strategies for further development. This supports the practice-oriented generalizability of our findings, and the, allowing the study to contribute to the very limited literature on strategy considerations in the context of platforms. In other words, the identified entry models and strategies can be generalized in other industries, especially in different business-to-business contexts. Thus, the findings also illustrate how platform-based businesses do not "fit" into the core business logic and culture of a traditional, pipeline-based business, as they require strategic considerations among multiple actors.

Regarding its *research limitations*, this empirical study is based on a single case study undergoing a co-evolution state. Thus, the empirical findings are only tentative and not generalizable; instead, they open avenues for further studies. Therefore, further research may need to continue this study by conducting a follow-up investigation into the subsequent co-evolution phases of a platform-based business ecosystem. Another option would be to expand a single case study into new cases to increase the amount of empirical evidence and verified conceptual frames, as well as to gain a better understanding of platform ecosystem emergence and relevant market-entry models and strategies. Doing so can help support the implementation of the eco-systemic changes that are needed in the construction industry.

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sinergie
italian journal of management

ISSN 0393-5108
ISSN 2785-549X
DOI 10.7433/s121.2023.02
pp. 19-38

Nutritional claims and framing effect: how does the way of communication impact on the product perception?

Received
15th February 2022
Revised
10th July 2023
Accepted
9th August 2023

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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.*

Key words: nutritional claim; sugar claim; framing effect theory; packaging; product perception; consumer behavior.

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") (Buul 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 (2013) 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 (WORLD HEALTH ORGANIZATION, 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 (α>0.70; Cronbach's alpha coefficients are shown in Tab. 1).

Fig. 1: Stimuli

"Only fruit sugar" claim

"No added sugar" claim

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" (α=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
Perceived healthiness (Bui *et al.*, 2013)	Poor source of Nutrients - Rich source of Nutrients	0.914
	Not very nutritious - very nutritious	
	Not healthy - very healthy	
Perceived quality (Dodds *et al.*, 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)	
Attitude toward the product (Muehling *et al.,* 1991)	Bad - Good	0.901
	Unfavorable - Favorable	
	Negative - Positive	
Purchase intention (Kaushal *et al.*, 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.	
Willingness to pay (Konuk *et al.*, 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.	
General health interest (Roininen *et al.*, 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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sinergie
italian journal of management

ISSN print 0393-5108
ISSN online 2785-549X
DOI 10.7433/s121.2023.03
pp. 39-53

United we stand, divided we fall. A co-authorship analysis of management scholars in Italy[1]

Received
9th February 2022
Revised
10th May 2022
Accepted
30th May 2023

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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.*

Social network analysis was then applied to co-authorship publication data to analyse co-authorship dynamics and publication behaviour in four time 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 the community of management scholars and 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 Italian management scholars and on their co-authorship behaviour.*

Key words: bibliometrics; co-authorship analysis; ego-networks; management scholars; Italy

[1] Acknowledgments: We express our gratitude to two anonymous referees for comments on an earlier version of the article and to participants at the EURAM 2022 and SIMA-SINERGIE 2022 conferences for comments and advice.

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 Mitręga, 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, 2020; Van Dalen and Henkens, 2012).

In this scenario, collaborations have become an increasingly common avenue to meet demands for increasing the quantity and quality of 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 the 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. Firstly, using a bibliometric analysis of these scholars' publications, we explore this community's main research themes and publishing journals. Secondly, we conduct a co-authorship analysis to examine 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 84.7% of the Italian Ministry of University and Research (MIUR) universe. We then created a peer group of these 550 scholars and downloaded all 5,294 publications associated to them in Scopus for the period 2000-2019.

Next, Social Network Analysis (SNA) was applied to this co-authorship publication data to investigate co-authorship dynamics and publication behaviour in four time windows (2001-2005-2010-2015-2019). Various co-authorship behaviours were then analysed through ego-networks.

This work presents some novelties. 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, concerning Italy, this research is the first work on the Italian management community with

results that can be compared to 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, interesting transformations emerged, identifying some different ideal types and highlighting a relevant generational shift. In the first time windows, few collaborative activities emerged and were essentially related to the academic pyramidal structure with the full professor at the top. In the last two time windows, a very dense network of relationships has emerged, characterised 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 contributions 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 1995-1999, verifying also the theory of small words (Watts and Strogatz, 1998; Milgram, 1967). Next, Barabasi *et al.* (2002) investigated the dynamics and evolution of co-authorship networks in mathematics and 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 (Glänzel and Schubert, 2004; 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 has been given to network topologies and dynamics (Newman, 2001; Albert and Barabasi, 2002). Most of these studies focus on macro-level network properties, seeking to describe a social network's global characteristics and conceptualise its overall structural features (Yan and Ding, 2009; Capone and Lazzeretti, 2017; 2018).

There has also been research on co-authorship in the social sciences (Glanzel, 2002; 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 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[2].

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 also have negative effects and a 'dark side' due to: compromises, organisational 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).

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, therefore, the mechanism of preferential attachment was not active in this community. Acedo *et al.* (2006) conducted a co-authorship analysis for management and organisational studies focusing on the main international journals. They pointed out a growing tendency of co-authored papers in the management field, 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,

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

pointing out that 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 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, underling 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 the community's main authors and historical evolution, while Sedita *et al.* (2018) used co-authorship analysis to investigate the development of the leading 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 Qualification (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 of co-authorships (network relational positions, etc.).

3. Research design

To fulfil our research aims, we developed a case study on the publication behaviours 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.*, 2020). 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. Instead, 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 collaborations. 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[3].

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 database and not the ISI Web of Science database, as Scopus permits the creation of peer groups and the download of peer group publications. Moreover, the Scopus database is typically larger than the ISI Web of Science database, 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 applied to co-authorship publication data to examine co-authorship dynamics and publication behaviour in four time windows (2001-2005; 2006-2010; 2011-2015; 2016-2019). Finally, co-authorship behaviours were analysed via ego-networks.

[3] 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 identified them; while some others may not have published a paper before 2019.

4. Results

4.1 Descriptive analysis and evolution of publications

Figure 1 presents the evolution of scholarship production by Italian management scholars in the period 2000-2019. Fig. 1a shows the evolution of all publications through time, while Fig. 1b focuses on articles, omitting book chapters and proceedings. Fig. 1c presents the evolution of citations, and Fig. 1d shows the share of contributions published in top percentile Journals, as calculated by CiteScore[4].

According to all figures, production has increased either from a quantitative point of view or from a quality perspective. The number of contributions published in journals in the Scopus database extraordinarily increased, starting from less than 50 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 articles (Fig. 1b), 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)[5] 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.

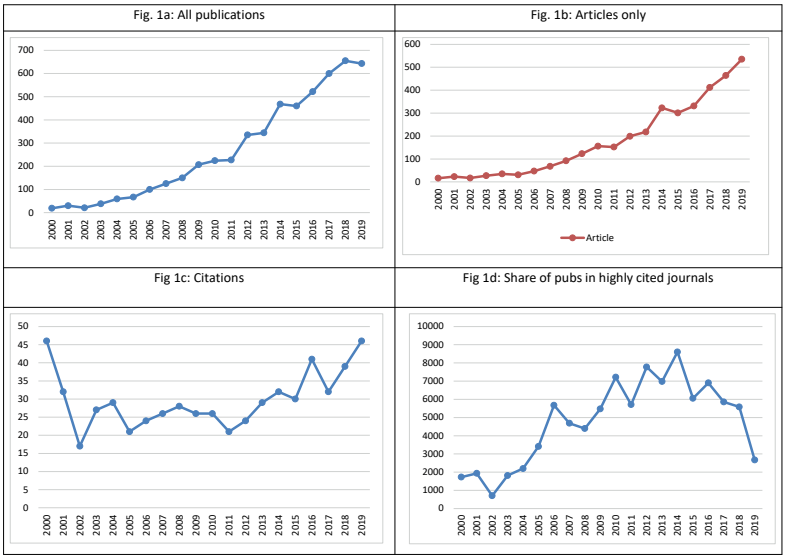
It should also be noted that the increase in quantity was followed by a consequent growth of quality. Fig. 1c underlines the growth in citations of the contributions published by the community.

Examining where the Italian management community publishes, we can also see that their contributions were published in better journals over 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 also an increase in publication quality.

[4] 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.

[5] In Italy candidates to associate and full professorships are required to qualify in a national-level evaluation known as the National Scientific Qualification (ANS) (Abilitazione Scientifica Nazionale). See Bagues *et al.* (2022).

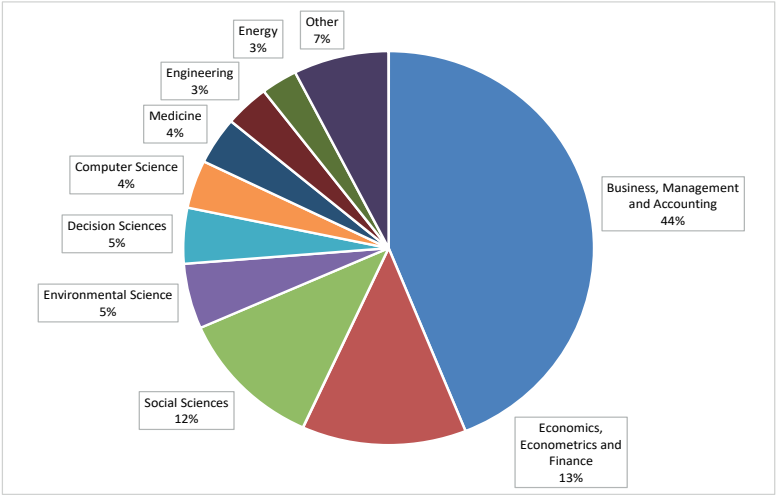
Fig. 1: The evolution of the publications of the Italian Management Scholars, 2000-2019



Source: our elaborations

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 classified by the Scopus database for the 5,294 management publications. 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 the 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 in which the Italian management scholars have published. The table shows all journals in the "A" ranking on the ASN list[6], less four journals highlighted in bold character. This list highlights the importance of publishing in journals with an "A" ranking.

Not all the journals have a similar impact; 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, Research Policy, 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*

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

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, only two journals are classified as 4*, while other journals are classified as 3, 2 and even 1. Thus, while these journals are all in ASN "A" rank, in international rankings, not all are considered top journals. This situation can create opportunistic behaviour, as it incentivises scholars to publish in less important "A" ranked journals, as they have higher acceptance rates and can facilitate recruitment or career advancement.

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 articles 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 present in the first decade disappeared in the second, such as *Journal of Management and Governance* and *L'Industria*. From this point of 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 improve their scientific production and submit their work to top-quality journals. Unfortunately, some of the journals that disappeared in the second period had a good Italian reputation. For instance, the *Journal of Management and Governance* was published by the Italian Academy for Business Economics (AIDEA) and disappeared in the second period.

Another important journal missing in both periods is *Sinergie - Italian Journal of Management*, which was not included in the analysis because it was finalising its inclusion in the Scopus database (Pastore, 2021)[7].

It is also interesting to point out the average number of authors per article[8], underlining the deep changes that the community has faced 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 (Figure 3).

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

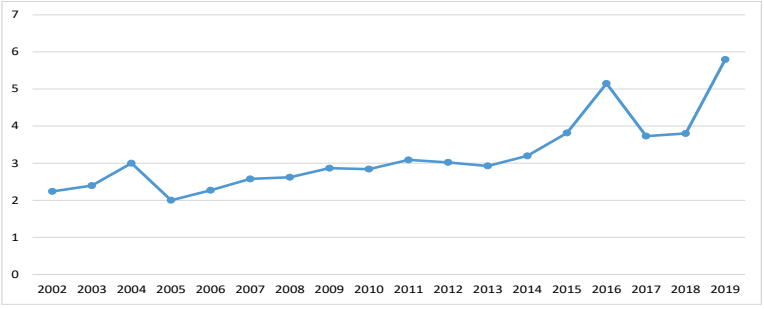
[8] The average number of authors per article has been calculated for each year by dividing the total number of authors by the total number of articles.

Tab. 2: The main publishing journal

Pos	Journals	Pubs	SJR (2019)	3ABS 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	1.125	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

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 in the period.

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

We divide the entire period into four time windows in order to investigate four different co-authorship networks: 2000-2005, 2006-2010, 2011-2015 and 2016-2020 (Table 3). Time windows are common in co-authorship and network analyses, as they avoid outliers and allow to analyse collaborations over longer periods (Sedita *et al.*. 2020; Casanueva and Larrinaga, 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. As highlighted previously, the number of co-authors tended to grow during the full period[9].

The overall number of publications went from 234 in 2000-2005 to 2.420 in 2016-2019, indicating a huge growth. Also the number of (unique) authors goes from 336 to 5.996, underlining one more time, the enormous number of collaborations. Furthermore, the maximum number of co-authors in the first period was 13, while in the last window, it almost doubled reaching 20[10].

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

Finally, Social Network Analysis was applied to the co-authorship networks in the four sub-periods. Figure 4 presents the co-authorship networks in the four time windows. Each node represents an author, while a line represents a co-authorship.

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

In the second period (2006-2010), the structure has begun to change and stable groups of researchers are no longer the majority. The overall network is not yet fully 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.

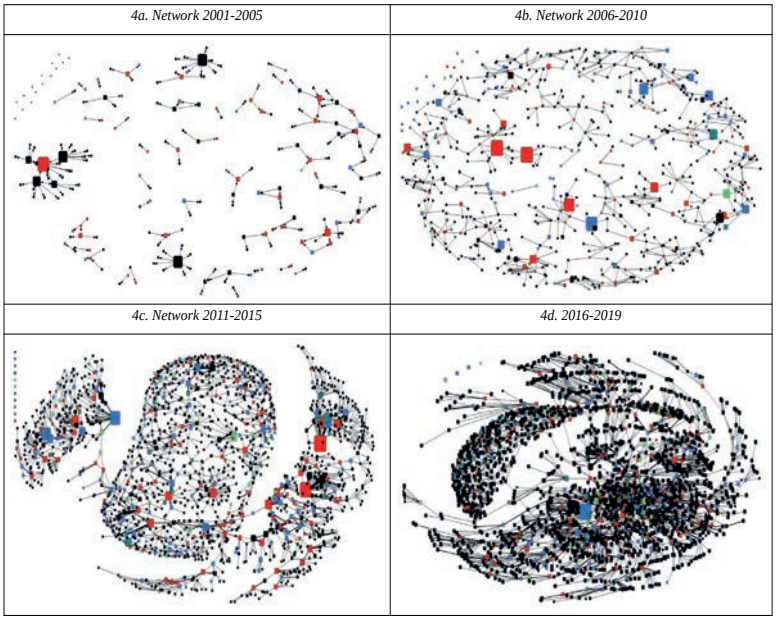
The last two time windows (2011-2015 and 2016-2019) emphasize the growing complexity of the management community with the appearance of a large and wide macro-network of collaborations, not only with local

[9] We remind 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.

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

and national scholars but also with international scholars and other communities. The community of management scholars appears now as a wide and large community, where there is an increasing propensity toward collaborations and co-authorships. Stable and continuous collaborations are not as visually evident as before. The figure highlights how the community has changed its co-authorship behaviour over time (Fig. 4).

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



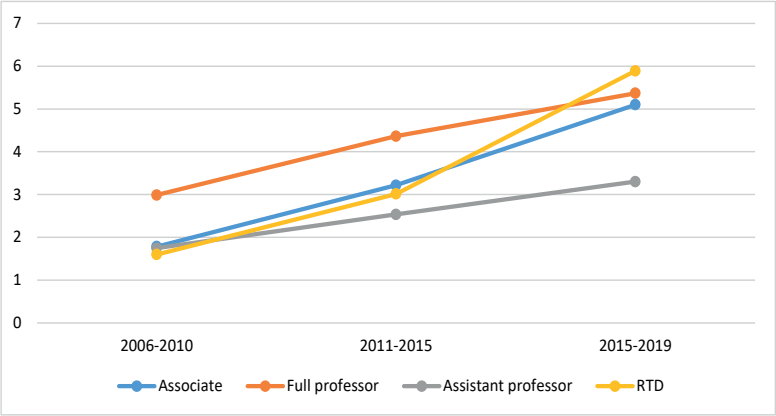
Source: our elaborations. Legend: Red nodes: full professors; Blue nodes: associate professors; Dark green nodes: permanent assistant professors; Light green nodes: fixed-term assistant professors.

Finally, Figure 4 highlights the changes in the prevailing roles across the time windows. In fact, in the first two time windows, the largest nodes and those with more collaborations belonged to full professors (red nodes) and some important associate professors (blue nodes). Besides, in the last two periods largest nodes represent more associate professors (blue nodes) and fixed term assistant professors (light green nodes) (RTD).

This phenomenon is also highlighted in Figure 5, where the average degrees for the various job positions are compared across the last three time windows. In the first sub-period, full professors had more co-authorships than those in other job positions. This effect gradually fades away, and in the last period, the fixed-term assistant professors have more co-authorships than both the associate and full professors. This phenomenon most likely highlights the urgent need for those in the most precarious jobs to publish at all costs, pushing them to expand collaborations to "publish and not perish". We remind, in fact, that fixed-term assistant professors (so called 'RTD') is a temporary position before permanent professorships and it is

particularly critical because it has a fixed duration (3-5 years), after which the candidates that are not confirmed with a higher position are forced to leave the university.

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



Source: our elaboration

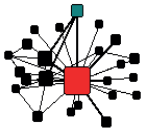
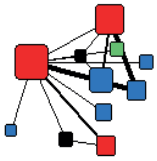
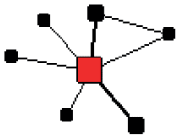
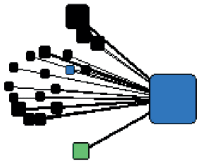
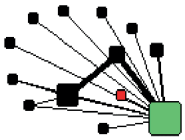
In order to further highlight this '*generational divide*' in terms of position ego-networks were investigated. An ego-network is a network consisting of a focal node ("ego") and the nodes to which it is directly connected (called the "alter" nodes) and the bonds if any between the ego and alters. These 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 is not generalisable. However, it can highlight 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. Some networks typical of the first two periods are presented in the first row. 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 time windows. Figure 6.2 presents an ego-network that can be found in all periods, that is developed at a single university with local collaborations. This network is composed of full professors, associate 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 how the community once was, whereas Figures 6.4 and 6.5 highlight ego-networks that emerged in the last two time windows. 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 many collaborations and publications is a fixed-term assistant professor (RTD), a young scholar. This phenomenon most likely emerged in response to the need to publish at all costs by those in the most precarious positions.

Fig. 6: Some ego-networks of publishing behaviours

6.1. Full professor gatekeeper(first two periods)	*6.2. University research group*	*6.3 Lone 'ranger'(first two periods)*
		
6.4. Coordinator (PA)(last two periods)	*6.5. The rising assistant professor (last two periods)*	
		

Legend: Red: full professor; Blue: associate professor; Dark green: permanent assistant professor. Light green: fixed-term assistant professor.

Source: our elaboration

5. Conclusions

The aim of this paper was to present the evolution of the publications of the Italian management community 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 the number of articles published in international journals with high impact. The study period lasted about twenty years and showed a clear evolution of 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 analysis we identified some different ideal types that highlight a relevant generation shift. In the first period, we had a few collaborative activities that 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. This generational divide is also present in the co-authorships and is the analysis's most relevant result.

The last result concerns the analysis of co-authorships. In general, co-authorship dynamics changed considerably in the period, 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 the University.

In particular, in the last of the four time window, fixed-term assistant professors (RTD) exceeded full professors in terms of research co-authorships. This phenomenon can be related to the 'publish or perish' discourse, where those in the most precarious jobs need to publish at all costs or leave the 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 profound consequence for the future of recruited scholars.

Finally, the study had some limitations as the analyses were limited to papers appearing in the Scopus database containing articles in indexed international journals. We did not consider books and articles in Italian journals, also important to Italian management scholars, such as Sinergie - Italian Journal of Managemen, which only recently finalised the process for inclusion in Scopus (Pastore, 2021). Moreover, an analysis based on the quality of publications, for instance with the number of citations was not conducted. Such 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 of the publishing behaviours and dynamics of the Italian management community. It sheds light on some critical and important issues related to the community's evaluation and recruiting policies.

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sinergie
italian journal of management

ISSN 0393-5108
ISSN 2785-549X
DOI 10.7433/s121.2023.04
pp. 55-74

Selected papers

Women and international strategy: preliminary results

Received
15th February 2022
Revised
7th March 2023
Accepted
10th July 2023

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Abstract

Framing of the research. *Although the large literature focuses separately on women in the upper echelons and firm internationalization, gender differences in international business research have received little attention. We enrich this field by adopting the liberal feminist theory to enlarge the way to study the relationship between women in the upper echelons of firms and international strategy.*

Purpose of the paper. *Our research question considers the role of women on international strategy. 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. Thus, we aim to detect if and how the (internal and external) context moderates the impact of women in the upper echelons on internationalization.*

Methodology. *To examine the relatioship between the presence of women in the upper echelons and internationalization and the moderating role of the (internal and external) context, we performed an ordinary least squares (OLS) regression analysis on a dataset of 2,861 Italian firms referring to 2017.*

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 women directors. The limitation regarding observation time could be faced considering the period women have been on the board. Women's roles (e.g., CEO) could also be investigated.*

Managerial implications. *Remedial strategies should focus on the firm's development 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 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.*

Key words: women; upper echelon; internationalization; FDI; context; empirical analysis

1. Introduction

This paper aims to advance our knowledge of the role of women on international strategy. We rely on the liberal feminist theory and suggest

that while men and women are equally capable of internationalising, women may face gendered barriers within and outside the firm, hindering internationalisation.

Women represent both a potential source of economic and social development (Ahl, 2006; Farrell and Hersch, 2005; Jennings and Brush, 2013) but they are underrepresented in firm's upper echelons: women were only 32% of directors in European largest firms in 2022 and 8% of chief executive officers and board directors in 2020 (European Institute for Gender Equality, 2022). In recent years, the presence of women in organizations has been considered crucial to achieving sustainable development goals (Eden and Wagstaff, 2021; Akter *et al.*, 2019). At the policy level, since 2013 the European Commission has started to provide direction to improve gender balance on boards and more efforts have been taken towards 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). Policy interventions should therefore lead to an increase in the presence of women in firms. We consider that this topic needs further development and, in particular, as management scholars, we should start to consider the influence of women on a firm's strategies.

Specifically, this paper aims to develop a deep analysis of the role of women in the internationalization strategy by adopting the liberal feminist theory (Black, 1989).

Firm internationalization has received attention as it benefits businesses at different levels (Dagnino *et al.*, 2019). It enhances organizational capabilities and generates new resources crucial to firm performance, survival and growth (Chen *et al.*, 2016; Freixanet and Rialp, 2020). The few existing studies 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. 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). Specifically, we aim to develop a framework that builds a bridge between the two strands of literature: international business and feminist theory. In line with liberal feminism's view, we assume that men and women are essentially the same regarding their ability to internationalize (Ahl, 2006). Still, 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). Still, 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 of the relationship between women in the upper echelons and firm internationalization, adopting the lens of feminist theory and 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 women-led firms are less likely to internationalise when the external and/or internal contexts are non-egalitarian. Our contribution goes to advancing the understanding of strategic decisions related to internationalization, providing immediate applicability to managerial issues and policy recommendations.

2. Theoretical framework

2.1 The missed link between women in upper echelons and firm internationalization

The presence and the role of women inside firms will increase due to the changes and the supportive policy suggestions that are taking place in the last decades. Consequently, the management field needs to advance on this topic, considering women's role in the strategic decision process. Instead, how women in the upper echelons influence firm internationalization has been under-researched and the few studies are 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). However, few existing studies focus on light forms of internationalisation, such as exporting.

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 the 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 internationalize 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 pure phenomenon-driven approach has degenerated into mere empiricism. To advance theoretically on this topic, we aim to provide a framework to interpret the relationship between women in the upper echelons of firms and the decision to internationalise.

2.2 Towards a feminist approach in international business

Moving to analyse how international business has considered women in the upper echelons, we have a surprising result. Until now, no theory has adequately captured firm performance's gendering and 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 concerning 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 is 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 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). Following liberal feminism, we posit that women realize their full potential less frequently because they are

deprived of essential educational opportunities, excluded from key financial networks or employed in lower-paying jobs (Verheul and Thurik, 2001). A growing literature in experimental research demonstrates the influence of environmental factors on women's 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, a stereotype is a widely shared belief about men's and women's innate characteristics that reveal gender discrimination regarding what it means to be a woman or a men upper echelon in society. Evidence associated with women and men stereotypes is abundant: people believe that each gender has typical-and divergent-traits and behaviours (Diekman and Eagly, 2000; Powell, 2018). These beliefs about gender pertain to communal and agentic attributes (Eagly, 1987). Communal characteristics describe a concern with the welfare of other people-for example, affectionate, helpful, kind, and sympathetic- and are typically women attributes (Eagly and Karau, 2002). Agentic characteristics describe an assertive, controlling, and confident tendency -for example, aggressive, ambitious, dominant, independent, and self-confident- and are typically men's attributes (Wajcman, 2013). Both 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 moderating the role of women (Karam and Zaki, 2020). Numerous studies 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 contexts that impede them from realizing their full potential. This paper focuses on non-egalitarian contexts, i.e., men-oriented and patriarchal contexts in which differences between genders are considered 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 operating in an environment characterized by gendered beliefs and 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 of women's role in patriarchal society generates a less favourable social climate concerning 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 of women in the boardroom affects firms' availability of external financing as the outcome of the social construction in a specific institutional context. Access to financing is crucial 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, preferential treatment favouring men-led firms regarding the timing and delivery 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 efficiently and economically, 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 must adapt the internal structure (e.g. labour division, hierarchy, skills acquisition) (Chandler, 1977). For example, the transition from the small to the big stage emanates from factors such as increased professionalization and formalization. In an open, innovative, heterogeneous and dynamic environment, those

organizational futures state for an egalitarian context. In these contexts, where the barriers as mentioned earlier 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 a minority group. They thus risk being a symbol without visibility and power, not receiving recognition for their contribution (neither for a formal position in the firm) and, in short, not receiving the same consideration as their men counterparts.

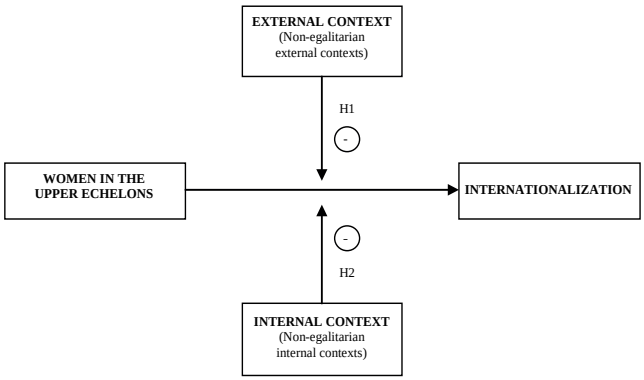
Gendered barriers generated from the internal context are the result of several causes: gender discrimination and stereotypes, undervaluation of women's work, gender-based labour market segmentation, a culture that leads to treating men and women unequally, and finally, the issue of work-life balance (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 and expectations are captured in the framework shown in Figure 1.

Fig. 1: Impact of women in the upper echelons on internationalization: a conceptual framework



Source: our elaboration

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 the 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 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 of internationalization. The Aida database, which contains information on Italian companies, was used to collect 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. 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: $\chi 2$ 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 firm 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). FDIs are a demanding mode of internationalization because they require higher investment costs and committed human resources. They, therefore, require more difficult and critical strategic choices. The selection of FDIs as a dependent variable should therefore provide a clearer picture of the impact of women directors on strategic decisions when internationalizing.

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 based on 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 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: the great differences across Italian regions regarding gender roles. Recent studies show the non-egalitarian context of Southern Italy where a traditional, patriarchal, and men-oriented view is the predominant: the woman is traditionally seen as the homemaker while the man is 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 regarding 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 firms, gender stereotypes might be less frequent and policies favouring 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, which is 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 the firm foundation (Hölzl, 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 (Kafouros *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 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.

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:
Internationalization = ƒ(Women directors; External context; Internal context; Control variables)

Model 1:
Internationalization = ƒ(Women directors; Women directors X External context; External context; Internal context; Control variables)

Model 2:
Internationalization = ƒ(Women Directors; Women directors X Internal context; External context; Internal context; Control variables)

To test our hypotheses, we perform ordinary least squares (OLS) regression analysis (Greene, 2003).

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 firm	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 (men 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

Source: our elaboration

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 comprises 2,861 Italian firms where only 43% register at least one woman among the board members. 1,454 out of 2,861 firms (around 54%) are multinational; 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).

Tab. 2: Descriptive statistics

	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%)	
Variable	**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

Source: our elaboration

In the full sample, the average number of directors (men and women) 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, firms without women directors are not surprisingly smaller than firms in the full sample and firms with women directors. The 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 fewer 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 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, most 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).

4.2 Empirical findings

Table 3 shows the regression results for the three models developed, while Figure 2 reports interaction graphs.

Women directors has a positive and significant coefficient in all models ($b = 0.6435$, $p < .05$ 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 and significant coefficient 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. The internal context reduces the positive effect of women directors.

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

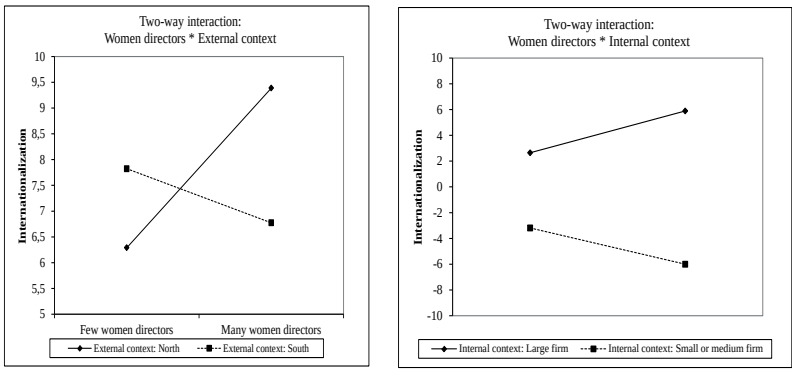
characterized by discrimination against women. Thus, our results confirm that women in the upper echelons experience discrimination from a non-egalitarian external context, which impedes them to internationalize. Figure 2 Left Panel depicts the effect.

Tab. 3: Empirical results

Dependent variable: Internationalization	**Base Model**	**Model 1 External contest**	**Model 2 Internal contest**
Women directors	0.6435 **	0.8383 ***	2.0829 ***
	(0.2698)	(0.2791)	(0.3811)
Women directors * External context		-2.0562 ***	
		(0.7643)	
Women directors * Internal context			-2.4069 ***
			(0.4522)
External context	-0.0017	0.9492	-0.3918
	(0.7704)	(0.8468)	(0.7702)
Internal context	-9.4741 ***	-9.4525 ***	-6.9620 ***
	(0.8297)	(0.8288)	(0.9511)
Firm size	0.0000 ***	0.0000 ***	0.0000 ***
	(0.0000)	(0.0000)	(0.0000)
Firm age	0.0821 ***	0.0822 ***	0.0815 ***
	(0.0132)	(0.0132)	(0.0132)
Innovation	1.9065 ***	1.8885 ***	1.9320 ***
	(0.6086)	(0.6080)	(0.6057)
Board dimension	0.3942 ***	0.3895 ***	0.3312 ***
	(0.1102)	(0.1101)	(0.1103)
Return on equity	0.0316 *	0.0303 *	0.0290
	(0.0181)	(0.0181)	(0.0180)
Return on assets	0.0257	0.0277	0.0235
	(0.0503)	(0.0502)	(0.0500)
Return on investment	-0.1816 ***	-0.1831 ***	-0.1830 ***
	(0.0405)	(0.0405)	(0.0403)
Productivity	0.0000 ***	0.0000 ***	0.0000 ***
	(0.0000)	(0.0000)	(0.0000)
Leverage	-0.0063	-0.0053	-0.0036
	(0.0143)	(0.0143)	(0.0142)
Financial independence index	0.0023	0.0021	0.0045
	(0.0132)	(0.0131)	(0.0131)
Risk	-0.0293	-0.0266	-0.0382
	(0.0467)	(0.0467)	(0.0465)
Available slack resources	-6.7996	-6.9165	-6.6343
	(4.3674)	(4.3629)	(4.3467)
Recoverable slack resources	0.0223 ***	0.0224 ***	0.0213 ***
	(0.0067)	(0.0067)	(0.0066)
Potential slack resources	1.6453	1.4665	1.2309
	(1.8015)	(1.8008)	(1.7946)
Pavitt science based	-1.6529	-1.5332	-1.5456
	(1.4013)	(1.4004)	(1.3947)
Pavitt specialised suppliers	-1.8940 *	-1.8333 *	-1.7733
	(1.0999)	(1.0989)	(1.0948)
Pavitt scale and information intensive	-1.7151	-1.7056	-1.4310
	(1.2635)	(1.2621)	(1.2586)
Pavitt suppliers dominated	-1.3961	-1.3620	-1.2056
	(1.0448)	(1.0437)	(1.0404)
Intercept	7.2680 ***	7.0482 ***	5.5466 ***
	(1.6208)	(1.6211)	(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*

Source: our elaboration

Fig. 2: Interaction effects



Source: our elaboration

Hypothesis 2 is confirmed as the interaction effect of Women directors and Internal context reveals a negative and significant coefficient (b = -2.4069; p < .01 in Model 2). Thus, our results confirm that women in the upper echelons experience discrimination from the internal context and an internal barrier to internationalization. Figure 2 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 (coefficients range from 0.000 to 0.3942 and are all significant at p < .01 in all models). Innovation is also positive and significantly different from zero in all models (b = 1.9065, p < .01 in Base Model; b = 1.8885, p < .01 in Model 1; b = 1.9320, p < .01 in Model 2); innovation allows the firm to develop new products or services to sell internationally. The variables measuring firm profitability matter regarding internationalization except for Return on Assets, which is never significant. Firm productivity has instead a null but significant impact on internationalization. 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 (b = 0.0223, p < .01 in Base Model; b = 0.0224, p < .01 in Model 1; b = 0.0213, p < .01 in Model 2). This result confirms that financial resources availability is a basic requirement for developing a business outside 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 ran other additional models. First, we consider alternative measures of the presence of women in the upper echelons (e.g., the 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 considered 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 internal institutional context in moderating 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 the South and other regions. The coefficients report coherent results to our main regressions.

Due to the presence of both domestic and international firms, we made a Heckman selection model to check for possible selection bias, again finding the same results as the proposed Models in the second step.

In conclusion, all the alternative models produced the same results proposed in the paper.

Finally, 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 interest results involve interactions. Our regressions are thus safeguarded against endogeneity.

5. Discussion and conclusion

Our paper aimed to develop a deep analysis of the role of women in the internationalization strategy by adopting the liberal feminist theory. Our paper has theoretical and empirical contributions and managerial and policy implications.

At the theoretical level, our first contribution is the framework proposed to create a theoretical bridge between the management literature and the feminist theory to develop our understanding and provide insights to overcome the stereotypical idea of women in management (D'Allura *et al.*, 2022). First, we provide evidence that literature on women in the upper echelons and international business is well-developed apart. The first consequence of this development is an extreme lack of coverage of when and how women internationalize. Further, our review underlines that some issues developed in feminist theories may influence the barriers women in the upper echelons of international business face. Building our rationale from the insights of the liberal feminist theory, we argue that men and women have the same capacity. Still, they face different barriers as a result of social construction.This advancement at the theoretical level introduces the role of the internal and external contexts. Thus, bridging feminist theory and management theory is useful to grasp the moderating effect of some aspects that are the clue argument on those and then advance the management theory using an interdisciplinary approach.

Then, we empirically demonstrate that internationalization is not necessarily related to whether the upper echelons are men or women. Still, 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 on this topic. There is no

gendered competence. Prior contributions risk increasing discrimination. The risk arises when considering different firms' strategies due to women's or men's characteristics. Our effort in this paper aims to inspire further theoretical and empirical investigation to create a new basis of knowledge more inclusive of the feminist theory to appreciate the value of diversity and not the increase of stereotypes.

Moving on to managerial and policy implications, we argue that, while the fact that women's 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 internationalize is certainly not a choice but on the contrary the possibility to be heard. Specifically, if gender differences in internationalization are associated with the internal context, remedial strategies might best focus on the firm's development to make it more egalitarian. Otherwise, public incentive programs might need to be targeted toward addressing impediments, including 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.

As with every work, this study is not devoid of limitations. First, our empirical analysis considers the Italian context. Future analysis should explore different contexts both to apply our framework to different social conditions and to explore how culture influences the role of women inside the organisation and in their role as decision-makers.

Concluding, there is a need for a political agenda to generate new knowledge, awareness and culture in the field. Policymakers require methodological reflexivity, the ability to see multiple worldviews, and the need to pay attention to the internal and external context of 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 also about women's empowerment. We believe academic research can play a strategic role in improving our understanding of what and how (men's and) women's contribution is expressed in different internal and external contexts. In particular, we encourage other researchers to focus on the role of women in international business to revisit and rethink the key assumptions of the field. Both those aspects are strategic in the management field to shed light on the role that women may play inside the organisation and, specifically, in the strategic decision process such as internationalisation.

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sinergie
italian journal of management

ISSN 0393-5108
ISSN 2785-549X
DOI 10.7433/s121.2023.05
pp. 77-100

Substance and symbol in ESG-linked executive compensation: evidence from Italian listed companies

Received
10th March 2022
Revised
27th May 2022
Accepted
7th June 2023

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Abstract

***Framing of the research**: A very recent development in corporate governance studies concerns how to integrate environmental, social and governance (ESG) indicators in executive compensation plans. The debate is no longer about whether the use of ESG indicators in executive compensation makes sense, but about how to utilize them 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 the use) of ESG indicators in chief executive officers' (CEOs') compensation plans devised 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 to ESG indicators in their compensation plans.*

***Methodology**: Our sample covers all Italian listed companies on the Financial Times Stock Exchange Milano Indice di Borsa (FTSE MIB) during the last five years (2017-2021). To analyse data and define the specific configurations mentioned above, we employed fuzzy-set qualitative comparative analysis (Fs/QCA).*

***Results**: In an overall context that shows relevant progress in the adoption of ESG indicators as part of compensation plan metrics, three configurations emerged which achieve the highest ESG weights and correspond, according to our interpretation, to different levels of substantiality in ESG implementation.*

***Research limitations:** First, we did not consider other conditions that could have helped to identify cases of symbolic adoption. Second, we have not examined the type of ESG indicators that firms adopt.*

***Managerial implications:** Sustainability-oriented investors might look for signs 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 in CEOs' compensation plans.*

Key words: ESG weight; ESG indicators; neo-institutionalism; symbolic adoption; substantial adoption; QCA analysis

1. Introduction

Recent economic and social pressures (i.e., the Covid-19 pandemic, as well as the emerging political and economic crisis) have increasingly encouraged more firms to adopt a stakeholder focus (Van Barneveld *et al.*, 2020). As a consequence, environmental, social and governance (ESG) variables have been proposed as metrics for gauging corporate efforts. As might be expected, ESG values have become increasingly popular and investment strategies driven by this sustainable perspective have gained popularity worldwide (Cornell and Damodaran, 2020; Díaz *et al.*, 2021; Zumente and Bistrova, 2021). These circumstances are also confirmed by statements published by several associations of primary company leaders and international organizations. The Business Roundtable, for example, a group of prominent chief executive officers (CEOs) of major US 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 have declared 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). Moreover, the universal purpose of the "Davos Manifesto 2020" outlined 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' objectives, as well as in international public-private cooperation.

According to this perspective, the alignment between the interests of shareholders and managers (Barnea and Rubin, 2010), rather than being reduced in 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 behaviour which will result in the aforementioned legitimacy and in a "win-win" situation (Baron, 2009; Farooq *et al.*, 2017). We have recently noticed 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).

Based on this, companies have also started to incorporate ESG metrics into executive compensation (Flammer *et al.*, 2019). According to Baraibar-Diez *et al.* (2019), this represents the "response to demands of society in terms of sustainable behavior" (2019, p. 1457). As noted, companies must acquire a renewed role in the social and economic systems that leads them to reach a (new) legitimacy (Baccarani *et al.*, 2020; Matthews, 1993; Romito *et al.*, 2021). According to the organizational literature (Ashforth and Gibbs, 1990), firms may obtain this so-called "citizenship" (Melo and Garrido-Morgado, 2012) on a large scale, as well as through "coercive, mimetic and normative isomorphism" (DiMaggio and Powell 1983), that will result in a compliance with the values, norms and expectations of a greater number of community members (Perrow, 1970).

Therefore, the debate is no longer about whether the use of ESG indicators in executive compensation plans makes sense, but instead about how to utilize them in the most effective way. On this point we have

several confirmations that the inclusion of ESG indicators in executive compensation plans is also a topical theme for practitioners. The Haut Comité de Gouvernement d'Entreprise (High Committee for Corporate Governance) for instance, in its 2020 report, highlighted the necessity of including at least one environmental indicator in the determination of an executive's variable compensation.

These observations raise an interesting question: *what are the governance factors that affect the ESG weight in remuneration plans?*

In contrast to previous research on this topic, which mostly aimed at demonstrating whether implementing a sustainability-based compensation policy has a positive influence on companies' ESG and economic engagement (Baraibar-Diez *et al.*, 2019), or on long-term orientation and the firm's value (Flammer *et al.*, 2019), this paper is based on a configurational approach as part of the emerging neo-configurational direction of the study of management (Misangyi *et al.*, 2017).

The purpose of this paper is therefore threefold. 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 by adopting a multi-dimensional and all-encompassing one, 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 the use) of ESG indicators in the CEOs' compensation plans outlined 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 to ESG indicators in their executive compensation plans.

To accomplish these objectives, after 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 on the Financial Times Stock Exchange Milano Indice di Borsa (FTSE MIB) during the last five years (2017-2021) and, to the best of our knowledge, this database is the first longitudinal database of ESG indicators in CEOs' compensation plans. To analyse the data and define the specific configurations mentioned above, which is the main contribution of this paper, we employ fuzzy-set qualitative comparative analysis (fs/QCA), which is broadly recognized as an appropriate method in social science for defining different combinations indicating a specific outcome (Cucari, 2019b; Misangyi *et al.*, 2017; Pappas and Woodside, 2021).

Our study is structured as follows: Section 2 illustrates the theoretical background; Section 3 describes the fs/QCA methodology and Section 4 reports the descriptive statistics and fs/QCA results. Lastly, Section 5 includes the 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 refers to the system by which firms are controlled and managed (MacMillan *et al.*, 2004). The European Commission (2011) states that firms can be viewed as 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 would apparently deny a direct relationship between corporate governance and corporate social responsibility (CSR), leading to the so-called "separation thesis" (Harris and Freeman, 2008). However, the broader approach to CSR indirectly encompasses corporate governance mechanisms, while ESG even explicitly includes corporate governance as one of the pillars of firms' socially responsible business models and behaviour (Gillan *et al.*, 2021), reaffirming that corporate governance is in any case viewed as a topical theme in social responsibility.

On this point, scholars have long debated whether 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 indeed been opposed by the stakeholder approach (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, over time, gained a higher consensus that has become even more evident in the last two years because of the Covid-19 pandemic and its effects on the community. According to this wider perspective, corporate governance 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 fulfil 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 corporate governance, rather than being illusory (Bebchuk *et al.*, 2022; Bebchuk and Tallarita, 2021), leads to a "win-win" situation for shareholders and other stakeholders (Edmans, 2021).

The recognition of a synergistic relationship between corporate governance 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 corporate governance, social and environmental concerns can all be viewed as elements that contribute, in an integrated way, to the sustainable growth of firms (Van den Berghe and Louche, 2005).

From this viewpoint, the needed new measures of value creation should include ESG goals as a complement to standard financial metrics (Schwab, 2019). Moreover, ESG objectives are not only a supplement to financial information, but also a driver of companies' overperformance, since many scholars have found a positive relationship between ESG and financial performance that means that short-term ESG investments lead to long-term higher value creation (Friede *et al.*, 2015; Henisz *et al.*, 2019; Mishra, 2020), 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 the individuals and communities to whom they are somehow accountable (Russo and Perrini, 2010), besides the more intuitive beneficial effects in terms of efficiency (Brammer and Millington, 2005) that firms can obtain through higher ESG engagement, scholars have highlighted the relevance of responsible behaviour in responding to stakeholders' pressures, thus acquiring 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 fulfil their obligations to society, thus establishing 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 relationship between companies and stakeholders can be enhanced by additional investment by firms in ESG performance. This strategic choice may result in a higher reputation for firms (De Castro *et al.*, 2006), that is, the set of expectations, perceptions and opinions that stakeholders have regarding the values and behaviours of a given organization (Fombrun *et al.*, 2000). By demonstrating that they respond to ESG pressures, firms may raise their reputation and obtain so-called citizenship (Matten and Crane, 2005) and legitimacy (Carroll, 1994).

The aforementioned reasons for which companies may consider it worth raising their ESG engagement is consistent with the NIT, which is recognized as 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 stimulated by two reasons: efficiency (substantive/economic) and legitimization (symbolic/impression management) (Meyer and Rowan, 1977). Of course, both aspects motivating the response of firms to stakeholder pressure are driven, on a large scale, by the three well-known mechanisms of institutional isomorphism: the coercive one, that originates from political influence, the mimetic one, that stems from risks and responses to uncertainty, and the normative type, which is mainly related to education and professionalization (DiMaggio and Powell, 1983). All 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 recent years (consider that about 500 of the 800 billion euros of Multiannual Financial Framework 2021-2027 and NextGenerationEU are allocated to CSR objectives), in addition to the sanctions. Similarly, from a competitive point of view, globalization and the more rapid diffusion of

information, which have increased in the last 10 years due to technological progress, have exacerbated the reputational risks for companies, leading them, in a mimetic way, to pay more attention and neutralize their gaps in terms of ESG engagement. Lastly, as Ghoshal warned in 2005, academic and managerial training has increasingly drawn from scientific research in terms of the aforementioned shift from a shareholders' view to a stakeholders' one, which is consistent with a greater ESG engagement, in order to prevent bad theories from negatively influencing good managerial practices (Ghoshal, 2005).

In order to fulfil stakeholder expectations and obtain reputation and legitimacy, companies have to accurately disclose information on their responsible behaviour (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 do not effectively communicate their socially responsible activities (Kim, 2017). Obviously, corporate social disclosure impacts differently on different companies. Firms that, because of their core activity, may more heavily and negatively impact on the community (as is the case of chemicals, food or pharmaceutical companies, for instance) are more likely to give greater attention to this topic and diffuse more information about their social and environmental engagement (Boutin-Dufresne and Savaria, 2004; Gao *et al.*, 2005). Likewise, larger companies, who typically have a larger impact on community as well as greater notoriety, usually suffer higher stakeholder pressures, to which they have to respond with an 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 the varying forms of capitalism and governance that characterize companies in various contexts may differently affect the expected level of CSR disclosure (Aguilera *et al.*, 2006; van Der Laan Smith *et al.*, 2005). Regardless of 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 abovementioned considerations describe a 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 greater ESG engagement are more likely to turn into financial performance improvements only in the medium to long term, and 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 also result in the described enhancement of shareholder value.

2.2 ESG-linked compensation plans

Following the "pay for performance" assumption, several authors have stated the importance of ESG-based compensation policies for motivating executives to pursue sustainable objectives beyond financial performance (Haque, 2017). Moreover, 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 expansion in long-term orientation); ii) growth in firm value; iii) a rise in social and environmental initiatives; iv) a reduction in emissions and v) an increase in green patents, but did not provide any evidence regarding the link between compensation plan design and corporate social performance.

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 analyse 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. In addition, the criticisms are related to the scarce transparency and the absence of outside reviewability (Bebchuk and Tallarita, 2022). However, the inclusion of ESG metrics in compensation plans could depend on internal and external factors. As shown by Cohen *et al.* (2022), the inclusion of ESG metrics, at a macro-level, is more common in countries that are generally perceived to be ESG-sensitive; at a micro-level, it is associated with firms that have publicly issued environmental commitments, as well as those with more independent boards that have a higher percentage of female members and the presence of institutional investors.

Therefore, the debate has shifted regarding 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 the substantive vs merely symbolic inclusion of ESG indicators in executive compensation plans (Adu *et al.*, 2022), although some discussion concerning whether CEOs' compensation may be driven by symbolic and substantive considerations has been developed in the less recent past (Zajac and Westphal, 1995).

From this perspective, understanding both the progress that companies are making towards a greater inclusion of ESG goals in executives' compensation plans and identifying the driver of this new form of alignment between shareholders and managers objectives is critical. In the following sections of this paper, we will contribute to the 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", the compensation committee independence and the compensation plan structure, may lead to 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 and 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 remuneration for CEOs and CSR performance. 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 among the board members is likely to promote a higher CSR engagement (Jo and Harjoto, 2011; Jo and Harjoto, 2012).

Another corporate governance mechanism that can somehow reduce the aforementioned misalignment between shareholders and managers is the vote on the remuneration plan ("say on pay"). Through this mechanism, shareholders express their opinion on executives' compensation (Conyon and Sadler, 2010; Esposito De Falco *et al.*, 2016), showing an increased activism towards orienting managerial behaviour (Cucari, 2019a). However, even if less 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 remuneration 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 and the total number of performance indicators used to define short-term incentives. We incorporated these two measures because, on one hand, the number of ESG indicators in the compensation structure can serve as a proxy for a broader and more diversified vision of CSR engagement, which is consistent with the legitimacy theory and with the need for an enhanced disclosure of firms' sustainable behaviour. On the other hand, we decided to take into account the overall number of indicators included in the compensation structure because it can serve as a proxy for less limited discretion regarding managerial behaviour, which is consistent with higher agency problems and, therefore, with a higher necessity of including CSR objectives as a part of the CEO's compensation in order to more effectively align their interests to shareholders' ones.

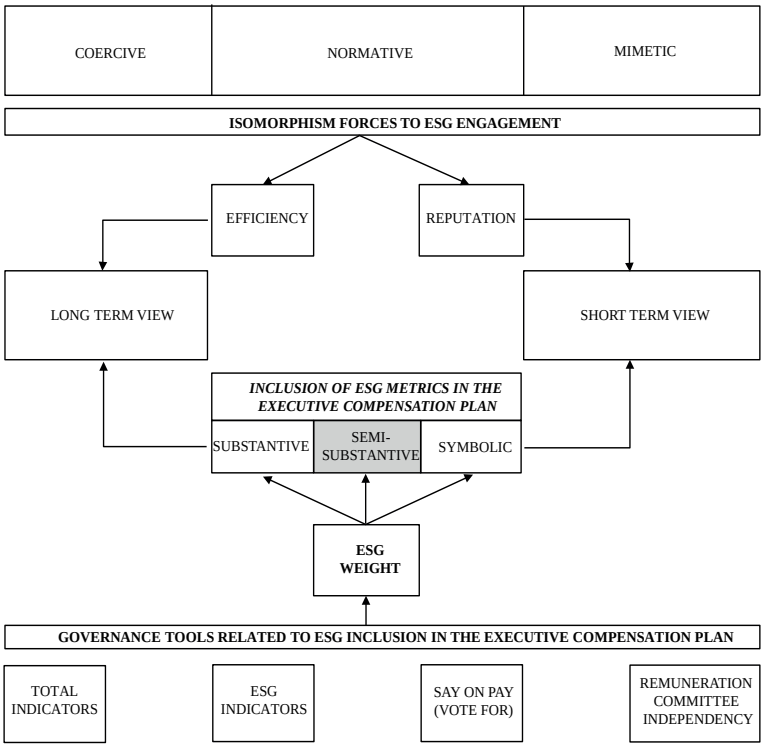
When investigating the effect of the selected variables on the relative weight assigned to ESG performance indicators in the overall compensation plan, our contribution will provide different configurations of the mentioned drivers that can lead to shaping a more symbolic or substantive inclusion of 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 simply for legitimacy effects, while providing only an appearance of economic rationality.

As described in the following image (Fig. 1), our theoretical framework first considers the forces of organizational isomorphism that drive greater corporate engagement in social responsibility. These forces orient a firm towards greater social responsibility primarily to achieve

efficiency goals (in the long term) or to improve the company's reputation and citizenship (in the short term) Similarly, there are governance variables, such as the say on pay vote and remuneration committee independence, that push companies towards a greater adoption of ESG metrics (ESG weight) in structuring executive compensation plans.

The result of the varying incidence of these variables across firms ends up determining a substantive, semi-substantial (grey zone) or symbolic approach to the inclusion of ESG metrics in the structuring of compensation plans. Ultimately, an essentially substantive approach to the inclusion of ESG metrics turns into a more short- or medium- to long-term view of the topic.

Fig. 1: Conceptual model



Source: Own elaboration

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 for an investigation of the impact of ESG indicators during the recent Covid-19 pandemic. 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 interesting to examine within a neo-institutional framework, whose aim is to make sense of the institutionalization of organizational practices under the effects of contextual influences. By the same token, listed companies are more likely to carry out a merely symbolic and formal application of new practices, such as ESG implementation, simply 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 for studying corporate governance (Boyd *et al.*, 2017; Cucari, 2019b; Filatotchev and Wright, 2017; Tihanyi *et al.*, 2014). 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 (Greckhamer *et al.*, 2018; Misangyi *et al.*, 2017). 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 (Fiss *et al.*, 2013; Ragin, 1987) 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 the literature requires a much richer empirical base.

In this sense, QCA has been adopted in corporate governance research to empirically help tackle the complexity implied by the bundle perspective on corporate governance (Cucari, 2018; Khlif *et al.*, 2019). Specifically, we adopted the 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 needed to express variables into sets and subsets according to their degree of membership in a specific condition (the calibration process). Our analytical model comprised one outcome, which measures the relative weight assigned to ESG performance indicators in short-term incentive plans and four causal conditions in line with the literature above (Tab. 1).

Tab. 1: Outcome and conditions

Outcome/conditions	Data source	Description
ESG weight (outcome)	Report on remuneration policy and payments	Relative weight (%) assigned to ESG performance indicators used to define short-term incentives
ESG Indicators (condition)	Report on remuneration policy and payments	Number of ESG indicators used to define short-term incentives
Total indicators (condition)	Report on remuneration policy and payments	Total number of performance goals used to define short-term incentives.
"For" votes (condition)	Elaboration of the meeting minutes and of the summary report of the votes	Percentage of favourable 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)	Report on corporate governance and ownership structure	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 can be based on theoretical criteria when available. Unfortunately, in this case, we were not able to 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).

Tab. 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" votes	0.75	0.92	0.97
Rem committee independence	0.67	0.83	1

Source: our elaboration

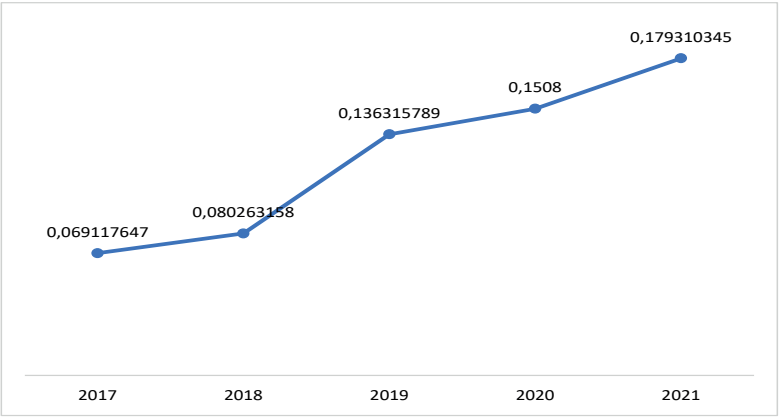
We considered the value average both for the outcome and for the causal conditions over a period of five years. Finally, we set our consistency threshold at a minimum of 0.80 (Ragin, 2008).

4. Results

4.1 Descriptive statistics

The following figures and tables show the descriptive statistics for all the variables used in the analysis.

Fig. 2: Average ESG weight over time



Source: our elaboration

The average ESG weight, for firms in our sample, has been growing quickly in recent years (Fig 2). 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 five years, as well as the relative percentage of ESG indicators over the total, are shown in Tab. 3. 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 more slowing than the former across the years.

Tab. 3. Average ESG indicators and total number of indicators over time

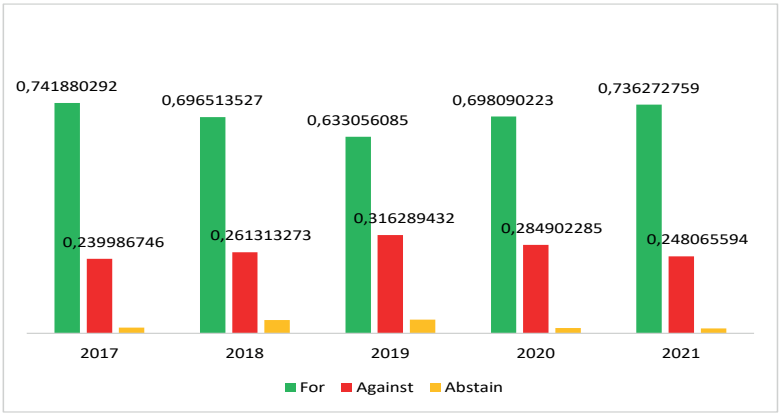
	2017	**2018**	**2019**	**2020**	**2021**
Number of ESG indicators	0.65	0.70	1.15	1.42	1.76
Total number of indicators	6.65	6.16	6.62	7.88	7.97
Percentage of ESG indicators over total number of indicators	18.54%	19.67%	22.34%	25.14%	25.51%

Source: our elaboration

The percentage of "for" votes over total votes is relatively high (always greater than 60%) in all the years considered (Fig. 3), 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.

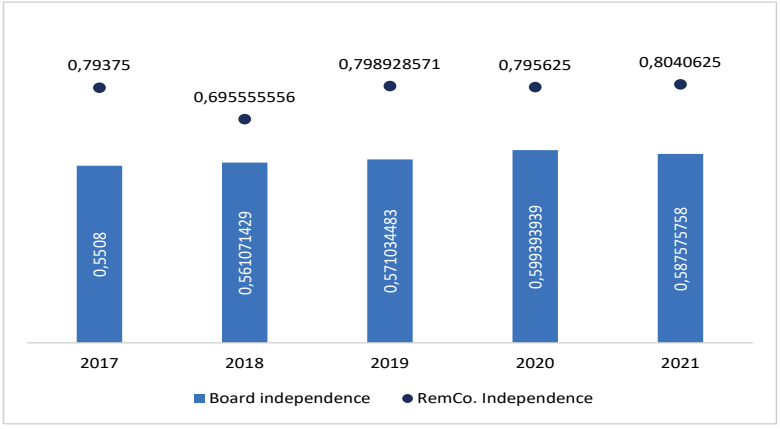
Fig. 3: Percentage of "for" votes over total votes



Source: our elaboration

Fig. 4 shows the average percentage of independence of both the board and the remuneration committee of the firms in our sample. It is immediately evident 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.

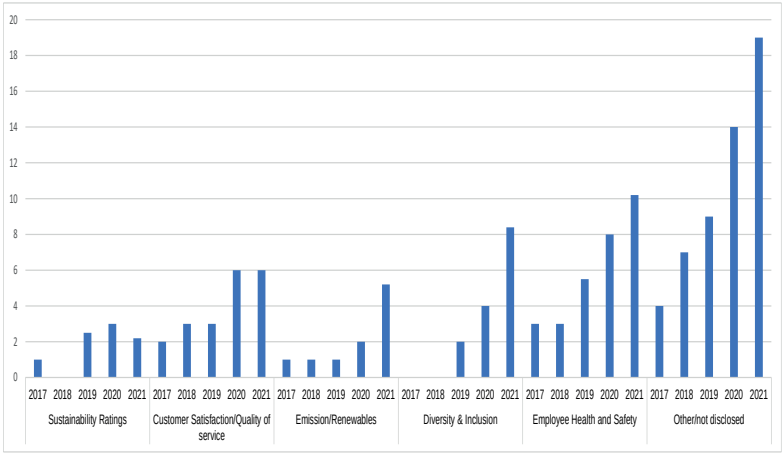
Fig. 4: Percentage of "for" votes over total votes



Source: our elaboration

Finally, Fig. 5 shows the evolution of the number of ESG indicators over the five years, divided by category. It emerges that, even if all categories have been growing over time, most of the indicators are in the category "other/not disclosed".

Fig. 5: The number of ESG indicators divided by category



Source: our elaboration

4.2 fs/QCA results

The results of the fs/QCA are shown in Tab. 4. Following the notation introduced by Ragin and Fiss (2008), we have 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 the empirical importance (Ragin, 2008). The consistency signifies how closely a perfect subset relationship is approximated. In our study, we obtain an overall coverage value of 0.51 and an overall consistency value of 0.95, which are suitable scores for the analysis.

Coverage indicates empirical relevance, so greater coverage implies that the solution has a greater empirical relevance (Ragin, 2009), which means that a greater number of empirical cases are covered.

Tab. 4: fs/QCA results

	Configurations		
Conditions	1	2	3
ESG indicators	•		•
Total indicators	○	○	
'For' votes	○	○	○
Remuneration committee independence		•	•
Note: Black circles ("•") signify the "presence" of a condition, circles with a cross-out ("○") represent its "negation", and blank spaces in the solutions indicate "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 indicators, associated with a low percentage of "vote for" and "don't care situation" regarding 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 indicators, associated with a low percentage of "vote for" and a highly independent 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" for the total indicators, associated with a low percentage of "vote for" and a highly independent 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 are 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, they nonetheless 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., a 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. From 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 out 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 larger the number of ESG indicators are present in a remuneration plan, the greater the awareness of the company decision-makers of their importance for keeping track of ESG performance. In addition, a truly independent remuneration committee ensures that ESG implementation is not simply 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 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 regarding 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 there is 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 taking into account 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 a 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, this configuration includes those organizations that generally obtain a low percentage of "for" votes, while having a remuneration plan that includes fewer total indicators and several ESG indicators. At the same time, in this case it is therefore irrelevant whether the remuneration committee is essentially 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 relation to the firm's operations.

Several theoretical and practical implications can be drawn. First, 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 is not surprising, 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; Esposito De Falco *et al.*, 2018). However, it must be considered that the "for" vote relates to the remuneration plan as a whole, so that investors have no way of approving or rejecting a single component (e.g., financial indicators, ESG indicators) of the remuneration plan. Therefore, lower percentages of "for" votes are intended as general dissent regarding the remuneration plan, but not ESG weights specifically. This result is in line with the growing number of companies that are linking executive pay to sustainability metrics. Therefore, it emerges that the "say on sustainability", like the "say on pay", could govern the votes at the upcoming shareholder meetings. Consequently, examining the configuration of variables could help investors to vote more conscientiously. Sustainability-oriented investors might look for signs in the bundle of characteristics of the remuneration policy to infer whether it corresponds to a more or less substantial implementation of ESG engagement.

Second, another important result is represented by the percentage of independent directors within remuneration committees, which have the responsibility of designing the remuneration plan and defining the remuneration policy (Kuo and Yu, 2014). This governance variable 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 directors who are not independent 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).

Third, the number and the type of ESG indicators adopted can be an indication for investors of how symbolic or substantial the adoption of the ESG logic within the firm is, as emerged from the descriptive analysis. Too few or vague, general, or poorly measurable indicators may indicate a purely formal compliance with sustainability, which allows the firm to define themselves as socially and environmentally friendly, without having to transform their internal processes.

Therefore, from the point of view of organizational design, our results suggest that firms should aim for highly independent remuneration committees and for remuneration plans that are linked to a comprehensive set of ESG indicators. This not only creates a basis for aligning managers' behaviour to long-term sustainability goals, but also sends signals to investors regarding the authenticity and substantiveness of the firm's intent. In designing the remuneration plans, firms should also ensure there is balance between the number of ESG indicators and the total number of indicators, since a low proportion of ESG indicators over the total can be read as a sign that little attention is paid towards sustainability performance.

Some limitations of this study need to be addressed through additional investigation and future research. In the first place, we looked at only a subset of the possible signs of substantial or symbolic ESG adoption. For instance, we did not consider other conditions - such as the 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 analysis is needed to verify the extent of symbolic adoption in different industries, as well as the profiles of symbolic adopters in these domains. We have also not thoroughly examined the type of ESG indicators that firms adopt, especially in the fs/QCA results. Subsequent papers could try to identify the profiles of symbolic adopters of specific (ESG) indicators.

Further investigation is needed regarding how ESG-based compensation plans affect firm performance. While it is commonly believed that using variable remuneration components can contribute to orienting top management towards the long-term viability of the firm and boosting firm performance, less is known about how firm performance is affected when compensation is linked to sustainability goals. Investigation on this topic could certainly also draw insights from the literature examining the link between sustainability and economic performance.

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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

sinergie
italian journal of management

ISSN print 0393-5108
ISSN online 2785-549X
DOI 10.7433/s121.2023.06
pp. 101-125

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

Received
15th February 2022
Revised
24th February 2023
Accepted
18th July 2023

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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 university can enable the growth of early-stage innovative firms.*

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 in Italy universities are not enabling the growth of early-stage innovative firms, on average. Indeed, companies which are not related to the university show a better performance, and most of all the ecosystem-level variables related to the academia are not correlated to sales growth in most cases.*

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 early-stage innovative firms.*

Originality of the paper. *Previous literature neither did address the comparison between IISs and USOs in Italy, nor the comparison between these two types of firms and USOs that are classified as IISs. Moreover, it is among the first studies to provide insights on the current linkages in the Italian innovation ecosystem.*

Key words: innovation ecosystem; university spin-off; innovative startup; early-stage; panel data.

1. Introduction

Since its foundation, the European Union (EU) has been a convergence machine, directing investments and actions towards the achievement of economic and social growth in all its member states. In following this

purpose, the development of research and innovation (R&I) has always played a central role.

Especially, parallel to the emergence of the knowledge economy and exponential technologies, in the last ten years one of the main goals of the EU has been that of making the generation and commercialization of innovations a continuous and self-sustaining process (González Fernández et al, 2019). Starting from 2014, indeed, EU policies begun to show a larger investment focus in the development of national and local innovation ecosystems across its countries and give early-stage innovative firms a major role in this concern. In the last two decades, after all, the new frameworks of 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 been developed by academics precisely as a result of an effort to improve our knowledge of the mechanisms of innovation and high growth entrepreneurship development.

Despite this new level of knowledge and EU's efforts, however, if we look at the innovation performance of its member states we can notice how fragmented and poorly conducive to innovation the European environment is[1]. Countries which together constitute the largest market in the world, are performing and investing less than others in terms of innovation, and among them Italy represents a notable case. It is the eighth economic power globally[2] and still performs as a moderate innovator (Hollanders *et al.*, 2012; 2014; 2016; 2019; Hollanders and Es-Sadki, 2017), lagging behind other member states both in the public – in terms of public expenditure in R&D, use of structural funds for R&I activities, cooperation between public and private actors, bureaucracy, and the growth rate of doctorate students – and the private sector – in terms of venture capital investments and private co-financing for R&D activities (European Commission - JRC, 2017; Hollanders *et al.*, 2020).

Analyzing this case under the lens of the innovation ecosystem framework can help us comprehend why this happens, and how to fill the existing gaps both in the literature and the practice. The construct, indeed, has the potential to explain the processes of value creation at the regional and national level, and can be used to understand how the relations between actors involved in R&I activities may affect the overall economic and innovation 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). Innovation ecosystems, after all, build their success not only on the quality of their actors, activities, and artifacts, but most of all on the interdependent relations between them. Thus, to get a wider picture of the issue, an analysis of whether and how the interactions between these attributes create value, and enable the development of innovation and technology, becomes necessary (Jackson, 2011; Gomes *et al.*, 2018).

Among all the actors that live in an ecosystem (Carayannis and Campbell, 2009), in Italy, as well as in all Europe, universities have the

[1] https://www.europarl.europa.eu/factsheets/en/sheet/67/innovation-policy

[2] https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?most_recent_value_desc=true

potential to fulfill a central role as ecosystem "enablers" (Heaton *et al.*, 2019; Reichert, 2019), with their impact on the ecosystem dimensions of talent, culture, and support, and their potential for being catalysts for network building (Gonzales *et al.*, 2018). In the European context this means that, apparently, universities also have the capability to lead the shift to a better innovation performance throughout the EU. Indeed, as in other parts of the world, over the years universities have started to invest more heavily in operations related to their 'third mission', like the creation of their own innovative firms (the so called 'University Spin-Off Firms – USOs), pushed both by the increasingly challenging global competitive landscape and by the growing European focus on early-stage innovative firms.

After all, the contribute of early-stage firms – and, most of all, innovative ones – to regional development has been widely acknowledged by academics. Early-stage innovative firms, indeed, positively impact economic growth, job creation (Bormans *et al.*, 2019; Humala, 2015; Colombo and Delmastro 2002), R&I activities, and collaboration between actors (Rocha *et al.*, 2019; Witte *et al.*, 2018; Spender *et al.*, 2017; Mustar *et al.*, 2008). In addition, they contribute to the diffusion of a culture of entrepreneurship and innovation, and the execution of value-capture activities in ecosystems (Hoffecker, 2019). It is not a case that, in Italy, these firms have been the subjects of policy interventions thought to create a more dynamic and innovative business environment (i.e., Law 297/1999, Ministerial Decree 593/2000, Law 221/2012, Decree 147/2013, Startup Act), especially with the definition of a new category of firms called "Innovative start-ups", which have their own registry and requirements.

Nevertheless, when it comes to USOs and their performance, the debate is still open. On the one side, in fact, multiple studies show their positive impact on both the economy (Meoli *et al.*, 2013; Rasmussen *et al.*, 2006; Walter *et al.*, 2006) and the society as a whole (Fini *et al.*, 2018; Fontes, 2005), and associate them with higher performance when compared to similar firms (Francois and Belarouci, 2021; Czarnitzki *et al.*, 2014; Zhang, 2009; Rothaermel and Thursby, 2005). On the other side, instead, evidence has been provided that USOs show a worse financial performance (Salvador, 2011; Wennberg *et al.*, 2011; Bonardo *et al.*, 2010, 2011; Ensley and Hmieleski, 2005) if compared with corporate spin-offs, thus leaving room for questions regarding the actual causes of such diversity of results, and the effectiveness of European universities in enabling innovative entrepreneurial endeavors.

While previous literature reports insights on universities' contribution to regional and ecosystemic growth (Carree *et al.*, 2014; Heaton *et al.*, 2019; Ierapetritis, 2019) and the growth of USOs, if compared with new ventures in general (Bigliardi *et al.*, 2013), on the low impact of Italian universities' context on USOs' performance (Corsi *et al.*, 2017), and on USOs' performance in general (Bigliardi *et al.*, 2013; Calvo *et al.*, 2013; Fini *et al.*, 2017; Rodríguez-Gulías *et al.*, 2018), the analysis of how and whether in Italy the direct linkage with a university actually enhances the growth of different types of innovative firms in their early stages remains unexplored, and still can give us a better understanding of the causes of the performance of the Italian innovation ecosystem.

Thus, to address this literature gap and provide both the theory and the practice with new insights on the phenomenon, our study intends to compare the performance in terms of sales growth of early-stage innovative firms having a direct link with Italian universities (USOs), with the ones who do not have it (i.e., innovative start-ups). Moreover, when USOs have the characteristics requested by the Italian law, they can be classified as innovative start-ups for the Italian government. Thus, our investigation is extended to this hybrid type of firm, too, and we make three different analyses to compare the performance in terms of sales growth of both USOs, IISs, and USOs that are classified as IISs.

That being said, 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 separately?

In both of our research questions, we seek to understand if universities are actually exploiting their potential to be enablers in the innovation ecosystem - which is among the main goals of their third mission - starting from the impact they have on the growth of their spin-off firms, which benefit of a privileged channel of information flow. In particular, we compare USOs with innovative start-ups, which are a novel element of the Italian innovation ecosystem and share many characteristics with USOs. We carry out our analysis on a unique panel dataset comprising of 149 Italian USOs, 1392 IISs and 95 USOs classified as IISs, too, all born between 2014 and 2016. Panel data methodology, indeed, helped us produce more reliable findings regarding the differences in the sales growth performance between these types of firms.

Our results show that in Italy, on average, universities are not enabling their spin-off firms to grow faster than non-academic innovative organizations at an early stage of development. This difference only fades when a firm is both a USO and an IIS. Despite the access to cutting-edge resources not available in the marketplace (Bierly *et al.*, 2009) and the assistance that universities extend to spin-offs - due to their significance in fulfilling a university's third mission and as a means of generating value (Pitsakis *et al.*, 2015) -, then, fledgling university spin-offs (USOs) are still not able to outcompete non-academic early-stage innovative enterprises.

This study offers an understanding of how USOs and IISs operate in Italy and the impact of the interaction of early-stage innovative firms with universities, in the Italian context. Also, it gives a launchpad for academics to explore the connections between innovators in Italy. It provides valuable information to start-up and university supervisors on the success of the association between universities and early-stage innovative firms, which could be considered when making strategic and financial decisions linked to universities' engagement in entrepreneurial initiatives and regional innovation ecosystems. Finally, it allows policymakers to comprehend the type of investments needed to support and foster the innovation ecosystems in Italy.

This paper is structured in the following way: Section 2 explores the literature background and lays out the research queries; Section 3 discloses the data and the chosen variables and gives the econometric model applied to further explore the research queries; Section 4, then, offers the results of the empiric investigations; finally, Section 5 gives suggestions for practitioners and further studies.

2. Literature background

2.1 The Innovation ecosystem framework

In the past two decades, a new field of research regarding entrepreneurial and innovative ecosystems has raised relevance among academics and policymakers, thanks to the growing urge to spur innovation development processes at the local level. Different studies explored the concept of innovation ecosystems (Granstrand and Holgersson, 2020; Autio and Thomas, 2014; Jackson, 2011; Carayannis and Campbell, 2009; Adner, 2006), and also enriched the literature by both differentiating the concept of 'innovation ecosystem' from the traditional idea of 'innovation system', and introducing new conceptual frameworks and fresh perspectives (Oh *et al.*, 2016; Gomes *et al.*, 2018; Scaringella and Radziwon, 2018, Thomas and Autio, 2019, Granstrand and Holgersson, 2020).

In particular, apparently all the different definitions point to a concept lately developed by Granstrand and Holgersson (2020), who 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 [..]".

It is clear, then, that the the focus of such ecosystems is that of enabling innovation and technology development, and value creation processes (Jackson, 2011; Gomes *et al.*, 2018) at the local level. However, if we want to add clarity to that definition, we should look more deeply at their evolutionary character, the co-existence of multiple actors and resources, and the fact that innovation ecosystems share actors, dimensions and resources with entrepreneurial ecosystems .

First, innovation and entrepreneurial ecosystems evolve through different phases (Moore, 1993; Cantner *et al.*, 2020) such as: birth, growth, maturity, decline, and re-emergence. This is also why a clear path and strategy for growth should be defined and followed (Moore, 1993; Rabelo and Bernus, 2015) as the ecosystem evolve, in order to reach success. Along an ecosystem's lifecycle, furthermore, actors as well as dimensions take on different roles and relevance. Thus, agents such as universities find themselves in the position of exploiting their potential in different ways, based on the specific phase the ecosystem is going through (Heaton et al, 2019), but always maintaining their role of catalysts for growth over time.

Speaking of the actors that characterize an innovation ecosystem, then, the Quadruple Helix approach (Carayannis and Campbell, 2009) offers the most 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. A view which is also confirmed in other studies, such as that of Jackson (2011), and Malerba and McKelvey (2020), which also agree on the central role of universities as enablers of innovation production, firm growth, and so forth in a region, together with other actors.

In this study, 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) by also creating innovation and entrepreneurship centers (Schiuma and Carlucci, 2018). On the other hand, they play a vital role in driving innovation and technology development through their research activities and commercialization efforts (Thomas *et al.*, 2021; Rothaermel *et al.*, 2007; Rogers *et al.*, 2001). By creating new knowledge, advancing technologies and managing innovation appropriability, moreover, universities contribute significantly to the growth of various industries (Thomas *et al.*, 2021; Malerba and McKelvey, 2020). Finally, they serve as key players in orchestrating innovation ecosystems, too, by fostering collaborations with other actors in the ecosystem (Reichert, 2019; Heinonen & Hytti, 2010) to promote knowledge sharing and value co-creation.

For the same reasons, we are interested in early-stage innovative firms, in the forms of 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 Early-stage innovative firms

Early-stage innovative firms - otherwise known as innovative start-ups - can be described as new firms that commercialize innovative products or services, with a great propensity for growth (Fiorentino *et al.*, 2020; Colombelli *et al.*, 2016; Ali and Shah, 2015) and knowledge production (Fritsch, 2011). Based on the particular innovation they are developing, they can rapidly switch their status of microenterprise to that of high-performing SMEs or big companies (Kantis *et al.*, 2020), as in the case of the so-called 'gazelles' and 'unicorns', and to expand swiftly through industries and geographies.

Possibilities, those, that sometimes come in contrast with the fact that their innovativeness can often hamper their capacity to grow and survive, which mostly depends on their culture, access to quality human capital, and absorptive capacity, other than on financial measures (Hyytinen *et al.*, 2015). Indeed, survival rates in innovative start-ups are usually low, also because of the uncertainty connected to their innovative product or service, the lack of access to proper support, and funding, and the ability

of the surrounding entrepreneurial and innovation ecosystem to foster their growth. These firms, in fact, generally benefit from their presence in successful ecosystems, and capture value from them by taking advantage of the high-quality talent, professional networks, infrastructures, policies, and capital available (Audretsch *et al.*, 2020).

At the same time, however, such firms are acknowledged for their contribution to fostering the growth of innovation and entrepreneurial ecosystems, as they usually create value by spreading a culture of innovation and entrepreneurship, creating jobs, developing new knowledge (Malerba and McKelvey, 2020), and fostering competition and collaboration among ecosystem actors (Colombelli *et al.*, 2016; Witte *et al.*, 2018; Rocha *et al.*, 2019) at the local level.

Given their contribution to economic growth, job creation, and ecosystem development, and their need of support (Wilson, 2015), thus, in recent decades policymakers and academics have grown their concern about the widening gap between Europe and the rest of the world regarding the development of innovative endeavors. Accordingly, while Europe is the biggest market in the world and has long been acknowledged as a global leader in the production of top-tier research, it has also often struggled to translate this expertise into technological innovation.

Keeping in view these facts, the EU Commission has recently increased its efforts in entrepreneurship and ecosystem development activities by reinforcing the policies towards capable innovators, starting with the introduction of the concept of Young Innovative Companies (YIC - Mas-Tur and Simón Moya, 2015; Czarnitziki and Delanote, 2013). In line with this, in 2012 the Italian government introduced a law (i.e., Law 221/2012) to define and support new early-stage innovative firms, too. This law classifies as Innovative Start-ups (that for our purpose we call Italian ISs - IISs) all the new businesses designed to create, build, and sell products or services of a high technological value (Scattoni *et al.*, 2019; Del Bosco *et al.*, 2021), and sustains them with tax credits, flexible labor arrangements, and easier access to financial resources. IISs must be based either in Italy or in another European Union country (but, in this case, with a branch in Italy), and must comply with characteristics regarding the R&D expense, the education level of the workforce, and the presence of patents (Matricano, 2020).

While these innovative start-ups are small in proportion among other start-ups, research shows that in Italy these start-ups grow more than their non-innovative peers on average (Fiorentino *et al.*, 2020), and try to locate near universities to benefit from knowledge spillovers (Calcagnini *et al.*, 2014) thus resulting to be relevant for the growth of innovation ecosystems at the regional and national level, as they seem to be more ready to actively participate in the ecosystem.

2.3 University spin-off firms

As in the case of YICs and IISs, university spin-offs (USOs) have been gaining attention in recent decades, as a consequence of the need for more performing innovative ecosystems, previously described.

The development of USOs, indeed, is embedded in universities' third mission (Rogers *et al.*, 2001) as a means to transform research results into commercial applications (Pattnaik and Pandey, 2016; Rasmussen *et al.*, 2014; Swamidass, 2013; Van Burg *et al.*, 2008; Rasmussen, 2008) and provide benefits to the surrounding environment. USOs are instrumental in driving technological advancement (Akram *et al.*, 2018), in part due to the unique resources that universities can offer and have also been found to be particularly beneficial in terms of collaboration between universities and businesses. Their ability to create a platform for collaboration between academic and industry partners, in fact, can lead to joint research projects, joint-venture companies and even innovative products, helping universities in diversifying their research and teaching, and helping businesses to access new knowledge and expertise (Tohidi *et al.*, 2020).

The linkage with the university and the commercial world, and the ability to increase the absorptive ability of a region through the indirect dissemination of new technology at the local level (Fini *et al.*, 2018; Criaco *et al.*, 2014; Clausen and Rasmussen, 2013; Vincett, 2010; Fontes, 2005; Hindle and Yencken, 2004; McQueen and Wallmark, 1982), then, make USOs highly valuable actors of any innovation and entrepreneurial ecosystem. This, moreover, is particularly true if we think that, when in their early-stages, USOs can be seen as another form of early-stage innovative firms.

In addition to this university spin-offs are twice as likely to succeed as non-university start-ups and are typically more likely to be provided with the necessary financial, structural, and mentoring support to ensure robust growth. But these results are only possible if they live in an enabling environment, created by universities that develop the right capabilities to transfer knowledge to commercial markets[3]. Indeed, despite their potential to generate innovation, USOs share the same challenges of early-stage innovative firms, that can prevent them from growing quickly and producing innovative products and services (Pfeffer *et al.*, 2016). In addition to that, USOs often struggle to transition from being research-oriented to being market-oriented (Kortum and Lerner, 1999), posing questions on the ability of universities to provide them with the right environment, resources, and support.

That is why, over the years, policies have been developed to encourage universities to invest in technology transfer and the development of these companies (Bolzani *et al.*, 2014; Grimaldi *et al.*, 2011; Rappert *et al.*, 1999). This process has increased the linkages between academia and industry, allowing potentially high-growth firms to be established with a significant innovative and economic influence (Vincett, 2010; Lawton Smith and Ho, 2006). In parallel with this, and long before the IISs case, policies (such as the Law 297/1999 and the Ministerial Decree 593/2000) have been created to foster the development of USOs in Italy, too, thanks to a regulatory framework that allowed Universities to decide and oversee their internal policies regarding the employment status of academic entrepreneurs,

[3] https://www.iblforum.org/knowledge-bank/investment-in-university-spin-offs-exploring-the-differences-between-university-and-non-university-start-ups/

intellectual property rights, and conflict of interest matters. (Salvador, 2009).

3. Data and Methodology

The research in hand aims to provide a comprehensive analysis of University Spin-offs (USOs) and Innovative Start-ups (IISs) in the context of Italy. By studying these two kinds of firms, this research aims to provide insights into how Italy can improve its overall innovation performance and innovation ecosystems. USOs and IISs are both significant actors in the innovation ecosystem, as they have the potential to generate new ideas, products that further contribute to economic development. The ultimate objective of this research work is to provide policy makers, researchers, and other stakeholders with a better understanding of the role of USOs and IISs in the context of Italian Innovation ecosystem.

To meet the objective, this research uses multiple databases to retrieve desired data. The first database is provided by Netval, contained information on 1949 Italian USOs, including the company name, foundation date, ATECO code (the Italian classification of economic activities), parent university, location, and VAT number. The database lacks some information, primarily non-sensitive information. However, the authors were able to fill in most of the missing data, including ATECO codes and VAT numbers, through a secondary source. The second database, provided by the Italian Registro Imprese, contained data on 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) registered between 2013 and 2020. This data includes the company name, foundation date, ATECO code, location, legal requirements, and website. However, this database lacks data regarding websites of some companies.

Furthermore, to integrate these two databases, we used financial data from the Aida-BvD database and secondary data from various sources, such as EU reports, the "Ministero dell'Istruzione dell'Universita e della Ricerca", and the websites of the Italian "Regitro Imprese" and Italian Contamination Lab Network". Overall, we used multiple sources of data to gather comprehensive information on USOs and IISs in Italy, which allowed us to conduct a detailed comparative analysis of different types of startups.

3.1 Exclusion criteria

Based on the main databases and additional sources as mentioned above, we apply exclusion criteria to obtain three different samples of firms. The first sample includes companies that were founded between 2014 and 2016 and have at least three years of financial data available, with a valid VAT number. This criterion helps ensure that the companies are at a similar stage of the company lifecycle and comply with the legal requirements (IISs were defined in Italy by law for the first time back in 2012). Companies founded outside this time frame are excluded due to the lack of comparable financial data.

The second exclusion criterion is to exclude cooperatives, consortia, social or agricultural companies, and companies that are in or have been in bankruptcy (i.e., "in liquidazione" or "in scioglimento"). This helps to eliminate companies with non-profit objectives and those that may not be in a stable financial condition, which could affect the results of the analysis.

After applying the exclusion criteria, we extracted a first sample comprising 149 USOs and a second sample containing 1392 IISs. The third sample is a cross-search of the first two "clean" datasets and contains 95 IISs that are also USOs.

We then integrated the obtained data with an average Regional Innovation Score for the years 2012-2019, retrieved from EU reports (Hollanders *et al.*, 2012; 2014; 2016; 2019; Hollanders and Es-Sadki, 2017), which provides information on the innovation level of every region in Italy. Finally, the financial data was retrieved from the Aida-BvD platform, which allows us to analyze the financial performance of the selected startups.

3.2 Dependent variable

We select firm growth as our dependent variable to examine how USOs and IISs performed differently in their first years in Italy. Growth is a good performance indicator in the context of this study because, despite the fact that innovation ecosystems' primary objective is to promote innovation and technology development in a specific area, they also improve innovative firms' growth potential (Feng *et al.*, 2021). Also, according to Zhou and de Wit (2009), a firm's ability to grow is directly correlated with its age, hence firm growth is an appropriate performance indicator since we only consider the first three years (due to dataset limitations).

Sales and employee growth appear to be the most often utilized indicators for measuring company growth (Wiklund *et al.*, 2009). To measure firm growth, we focus on growth in terms of sales. We use the natural logarithm of the differences in the sales of the firm between year t and year t-1. This approach is consistent with the previous studies by Wennberg *et al.*, and Rodriguez-Gulias *et al.*, (2018).

3.3 Independent Variables

The study in hand takes into account different independent variables (Table 1). First, we consider dummy variable that indicates whether a firm is a start-up, a university spin-off firm, or both. This is a categorical variable that takes on one of three possible values: start-up, university spin-off or both. This variable allow us to compare these types of firms to each other. Then, we consider firm specific dimensions such as financial - tangible assets (log_tot_tan_assets), intangible assets (log_tot_int_assets), shareholder equity (log_shar_equity) and number of employees (log_ employess) by following previous studies (Garnsey *et al.*, 2006; Rauch *et al.*, 2005; and Shalit and Sankar, 1977). After that, in line with previous studies (i.e., Díaz-Santamaría and Bulchand-Gidumal, 2021; Zhou and de Wit, 2009; Coad and Rao, 2008; Gibcus *et al.*, 2006) which highlight

the importance of external environment on firm growth, we use the OECD Taxonomy of economic activities based on R&D intensity ('Rdint' - Galindo-Rueda & Verger, 2016) and variables associated to local context, particulary those linked to universities and innovative start-ups. Following (Varum *et al.*, 2020; Reichert, 2019; Tripathi and Oivo, 2020; and Fini *et al.*, 2017) we, then, also consider the regional specific variables such as number of universities (log_uni_nuts), the number of university students in a given region (log_stud_nuts), the number of contamination labs (log_clab_nuts), and the number of accelerators / incubators in a region (log_inc_nuts).

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

Type of Variables	Description	Variable name	Sources
Dependent			
Financial	Growth in Sales	Growth	Wennberg *et al.*, 2011 Rodríguez-Gulías *et al.*, 2018
Independent			
Type	Type of company: USO, Startup, USO & Startup	Firm	-
Financial	Tangible Assets	log_tan_assets	Garnsey *et al.*, 2006
	Intangible Assets	log_tot_int_ assets	Garnsey *et al.*, 2006
	Number of Employees	log_employees	Garnsey *et al.*, 2006 Rauch *et al.*, 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 *et al.*, 2006
Regional	N° of universities in the region	log_uni_nuts	Varum *et al.*, 2020
	N° of university students in the region	log_stud_nuts	Reichert, 2019
	Regional innovation score	log_ris	Hollanders *et al.*, 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

3.4 Control Variables

To ensure the validity and accuracy of our findings, we have taken into account various industry-related variables, such as the sector type based on the Italian ATECO classification (ateco), as well as regional innovation ecosystem factors like geographical location and Regional Innovation Score (log_ris). Additionally, we have also considered macroeconomic shocks over time by controlling for 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 NUTS1 territorial

classification[4], 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 Score, the number of Incubators, Universities, Contamination Labs[5] (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 is based on a panel data estimation of the afore mentioned sample data. The advantage of using a panel dataset is that it allows us to control for unobserved heterogeneity across firms that may affect their sales growth performance. In order to account for heteroscedasticity and autocorrelation in panel data, as we also work with financial data (where the variance may change over time or across different firms), we run a GLS regression. In fact, using standard OLS regression would result in biased estimates if the variance of error terms differred across firms or over time periods. Moreover, we opted for a random-effects model because multicollinearity concerns prevented us from using a fixed-effects model.

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, using dummy variables. 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) = the vector of variables representing firm-specific characteristics for firm i, operating in year t

D_industry = industry dummies to control for industry specific effects

D_year t = yearly time dummies to control for time-specific effects

D_region = regional dummies to control for ecosystem-specific effects

ε(i,t) = the error term for firm i in year t

The dummy variable FIRM determines whether a firm is a USO, an IIS, or a USO that was born as an IIS. Keeping in view this model, we run a regression analysis on companies founded between 2014 and 2016 in the first three years of their lifecycle.

[4] 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

[5] 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

The primary objective of this study is to analyze and compare the performance of university spin-offs (USOs) and innovative start-ups (IISs) in Italy. Additionally, we aim to investigate whether there is a correlation between early-stage innovative firms' growth rates (sales) and their relationship with a university as a parent organization. We use the same model for both research questions as explained in section 3. The dependent variable used in the analysis is sales growth, which is measured as the natural logarithm of the difference in sales between year t and year t-1. The independent variables and controls used in the analysis are time-specific, firm-specific, industry-specific, and ecosystem-specific indicators, including R&D intensity level (rdint), ATECO code (ateco), and total intangible assets. The standard error is adjusted for the different five macro-regions of Italy such as 'Centro', 'Isole', 'Nord-est', 'Nord-ovest', 'Sud'.

The variable FIRM of our regression equation effectively explains the performance in terms of sale growth when we compare IISs to USOs, as shown in Table 2. The study in hand finds that IISs in Italy outperform USOs in terms of sale growth. However, the other variables used in the analysis do not show significant results in explaining the difference in growth rates between the two types of firms. The only variable that is explanatory in this regard is the total value of intangible assets. When comparing USOs and IISs with USOs that are also IISs, the results are not as promising. The difference in the potential growth rates of sales between USO/IISs and USOs that are IISs is not explained by the variable FIRM, as demonstrated in Table 3.

Both the first and second analyses' results could have a variety of causes. In our first analysis, if we consider how a firm's type and relationship with academia may affect that firm's growth, it appears that the academia "parenting" relationship with USOs does not guarantee better performance when compared to other innovative firms, such as IISs. We, therefore, follow Leyden and Link (2013) that the propensity for innovation and the relationship with academia do not directly result in higher economic performance, in spite of the fact that the greater tendency for R&D activities (especially due to composition of the workforce; Ranga and Etzkowitz, 2013) and access to research that is not yet commercially available should result in higher growth rates.

It is important to consider a range of factors when assessing a firm's economic performance, and not solely rely on measures of innovation or academic affiliation. While innovative firms outperform their non-innovative counterparts, they nonetheless confront several challenges and difficulties in their early phases due to their infancy and small size (Audretsch *et al.*, 2020). Therefore, higher performance does not depend only on the R&D until and unless accompanied by founding team's entrepreneurial, strategic, and commercial skills, new business development methodologies, a favorable environment, and a strong network of partners (Daz-Santamara and Bulchand-Gidumal, 2021; Iazzolino *et al.*, 2019).

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. The dependent variable is 'growth', at the top of the table

Growth	Coefficient	P>z
Firm		
Startup	24.75635	0.000
Year		
2016	2.010249	0.898
2017	-31.56854	0.309
2018	-39.28827	0.227
Rdint		
Low R&D	2.230406	0.795
Medium R&D	1.767358	0.843
Medium-High R&D	6.510788	0.382
Medium-Low R&D	-.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

As per as our second research question is concern, instead, the findings shown in Table 3 lead to different conclusions. First, both in the confrontation with IISs and USOs, the firm's type does not explain alone the differences in growth between them and USOs that are also IISs. This can be explained as that having innovative firms' characteristics does not guarantee firm's higher performance. While policy interventions aimed at fostering innovation and entrepreneurship are important, simply recognizing a firm as innovative does not guarantee its success or growth trajectory. Therefore, policies and support programs need to be designed to address not only the initial recognition and support of early-stage innovative firms, but also their longer-term growth and success by addressing a range of internal and external factors that can impact their performance.

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. The dependent variable is 'growth', at the top of the table

	IISs		USOs	
Growth	Coefficient	P>z	Coefficient	P>z
Firm				
Uso&Startup	-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				
Low R&D	1.688326	0.842	-3.73013	0.286
Medium R&D	2.710009	0.789	-3.129683	0.433
Medium-High R&D	7.550741	0.324	7.831438	0.302
Medium-Low R&D	-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.

Following this, we examine 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, contamination labs, universities, students, and incubators do not explain alone the differences in growth between the selected firms. This is not the case when we compare USOs to USOs that are also IISs. In this regard, the presence of incubators and a high Regional Innovation Score are positively associated with the growth rate of USOs that are also IISs. However, the number of students and universities in a region has a negative association with the growth rate of such firms in a NUTS 1 region. This leads to dual interpretation of the results. On the one side, in Italy, a region's innovation level, as well as the number of students, universities, contamination labs, and incubators, have less of an impact on innovative start-ups. This is due to the possibility that these firms are less integrated into the local innovation ecosystem and may also be more autonomous in their early life. In fact, the success of innovation ecosystem in promoting the growth of firms depends on the quality of connections between the ecosystem's actors, actions, and artifacts, rather than just the presence of supportive infrastructures, high-skilled human capital, and academia.

On the other side, USOs 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. Generally speaking, these conditions demonstrate the potential ineffectiveness of policy interventions that prioritize the quantity of support and actions over their quality, which is in line with the previous studies (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 its two most acknowledged types of early-stage innovative firms, and analyzing the impact that the linkage with a university has on their growth.

The European Union has made significant efforts to develop an innovation ecosystem and provide funding for its member states. However, there remains a substantial gap in innovation performance among the countries. Italy is a major economy, but still lags behind other member states as a moderate innovator. To address this issue, this paper aims to explore the effectiveness of interactions between universities and early-stage innovative firms in Italy by providing theoretical and empirical insights into the performance of university spin-offs and innovative start-ups.

Starting from two datasets of USOs and IISs in Italy, we carry out a panel data regression that allows us to compare the performances of these two types of early-stage innovative 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 early-stage innovative firms. University administrators should direct more investments into: transforming the organizational structure in order to make it more entrepreneurship-oriented; improving their entrepreneurship & innovation (E&I) development programs (such as Contamination Labs); helping their spin-off firms transition from being research-oriented to being market-oriented; better supporting them with a strong network of mentors and partners; creating new educational programs in line with the current needs of high-growth innovative firms; improving their strategic connections with other ecosystem actors, and especially with innovative start-ups. Founders of early-stage innovative companies, instead, could use this to make strategic decisions on both the definition of their company's organizational structure and the external collaborations. First, they should ponder and improve the strategic connections they develop with other ecosystem actors involved in R&I activities. Second, they should consider that the linkage with universities with poor E&I programs might not provide benefits for their growth.

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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sinergie
italian journal of management

ISSN 0393-5108
ISSN 2785-549X
DOI 10.7433/s121.2023.07
pp. 127-150

Rethinking innovation in light of women entrepreneurship

Received
15th February 2022
Revised
8th August 2023
Accepted
30th August 2023

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Abstract

Framing of the research. *Women empowerment and innovation are deemed an absolute priority in many countries. As a matter of fact, they had been included among the 17 sustainable development goals. Despite the common understanding that progress cannot occur regardless inclusivity, prior literature was being somewhat aloof on this matter. As the result, the research corpus seems mostly established on a sort of patriarchal knowledge, favoring a male-inspired stereotyping of the innovation narrative.*

Purpose of the paper. *This study contributed to extend the conversation on innovation by investigating the phenomenon using the lenses of cultural dynamics and women entrepreneurship.*

Methodology*. Using a large-scale cross-sectional dataset related to the year 2021, drawn from Eurostat and World Bank, hypotheses were tested by means of the Ordinary Least Squares (OLS) linear regression method.*

Results*. Our findings confirmed that innovation is more likely to occur when the country scores high in indulgence and there is a large number of women in business.*

Research limitations. *As a cross-sectional analysis, the study did not capture over-time dynamics.*

Managerial implications*. Inclusivity and well-being accelerate progress and foster innovation.*

Originality of the paper*. The paper challenged the extant narrative of innovation by proposing an alternative gender-based view of the process.*

Key words: innovation; Hofstede; culture; women entrepreneurship; knowledge; happiness

1. Introduction

Over time, Knowledge was carved as a monolithic corpus, unable to reflect nuances driven by subjectivity. However, a reality-grounded perspective suggests investigating subjective characteristics, such as those related to gender.

The focal distortion of extant knowledge is caused by the adoption of a univocal and gender-biased envision of the world. Mostly, gender biases are defined by country culture.

As the result, many research domains lack of an inclusive perspective. Innovation research makes no exception. Consistently, this paper is aimed at investigating what happens to innovation performance when a growing number of women is allowed to enter the entrepreneurial arena.

Previously, entrepreneurship and innovation were mostly studied in connection to male-related characteristics, such as individualism (Kashima *et al.*, 1995).

As a matter of fact, women entrepreneurship and empowerment are still marginal compared to male entrepreneurship (United Nations Development Program's Human Development Report 2021).

Two main resounding gaps emerge from this panorama: 1) a relatively small number of studies on gendered innovation; 2) little awareness of effects of gender biases on knowledge production.

Current work aimed at tackling the retrieved gaps by investigating the relationship among innovation, women entrepreneurship, and cultural dimensions.

Specifically, current research assumed that women entrepreneurship creates a fertile environment for innovation. However, a deep understanding of this phenomenon requires a thorough consideration of countries' cultural background(Hofstede *et al.*, 2005). So, this paper also investigated the impact of two main cultural dimensions: indulgence and masculinity. Indulgence measures the extent of personal freedom and the degree of well-being of a society, whilst masculinity expresses and the dominance of a gender over the other (Hofstede, 1980).

As matter of fact a restrained and masculine societies do not allow women to start up a business.

By and large Subjective Well-being (SWB, popularly known as happiness) can be described as the individual experience of pleasant emotions (Diener, 1984, Kim *et al.*, 2005; Blanchflower and Graham, 2021; Oishi *et al.*, 2013; Burns and Crisp, 2022; Roberts and Helson, 1997; Twenge and Campbell, 2008; Hamamura, 2012). As such, SWB varies over time and space. According to Hofstede *et al.*, (2010), it is possible to measure the happiness of a society in terms of "indulgence versus restraint". Indulgent cultures are focused on individual happiness, well-being, leisure, and freedom, as opposed to restrained cultures (Hofstede *et al.*, 2010). This approach closely recalls the Kantian practical philosophy, which is based on the idea that happiness is freedom of choices: freedom is the ultimate categorical imperative, or the highest moral value of all. A couple of centuries later, scholars rediscovered the value of happiness for economic growth (Khan and Cox, 2017; World Value Survey 2021) in terms of: value co-creation (Hughes and Vafeas, 2021), knowledge-intensive contexts (Salas-Vallina *et al.*, 2018), entrepreneurial initiative (Usai *et al.*, 2020), female entrepreneurship (Ozyirmidokuz *et al.*, 2019), entrepreneurial orientation (Bernoster *et al.*, 2020).

Despite indulgence being relevant for a variety of business matters (Xu *et al.*, 2004; Demangeot and Sankaran, 2012; Cleveland *et al.*, 2013; Zhang, 2017; Kleijnen *et al.*, 2009;, Cova and Dalli, 2009;, Sorum, 2020; Schneider *et al.*, 2013; Schneider *et al.*, 2016), previous studies overlooked its role in innovation. Antecedent research mostly focused on the impact of individualism on R&D investments (Shao *et al.*, 2013; Choi, 2020; Kim, 2021). Though, indulgence of culture might have a significant influence on individuals' perceptions, cognition, behavior, and creativity (Stein, 1953, Tesluk *et al.*, 1997; Chen *et al.*, 2018; Diener *et al.*, 2003; Gutiérrez *et*

al., 2005; Sirgy, 2021; Schmitt *et al.*, 2007). In addition, that genders show different cognitive and behavioral patterns.

According to the Big Five Inventory scale, women reported higher levels of neuroticism, extraversion, agreeableness, and conscientiousness than did men across most nations (Schmitt *et al.*, 2008). The Big Five Personality Traits Model - conscientiousness, agreeableness, neuroticism, openness to experience, extraversion (Schmitt *et al.*, 2007; Schmitt *et al.*, 2008; Komarraju *et al.*, 2011; Cobb-Clark and Schurer, 2012) -, is based on the assumption that personality impacts emotions (Berkovich and Eyal, 2021), cognition (Yeh *et al.*, 2021), entrepreneurial orientation (Santos, Marques, and Ferreira, 2020), and orientation toward innovation (Kusa *et al.*, 2021).

Based on above considerations, current work explored the relationship among innovation, women entrepreneurship, and two cultural dimensions - indulgence and masculinity.

Data were drawn from a mix of sources: the Eurostat database, the World Bank, and the last available version of the six-dimensions Hofstede's cross-cultural scale. The cross-sectional analysis was focused the year 2021.

After excluding missing cases listwise, the geographical span of the study covered a total of 16 different EU countries (Belgium, Bulgaria, Czechia, Denmark, Estonia, Finland, Croatia, Hungary, Italy, Latvia, Lithuania, Luxembourg, Poland, Portugal, Romania, Slovenia). In total, about 38.000 female owned enterprises were examined.

Relationships among variables were tested by using an Ordinary Least Squares (OLS) regression method.

Results confirmed the positive effect of women entrepreneurship and indulgence on 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 reports study's concluding remarks.

2. Literature background

2.1 Knowledge or knowledges?

Albeit we often use the singular noun "knowledge", correctly speaking we should use the plural "knowledges", which reflects subjectivity and variety of cultures.

As a matter of fact, knowledge is created by means of complex and continuous interactions between individuals' and collective's experiences of life (Durkheim, 1909). Individual knowledge is the outcome of cognitive structures, experiences, ideas, concepts, and forms of thoughts (Child, 1940; McCarthy, 2005), whereas social knowledge, named culture, can be described as the formal and substantial expression of societal languages, values, belief, norms, and envisions of the world. The two forms of knowledge influence each other mutually and incessantly (Berger and Luckmann, 1966).

Each society, and, therefore, each culture, has its own specific managerial and communication styles (Morris and Pavett, 1992, Bakhtari, 1995; Lam *et al.*, 2021), along with its own peculiar biases (Hall and Whyte, 1960). As instance, gender biases are more frequent and extreme in high-context cultures - e.g. Asia, Middle East, and Latin America (Women on boards) - than they are in in low-context cultures. As a matter of fact, the first type of culture is inherently patriarchal and attributes a high symbolic power to non-verbal communication.

Literature already recognized that the presence of a variety of cultures entails the existence of likewise forms of knowledges. Though, it failed to anticipate the times, by considering that the gender of an entrepreneur may also influence business outcomes, including country innovation.

Understanding the gender nuances of business phenomena is crucial for designing and chartering effective growth roadmaps.

This approach is known as the phenomenological study of knowledge, or the study of phenomena as they occur over time and space.

Accordingly, knowledge can be described as a purposefully implemented strategic construction of reality, or as an organized set of information, acquired by means of experience, exposition, and inference (Zack, 1999): it is a thing - susceptible to be stored - and a process, simultaneously. Consistently, knowledge can occur by acquaintance - "knowledge of things" by direct experience -, or propositionally - a "knowledge about things", which is acquired indirectly (Zagzebski, 2017).

Other knowledge taxonomies were proposed by scholars over time. Accordingly, knowledge can be classified as: individual, collective, and organizational (Kimmerle *et al.*, 2010; Hecker, 2012; Anderson and Lewis, 2014; Cress and Kimmerle, 2017; Zack, 1999; Nonaka and Takeuchi, 2007); 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).

Assuming that knowledge has a phenomenological value, then gender and personality might largely influence knowledge construction (or innovation, for what it matters).

This premise embodies the main rationale to current work.

According to Grant (1996), cognitive function of firms occurs as the recombination and transformation of personal and tacit knowledge into organizational one. In other words, organizational knowledge is formed by means of transforming tacit into explicit knowledge. Tacit knowledge (Polanyi, 1958, 1967) refers to awareness, conceptualizations, and perceptions of a person (Cowan *et al.*, 2000). As such, tacit knowledge is also contextualized, meaning that it is affected by culture and by one's experience of life (Ancori *et al.*, 2000). Scholars previously suggested that culture affects the individual's social network size (Batjargal *et al.*, 2019), entrepreneurial intentions (Shinnar, Giacomin, and Janssen, 2012), and personal social resources (Brieger and De Clercq, 2018).

Emotions are likewise relevant for knowledge creation. According to the SECI model (Nonaka *et al.*, 1994), emotions trigger those mechanisms of socialization, externalization, combination, and internalization leading to knowledge creation. 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 the "ba", where the "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 its "ba", it is a mere information (Nonaka and Konno, 1998). At a collective level, the "ba" sublimate 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 some 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 capturing the nexus between positive psychology and knowledge creation.

By and large, knowledge sharing occurs as the socialized response of an individual, elicited by positive emotions (Fredrickson *et al.*, 2003). Positive emotions go under the label of subjective wellbeing (SWB) and they are commonly called "happiness". Happiness can be described as "a positive inner state, deriving from goal achievement and fulfillment of aspirations" (Delle Fave *et al.*, 2016; p. 30). Happiness is a multifaced construct. We distinguish into: hedonic happiness, life satisfaction, and eudamonic happiness (Kim-Prieto at al., 2005; Kahneman *et al.*, 1999).

The academic interest toward positive psychology was growing in prominence recently (Delle Fave *et al.*, 2016; Ashkanasy, 2011; Waterman, 2008; Oishi *et al.*, 2013; Sirgy, 2021; Pena-López *et al.*, 2021; Uchida *et al.*, 2004; Oishi *et al.*, 2008; Joshanloo, 2014; Lee *et al.*, 2000).

In the field of knowledge management, studies prevalently limited their interest to value co-creation (Cosimato *et al.*, 2021; Hughes and Vafeas, 2021) and to team dynamics (Chumg and Huang, 2021), despite a potential relevance of happiness for innovation (Usai *et al.*, 2020; Brulé and Munier, 2021).

At a social level, happiness is captured by a cultural dimension introduced by Hofstede *et al.*, (2010) that was labeled as "indulgence versus restraint". Specifically, indulgence considers individual acknowledgement of leading a happy time (frequency and percentage) and the extent to which people enjoy freedom. Personal freedom can be deemed as an essential pre-condition for entrepreneurship (Minniti, 2008; Lamine *et al.*, 2021). Nonetheless, many limitations to freedom still impair individual development worldwide. These limitations mostly have a cultural origin. Entrepreneurship is one of the activities that can be prohibited to women (Goel, 2018).

2.2 Rethinking innovation in light of women entrepreneurship

The evolution of capitalism (Schumpeter, 1934; Schefold, 1996; Soriano and Huarng, 2013) urged scholars to provide a new envision of the dichotomy between entrepreneurship and innovation (Hodgson, 2001) in light of ethical progress (Ebner, 2006). To date, there is still a dearth of academic contributions on gendered innovation, though.

Women entrepreneurship is deemed to be a potential driver of societal progress (Bullough *et al.*, 2022). Nonetheless, a variety of factors impairs women active contribution to society by means of careers. Culture is one of the main obstacles that women must face (Anambane and Adom, 2018). As a matter of fact, gender biases are entrenched in culture worldwide (Globe 2020). Such biases affect women leadership legitimacy (Newburry, Belkin, and Ansari, 2008), despite their interpersonal skills, empathy (Macaskill *et al.*, 2002), ability of being multitasking (Ruderman *et al.*, 2002), and intercultural attitude (Javidan *et al.*, 2016). As instance, men are usually deemed independent, assertive, natural-born leaders, differently from women (Osborn and Vicars, 1976, Shahriar, 2018; Gupta *et al.*, 2019). Allegedly, gender biases lead to a sort of myopic managerial knowledge, unable to capture the gender-based contribution to innovation. Said literature shortcomings drove both national and supranational institutions to launch an urgent call for gender-fixing knowledge (EU Framework), as a mean for achieving gender parity.

Nonetheless, the majority of extant studies on innovation assumed an ungendered approach (Schumpeter, 1934; Rosenberg, 1982; Hagedoorn, 1996; Trischler *et al.*, 2020; Ughetto *et al.*, 2020; Ojong, Simba, and Dana 2021; Mokline, 2021).

Miller (1983) defined entrepreneurship as "the process by which organizations renew themselves and their markets by pioneering, innovation, and risk taking" (Miller, 1983, p. 770). According to the author, leader's personality is a factor affecting innovation by means of "locus of control".

Lumpkin and Dess (1996) emphasized the importance of context for entrepreneurial orientation,

Accordingly, culture and gender-related personality traits might have a slight influence on innovation (Figure 1).

As a matter of fact, innovation always begins with an act of creativity (Okpara, 2007). Kirzner (1999) advised that creativity is associated with entrepreneurial alertness. Alertness is the act of discovery/recognizing an opportunity occurring in reason of cognitive, motivational, and environmental factors (Foss and Klein, 2010). Studies suggested that positive affect - happiness - may be essential for alertness (Levasseur *et al.*, 2020; Fellnhofer, 2021; Tang, Baron, and Yu, 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). Until these days, the impact of culture on innovation was underemphasized though (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).

In Western-Calvinistic cultures, innovation is mostly seen as an individualistic process (Steiner 1995; Nakara *et al.*, 2021; Wang and Tan, 2020; Li *et al.*, 2020; Lee and Raschke, 2020; Morris *et al.*, 1993).

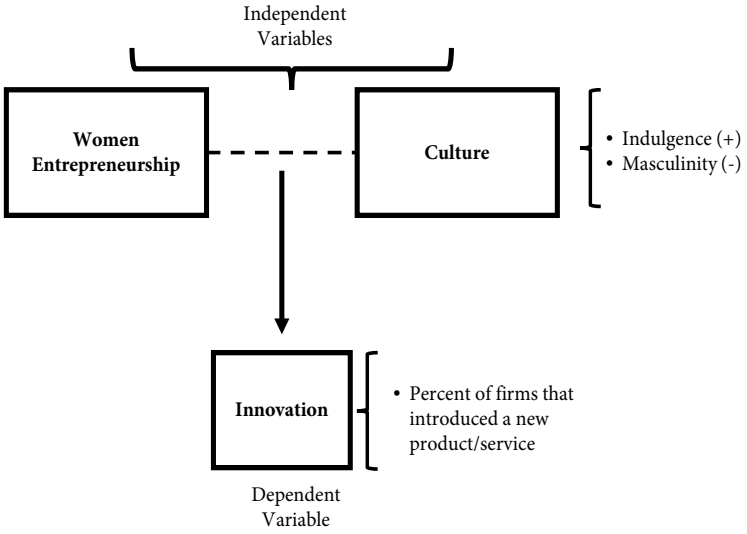
Such pervasiveness of a pragmatic approach to innovation (Montes *et al.*, 2005; Rampersad, 2020; Guth and Ginsberg, 1990) left a little room to understand how emotions influence this process. Yet, innovation is deemed to burgeon when an individual is in a positive mental state of flow (Csikszentmihalyi and Larson, 2014; Lomas *et al.*, 2020) and she/he achieves a sense of attainment (Plagnol and Easterlin, 2008).

Precisely, happiness has 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).

Evidence proved that happiness is positively associated with entrepreneurial orientation (Entrialgo *et al.*, 2000; Fowle, 2019; Bernoster *et al.*, 2020), resilience (Fowle, 2019), self-investment (Shimoni, 2021), and personal freedom (Clark *et al.*, 2008; Inglehart *et al.*, 2008). Emotions are also socially contagious -informed empathy (Miller, 2013).

Typically, empathy is a characteristic frequently associated with women (Arrosa and Gandelman, 2016), as much as extraversion and cooperation (Lu and Argyle,1991), or "mating bonds, deep friendship, close kinship, and cooperative coalitions" (de Groot *et al.*, 2015; p. 15). Despite occupational differences in the labor market - specifically, in engineering/computer, medical, teaching, and service occupations (Joy, 2006) -, women are also deemed more resilient than man, because of a contrast and habituation effect (Brickman *et al.*, 1978).

Fig. 1: synthesizes the research model and hypotheses



3. Research design and empirical analysis

3.1 Sample

Cultural variables were amply used to explain a variety of social phenomena during the last 20 years, at least. Regarding women entrepreneurship, most studies employed the Hofstede's scale (1980). Other scholars have used the Globe extended scale (House *et al.*, 2004), which considers both the six-dimensions Hofstede's scale (2006) and 21 primary dimensions of leadership.

Grounding on antecedent works, data for current analysis were drawn from: Hofstede's cross-cultural rankings, World Bank (Neumeyer *et al.*, 2019; Hechavarría and Brieger, 2020), and Eurostat (Mroczek-Dąbrowska and Gaweł, 2020; Gawel and Głodowska, 2021). Extracted data refer to year 2021 and to European Union (EU). The choice of focusing on a single year and only on one economic region was motivated by the need of increasing the accuracy of analysis by avoiding excess missing data.

In addition, EU is a multinational market region, characterized by an acceptable degree of market standardization, which makes this setting rather ideal for studying innovation.

Specifically, EU is characterized by the following factors: economic union, absence of 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.

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

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, to control for firms' dimension.

In total, we examined 16 different countries (Belgium, Bulgaria, Czechia, Denmark, Estonia, Finland, Croatia, Hungary, Italy, Latvia, Lithuania, Luxembourg, Poland, Portugal, Romania, Slovenia) and 38.000 women-owned enterprises.

3.2 Methodology

Previous researches used a wealth of methods to test relationships among culture, innovation, and female entrepreneurship and, precisely: 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; Aytekin *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 performed the Ordinary Least Squares (OLS) multiple linear regression analyses to test our model's hypotheses.

The general linear regression equation is the following:

$$\Upsilon_i = \beta_0 + \beta_1 \chi_{i1} + ... + \beta_n \chi_{in} + e_n$$

3.3 Variables

3.3.1 Independent variables

Our assumptions are the followings:

i. there is a positive relationship between innovation, women entrepreneurship, and indulgence.
ii. There is a negative relationship between innovation and masculinity.

We considered three different independent variables. The first independent variable is women entrepreneurship (Brush and Cooper, 2012; Ojong *et al.*, 2021). This variable was measured as the percent of firms with female participation in ownership (Matricano, 2022; Audretsch *et al.*, 2022).

Then, we considered two of the Hofstede's (2010) cross-culture dimensions: indulgence versus restraint (ivr), and masculinity versus femininity (mas).

3.3.2 Dependent variable

Innovation is used as our dependent variable. To measure this variable, we considered the "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; Orlando *et al.*, 2020).

3.4 Results

Table 1 shows the descriptive statistics of the analysis.

Tab. 1: Descriptive statistics

	Mean	Standard Deviation
Percent of firms whose new product/ service is also new to the main market	79,246875000000000	34,338741331767000
Mas	40,94	21,834
ivr	34,640066964285700	17,675831533336000
Percent of firms with female participation in ownership	96,996875000000000	41,007769462017800

The regression analysis considers how women entrepreneurship, indulgence, and masculinity influence innovation.

Table 2 synthesizes results of the regression.

Tab. 2: Multiple Regression Analysis

Riepilogo del modello[b]										
	R	R-squared	Adjusted R-squared	Standard error of estimation	Modified R-squared	Modified F	Df1	Df2	Sign. Modified F	Durbin-Watson
1	,965[a]	0,931	0,906	10,55	0,931	36,956	4	11	0	2,171
a. Predictors (costant), Percent of firms with female participation in ownership, mas, ivr										
b. Dependent variable: Percent of firms whose new product/service is also new to the main market										

The adjusted R-squared is 0,90 of model 2, which is very good. The Durbin-Watson test value is 2,171, therefore it is deemed acceptable. In particular, VIF values range between 1 and 2, which means there is very poor correlation between variables and that predictors are adequate.

So, the alternative hypothesis is accepted, with a statistically significant p value=, 0 < 0.05 and the null hypothesis should be rejected.

Therefore, the final model is:

- Percent of firms whose new product/service is also new to the main market = -31,8 - 0,3 mas + 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 women entrepreneurship. Increasing levels of women entrepreneurship foster innovation. Though, the constant shows that a high number of women entrepreneurs is required to drive a positive effect on innovation. In addition, indulgence is confirmed to be a driver of innovation. By contrast, masculinity seems to hinder innovation.

3.5 Discussion

This analysis largely contributes to extend the conversation about innovation, culture, and gender entrepreneurship by bringing to the

surface previously unknown and hidden mechanisms, such as gender biases in knowledge production.

Unprecedently, current findings ultimately proved the relevance of women empowerment for the progress of a country.

As a matter of fact, the constant of the regression model - our y-intercept - has a negative value, -31,8, meaning that if we set all of the independent variables in the model to zero, innovation would have been negative. Of course, this scenario is purely ideal and the constant also absorbs all model's biases, in mathematical terms.

Nonetheless, results show that gender parity is a preeminent goal for those countries whose primary aim is achieving a high level of innovation performance.

It must be noted that the proxy of innovation used in our model measures radical innovations, which accounts for a substantial and exportable progress, able to make a differential impact on countries' growth and their reputation/image.

In addition, the evidence also unveiled two further critical culture-related phenomena: 1) masculine-oriented cultures have a slight negative influence on innovation; 2) indulgent cultures seem to create a fostering environment for innovation.

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

Differently, our analysis proved that this cultural dimension might have a hindering effect on innovation. This finding is consistent with our model's assumptions.

As a matter of fact, along with representing an obstacle to women empowerment and opposed to feminine cultures, masculine cultures are based on the followings: assertiveness and egocentrism, gender roles that are clearly differentiated, conflict solved through force, gender wage gap, fewer women in management, traditional family structure *et al.*,

Differently, "Femininity stands for a society in which social gender roles overlap: Both men and women are supposed to be modest, tender, and concerned with the quality of life." (Hofstede, 2001; p. 297). This statement brings us directly to our second and most important result: indulgence is an important driver of innovation. This variable is inherently associated to femininity (Hofstede, 2001). Thus, not surprisingly, this finding is extremely consistent with the idea of women entrepreneurship.

Indulgent cultures have also proved to have a high association with personal freedom, subjective well-being, life satisfaction, and happiness (Li *et al.*, 2022).

Prior research found that indulgent societies are positively associated with innovation adoption likelihood (Syed and Malik, 2014).

Extending previous evidence, our analysis originally revealed that an indulgent culture favors radical innovation generation.

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

Current work extended theory in many directions.

First, our study originally contributed to gendered innovation literature by providing strong evidence that women entrepreneurship is a driver of innovation. For a long time, innovation was investigated by wearing the hat of the white-male entrepreneur. In other words, not only innovation was scantly associated to women entrepreneurship, but it was also biased by the idea that only male-related characteristics were able to drive innovation and progress. This study shed light on the gender bias that affect knowledge production, by unveiling that, on the opposite, innovation is more likely to be positively associated with personal traits that are frequently found in female-groups.

Then, this work contributed to unravel the effects of culture on innovation by tackling a previously unanswered call for large-scale evidence (Büschgens *et al.*, 2013). As a matter of fact, we originally found a negative association between innovation and masculinity.

In addition, current research extended the conversation on subjective-well-being (SWB) by proving the positive influence of happiness on country's radical innovation performance, as opposed to prior evidence (Aldieri *et al.,* 2021). The study has also some crucial implications for managerial decision making and policy makers.

At a managerial level, the study suggested how to escape the coevolutionary lock-in/lock-out trap by investing in gender parity. Typically, innovation is deemed to be a path dependent phenomenon (Thrane *et al.*, 2010; Coomb and Hull, 1998, Freeman, 1990, Goumagias *et al.*, 2022). Hiring women talents might have some relevant implications in terms of increasing levels of creativity and accentuated predisposition toward long-terms results (Van Everdingen and Waarts, 2003; Khan and Cox, 2017).

Consistently, policy makers should focus their efforts toward removing gender biases for the wellness of countries. Women still have poor access to scientific careers or to high-tech intensive resources (Women in Science) and they are exposed to gender pay gap (Chipman and Thomas, 1987, Solomon, 1985, Fox, 1995). Yet, they experience an impaired access to capital (Brush and Cooper, 2012) and to entrepreneurial opportunities (Verheul *et al.*, 2006). Finally, they also have frequent self-esteem and self-confidence issues (Garaika *et al.*, 2019). All the aforementioned problems represent a huge obstacle to women empowerment, and, as such, they endanger the progress of countries.

Lastly, the study has some major social implications in terms of well-being and quality of life. Current evidence confirmed that "happiness" and well-being are drivers of economic growth, by means of innovation. Probably, this result has a multifold explanation: SWB improves creativity, affects consumer behavior by increasing the likelihood of innovation adoption, pushes people to aim for more - i.e.: transcendental needs -, stimulates better and higher levels of education, provides with income slack for making free choices at all levels., etc.

Clearly, structural investments that bring up standards of life can restart country growth.

Among other perks, current robust analysis allows for replicability, thanks to the use of publicly available archival data. However, some limits might bias our results. First, our analysis is cross-sectional. Also, it only considers a limited number of countries/regions. Future research should extend the analysis with longitudinal observations and a larger geographical setting. In addition, we used a linear model, whilst non-linear relationships may still exist. Finally, future studies should also consider additional variables (e.g.: related to subjective well-being or country economy, politics *et al.*).

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sinergie
italian journal of management

ISSN print 0393-5108
ISSN online 2785-549X
DOI 10.7433/s121.2023.08
pp. 151-175

The impact of stakeholder orientation on innovation: an empirical investigation on firm patenting activity

Received
15th February 2022
Revised
22nd February 2023
Accepted
7th August 2023

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Abstract

Framing of the research. *The paper provides novel insights on how firms can boost innovation output 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 output.*

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.*

Key words: stakeholder orientation; innovation output; patenting activity; stakeholder management

1. 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 causal 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 innovation output, 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 reminder 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.

2. 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 results 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 results 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 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.

3. Methodology

3.1 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 has 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.

3.2 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 backword 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.

3.3 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.

Table 1 reports an in-depth description of each variable used to assess a firm degree of orientation towards its stakeholders.

Tab. 1: Description of the variables used to operationalize stakeholder orientation

Variable	Description
Employee Orientation	The variables measure a company's management commitment and effectiveness towards (a) maintaining diversity and equal opportunities in its workforce; (b) providing high-quality employment benefits and job conditions; (c) providing a healthy and safe workplace; and (d) providing training and development (education) for its workforce
Supplier Orientation	The variables measure a company's management commitment and effectiveness towards treating suppliers and contractors as key business partners, implementing concrete actions to improve the partnership process with suppliers and contractors,
Customer Orientation	The variable measures a company's management commitment and effectiveness towards generating sustainable and long-term revenue growth. It reflects a company's capacity to grow, while maintaining a loyal client base through satisfaction programmes and avoiding anti-competitive behaviours and price fixing.
Community Orientation	The variable measures a company's management commitment and effectiveness towards maintaining the company's reputation within the general community. It reflects a company's capacity to maintain its license to operate by being a good citizen, protecting public health, and respecting business ethics.
Natural Environment Orientation	The variable measures a company's impact on living and non-living natural systems, including the air, land and water, as well as complete ecosystems. It reflects how well a company uses best management practices to avoid environmental risks and capitalize on environmental opportunities in order to generate long term shareholder value.

Source: Own elaboration based on Asset4 variables description

3.4 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 measured 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.

3.5 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 2 reports the summary statistics and Table 3 shows 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. 2: 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: Own elaboration

Tab. 3: Pairwise correlations

	Variable	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1	Patents	-							
2	Radicalness	-0.05	-						
3	Originality	-0.04	0.50	-					
4	Generality	0.06	0.31	0.35	-				
5	Stakeholder Or.	0.33	0.01	0.02	0.02	-			
6	Empl. Or.	0.30	0.00	0.03	0.01	0.85	-		
7	Supplier Or.	0.28	0.01	0.02	0.02	0.69	0.54	-	
8	Customer Or.	0.22	-0.01	0.00	0.01	0.66	0.43	0.27	-
9	Community Or.	0.16	0.01	0.01	-0.02	0.81	0.65	0.37	0.46
10	Environ. Or.	.0.34	0.03	0.02	0.04	0.86	0.72	0.59	0.39
11	Size	0.29	-0.02	-0.01	0.00	0.54	0.46	0.41	0.35
12	Intangibles (ln)	0.26	-0.02	0.04	0.03	0.24	0.23	0.23	0.10
13	R&D expenses	0.14	-0.06	0.02	0.07	-0.03	-0.01	-0.01	-0.02
14	ROE	0.01	-0.01	0.00	-0.01	0.03	0.03	0.03	0.05
15	Debt-to-equity	-0.08	0.01	0.00	-0.05	0.03	0.03	-0.03	-0.01
16	Age (ln)	0.11	-0.02	0.00	0.03	0.22	0.21	0.14	0.13
	Variables	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*
9	Community Or.	-							
10	Environ. Or.	0.59	-						
11	Size	0.42	0.46	-					
12	Intangibles (ln)	0.16	0.23	0.37	-				
13	R&D expenses	-0.06	0.00	-0.13	-0.02	-			
14	ROE	0.02	0.01	0.02	-0.01	-0.04	-		
15	Debt-to-equity	0.07	0.03	0.05	0.10	-0.12	0.07	-	
16	Age (ln)	0.17	0.19	0.23	0.04	-0.04	-0.01	0.05	-

Source: Own elaboration

4. Results

Table 4 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).

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 ($\beta = 0.91$; $p < 0.001$), 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 (β = 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 (β = -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 (β = 0.46; p < 0.05).

Tab. 4: Results of the main analyses on the quantity of innovation output

	Baseline	Hp1	Hp1a	Hp1b	Hp1c	Hp1d	Hp1e
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***	48.46***	49.91***	49.73***	52.19***	52.96***	49.23***
	(12.36)	(11.61)	(11.89)	(11.85)	(12.11)	(12.38)	(11.92)
Intangibles (ln)	4.01*	3.88*	3.81*	4.15*	3.99*	4.02*	3.96*
	(2.30)	(2.26)	(2.25)	(2.28)	(2.29)	(2.30)	(2.27)
R&D intensity	46.50	47.87	46.23	45.51	48.63	46.53	46.20
	(48.84)	(48.75)	(48.44)	(48.59)	(49.57)	(48.86)	(48.29)
ROE	0.64*	0.59*	0.61*	0.65*	0.61*	0.64*	0.62*
	(0.35)	(0.34)	(0.35)	(0.34)	(0.34)	(0.34)	(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	-4.53	-3.87	-2.07	-3.42	-2.80	-3.77
	(7.11)	(7.05)	(7.13)	(6.96)	(7.08)	(7.05)	(6.99)
Constant	-53.55***	-45.51***	-46.90***	-46.59***	-47.15***	-48.06***	-47.25***
	(12.12)	(10.42)	(10.70)	(10.65)	(10.62)	(10.90)	(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

The results of the fixed effect models, aiming to analyze the impact on the quality of innovation output, are detailed in table 5. Results were estimated with robust standard errors.

Tab. 5: 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 (β = 0.07; p < 0.01). Additionally, the direction of the relationship between originality and stakeholder orientation goes as predicted in Hypothesis 2 (β = 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 (β = −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 is 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 a an alternative measure for the amount of innovative output (Trajtenberg, 1990). As a robustness, 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 relationships with innovation, as well as employee, environmental and supplier orientation remained positively related to the firm's innovative activity.

5. 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 innovation output. 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. Additionally, researchers, relying on primary data, might shed further light on the involvement of stakeholders in the innovation process, providing additional insights on the quality of innovation generated by stakeholder oriented firms. 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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sinergie
italian journal of management

ISSN print 0393-5108
ISSN online 2785-549X
DOI 10.7433/s121.2023.09
pp. 177-199

Firm performance and contribution of female training

Received
15th February 2022
Revised
24th February 2023
Accepted
28th August 2023

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Abstract

Framing of the research*. The present research contributes to the field of studying the effects 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 provides additional benefits to the firm.*

Research limitations. *Due to data availability, it was not possible to distinguish between general and firm-specific training.*

Practical 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 who undergo management training in a sample of Italian firms that adhere to Fondirigenti. The sample includes small, medium, and large firms.*

Key words: female managers; managerial training; firm performance; TFP; senior managers; gender diversity

1. **Introduction**

There are still few women in top corporate management positions. Although the situation has significantly improved in recent years, with female C-suite members rising from 17 percent in 2015 to 21 percent in

2020, the crisis generated by COVID-19 threatens the progress made (Thomas *et al.*, 2020; Crotti *et al.*, 2021). Therefore, many companies insist that a "business case" be presented in order to continue to invest in this issue (Deloitte, 2011; OECD, 2012).

Numerous studies in the existing literature offer substantial evidence supporting the importance of increasing female representation at the highest levels of organizations (Post and Byron, 2015; Jeong and Harrison, 2017). However, the evidence on this matter could be more consistent. Meta-analyses encompassing four decades of research reveal a positive correlation between female presence in top teams and long-term financial performance (Post and Byron, 2015; Jeong and Harrison, 2017). Nevertheless, the markets' reaction to the appointment of female CEOs is contingent on the context. For instance, the impact of female board representation is positive in countries with higher gender parity (Post and Byron, 2015; Hoobler *et al.*, 2018).

Having female leaders in corporate suites brings about several positive results, such as reducing the gender pay gap (Elkinawy and Stater, 2011) and fostering greater representation of women in top management positions (Stainback *et al.*, 2016; Furlotti *et al.*, 2019). It also fosters organizational innovation and creativity (Dezsö and Ross, 2012), leading to more dynamic and forward-thinking companies. Lastly, female leaders have proven to be effective in resolving critical situations (Cook and Glass, 2016), contributing to better crisis management and decision-making within organizations.

Moreover, female top managers or board representatives substantially increase firms' sustainability efforts (Birindelli *et al.*, 2019; Ciasullo *et al.*, 2022; Galletta *et al.*, 2022). This demonstrates that gender diversity at the highest leadership echelons enhances organizational performance and aligns with sustainable business practices.

These findings collectively emphasize the significance of achieving gender diversity at the highest levels of leadership, contributing to more inclusive and successful organizations that are better equipped to adapt to challenges, foster innovation, and pursue sustainable practices.

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 large, publicly traded US 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 investigations 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.

Taking a theoretical standpoint, the resource-based view of firms (Wernerfelt, 1984) and the dynamic capabilities perspective (Teece and Pisano, 1990, 1994, 1997; Teece, 1996) underscore the role of management in shaping corporate performance through purposefully extending, creating, or modifying the organization's resource base (Helfat *et al.*, 2009). The intentional element in capabilities highlights the importance

of management in defining organizational routines, making investment decisions, and coordinating intangible resources to attain efficiency and innovation benefits (Teece, 1984; Dosi, 1988; March, 1994).

In this context, success in competitive environments emerges from the continuous development, alignment, and reconfiguration of firm-specific assets (Teece and Pisano, 1994, 1997; Augier and Teece, 2006). Among these assets, quality company management, as an intangible asset, plays a critical role in attaining sustainable competitive advantage (Pisano, 2017). Consequently, managerial training contributes to the development of intangible firm assets. In addition, when an organization embraces diversity, it broadens the range of possible strategies and methods it can pursue in the marketplace, leading to the development of unique capabilities. By recruiting and training female managers, companies can enhance their decision-making abilities and organizational procedures, allowing them to identify and take advantage of opportunities more efficiently (Augier and Teece, 2009). This, in turn, results in better overall company performance (Christiansen *et al.*, 2016).

The present study investigates the impact of training of senior managers on firm efficiency. In doing so, the 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 provides a compelling and unique case study, as its context allows us to examine theories (which we consolidate into our working hypotheses) under extreme conditions: specifically, the low intensity of training Italian firms offer. This presents an intriguing opportunity to explore the potential impact of senior managers' training, unaccompanied by high-intensity worker training, on total factor productivity (TFP). Additionally, this context enables us to investigate the role of female managers and how they may mediate this relationship.

Our study contributes to the literature on gender diversity by underlying the role of female senior managers in 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 neglected in the previous research by addressing non-US firms of different sizes.

The rest of this paper is organized as follows. Section 2 presents the relevant literature. Section 3 puts forward the research hypotheses. The methodology is set out in Section 4. Section 5 is devoted to data presentation. The results are presented in Section 6, and discussed in Section 7. Finally, Section 8 concludes the paper.

2. Literature

2.1 Gender diversity

The influence of female representation in top management teams and advisory boards on firm performance has yielded a body of mixed evidence (Post and Byron, 2015; Jeong and Harrison, 2017). However, insightful meta-analyses encompassing four decades of research reveal a positive correlation between female presence in top teams and long-term financial performance (Post and Byron, 2015; Jeong and Harrison, 2017). Yet, the market's response to the appointment of female CEOs is context dependent. For instance, female board representation is positively associated with countries having greater gender parity (Post and Byron, 2015; Hoobler *et al.*, 2018), while female representation in top management teams is negatively linked to short-term stock market returns (Jeong and Harrison, 2017).

Furthermore, the presence of women on advisory boards has been found to decrease the likelihood of securities fraud (Cumming *et al.*, 2015). Moreover, women are more likely than men to be considered for promotion to positions associated with crises or high-risk situations (Ryan and Haslam, 2005; Glass and Glass, 2016). This highlights the potential value of female leadership in managing challenging circumstances.

Additionally, female leadership within companies has been associated with higher levels of innovation (Dezsö and Ross, 2012) and improved corporate reputation (Bear *et al.*, 2010). These outcomes emphasize the importance of gender diversity in fostering creativity and enhancing the overall perception of a company.

Furthermore, female representation in the high echelons of leadership contributes to reducing the gender pay gap (Elkinawy and Stater, 2011). Notably, appointing women to advisory boards has a positive spillover effect on the executive team and lower organizational levels (Matsa and Miller, 2011; Skaggs *et al.*, 2012; Stainback *et al.*, 2016). This cascading effect reinforces the significance of women's inclusion in strategic decision-making positions within organizations.

On another note, the impact of female top managers and board representatives extends to fostering firms' sustainability efforts (Birindelli *et al.*, 2019; Ciasullo *et al.*, 2022; Galletta *et al.*, 2022). This observation emphasizes that gender diversity at the highest leadership echelons enhances organizational performance and aligns with sustainable business practices (Marchini *et al.*, 2022). However, a robust female presence in leadership roles is needed to foster responsible environmental practices within companies (Coscia, 2023).

Despite a relatively large literature focusing on gender diversity and its impact on firm performance, most research attention has concentrated on investigating top management teams or members of boards of directors (e.g., Post and Byron, 2015; Jeong and Harrison, 2017), and little is known about gender diversity at lower levels of management (Kirsch, 2018).

Numerous studies on female representation have been carried out on large publicly traded companies. These studies frequently involve

analyzing samples of firms that are part of the Standard and Poor's index (for instance, Hoskisson *et al.*, 2002; Adams and Ferreira, 2009; Carter *et al.*, 2010; Dezsö and Ross, 2012). In other cases, researchers have used samples from the Fortune Most Admired Companies list, as seen in the works of Bear *et al.* (2010), Cook and Glass (2014), Cook and Glass (2015), and Glass and Cook (2016). A few studies, however, have concentrated on subsets of the largest publicly traded companies at the national level, as demonstrated by Kang *et al.* (2007), Rose (2007), Furlotti *et al.* (2019), and Ciasullo *et al.* (2022).

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 reflects 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

Extensive literature on training and its importance is readily available, and with time, interest in this subject has steadily increased, leading to a growing number of studies aiming to capture the impact of employer-provided training on productivity.

From a theoretical point of view, firm-offered training contributes to the development of intangible assets, which are crucial for obtaining competitive advantage according to the resource-based view (Teece, 1984; Wenerfelt, 1984; Barney, 1986). Firms can purposefully extend and modify their resource base through training programs, aligning it with their strategic goals (Protogerou, Caloghirou, and Spyros, 2012). By providing employees, especially managers, with the necessary knowledge and skills, firms can better exploit their existing resources and explore new opportunities to achieve superior performance. Learning empowers individuals to address specific problems effectively and efficiently through experimentation and repetition.

Furthermore, learning is a dual process involving both individuals and organizations simultaneously. While learning occurs at the individual level, the knowledge acquired is shared and institutionalized at the organizational level, integrating insightful and innovative ideas into the core elements of the organizational culture (Protogerou, Caloghirou, and Spyros, 2012).

Moreover, the dynamic capability view emphasizes the firm's ability to adapt and respond to changing environments. Training is crucial in

building learning capability, a fundamental aspect of dynamic capabilities (Teece and Pisano, 1997; Eisenhardt and Martin, 2000). Learning enables individuals and organizations to acquire new knowledge, adapt to evolving market conditions, and continuously improve their processes and routines.

Firm-offered training enhances the capacity of employees, particularly managers, to sense market opportunities and seize them effectively. It allows the firm to reconfigure its resources and processes in response to new challenges and opportunities, improving firm performance over time.

While training at all organizational levels is important, managerial training is crucial for a competitive advantage. In their meta-analysis, Durán and Aguado (2022) demonstrate that managers play a fundamental role in shaping dynamic capabilities, underscoring the significance of human factors in driving organizational evolution. Similarly, co-evolutionary theory emphasizes the pivotal role of managers in sustaining organizational evolution and, consequently, determining overall performance (Cafferata, 2016). This perspective aligns with evolutionary theory (Teece, 2007), which also recognizes the importance of the human factor in organizational evolution and performance.

Bloom and Van Reenen (2010) found that the variations in management practices across firms and countries played a crucial role in explaining the significant differences in productivity that could not be easily attributed to other factors. Extensive empirical evidence on the drivers of critical operating capabilities, such as productivity, quality, manufacturing flexibility, and R&D performance, unequivocally underscores the crucial role of effective management in influencing firm performance (Pisano, 2017).

Investing in training activities to improve the quality of management becomes a pivotal strategy for firms seeking to achieve sustainable competitive advantages and superior performance. By empowering their workforce with knowledge and skills, especially in managerial roles, organizations can better exploit existing resources, explore new opportunities, and adapt to dynamic market conditions, thereby positioning themselves for long-term success.

Measuring the returns on training investment for firms poses several challenges. One significant obstacle is the availability of data on training activities. Additionally, unobserved training heterogeneity and endogeneity can affect the econometric estimation of the impact of training on firm productivity. Researchers have shifted their research horizon from cross-sectional to longitudinal studies to address these biases. This change allows for a more comprehensive examination of the relationship between training and productivity.

The interest in understanding the return on investment of training activities has been growing among employers, and the availability of firm-level data has further facilitated the empirical investigation of this topic. However, the empirical findings have been mixed.

Bartel (1994) studied the effect of training programs on net sales. He found no impact of formal training on productivity in the same year, even after controlling for other human resource policies. Yet, businesses that invested in training programs experienced faster productivity

growth. Black and Lynch (1996) showed that the proportion of time spent in formal off-the-job training positively affected the performance of manufacturing sector firms, while computer training positively impacted nonmanufacturing-sector firms.

However, it is essential to account for endogeneity in the analysis. Black and Lynch (2001) demonstrated that the positive relationship between training and productivity disappeared when correctly considering endogeneity. On the other hand, Turcotte and Rennison (2004) found that an increase in technological training for employees was linked to a significant increase in productivity.

Ballot, Fakhfakh, and Taymaz (2006) revealed that returns on training could be shared between firms and employees, with firms experiencing higher returns. Dearden, Reed, and Van Reenen (2006) showed that an increase in the proportion of trained employees led to wage and value-added per worker proliferation. Barrett and O'Connell (2001) found that general training positively impacted productivity growth for Irish firms, while specific training had no effect.

Conti (2005) conducted an empirical analysis using individual-level data on training and firm-level data on productivity and wages for 1996-1999 in an industry panel representing all sectors of the Italian economy. Similarly, Colombo and Stanca (2014) examined the impact of workers' training on productivity and wages using a database representing the population of Italian firms, merging training information with company account data from 2002 to 2005. The results from both studies demonstrated that training had a positive and significantly impactful effect on productivity, although to varying degrees. Conti (2005) found that increasing the stock of trained workers in an industry by one percentage point led to a 0.4 percent increase in productivity, while Colombo and Stanca (2014) reported that a 1 percent increase in training was associated with a 0.07 percent increase in value-added per worker.

Feltrinelli, Gabriele, and Trento (2017) demonstrated that off-the-job formal training for middle managers in Italy during 2006-2011 had a noteworthy nonlinear exogenous impact on total factor productivity, particularly in larger firms.

The empirical literature overwhelmingly supports a positive and significant relationship between training activity and firm performance. However, the results are not always consistent in estimating the magnitude of this relationship, as seen in various studies (Barrett and O'Connell, 2001; Ballot, Fakhfakh, and Taymaz, 2006; Zwick, 2006; Colombo and Stanca, 2014). Despite these variations, the general consensus points to the importance of training in enhancing firm performance and productivity.

Despite the challenges in measuring training returns and varying empirical findings on the relationship between training and productivity, there is a general consensus supporting the significant positive effect of training on firm performance and productivity.

3. Research hypotheses

Numerous studies have consistently shown that individuals benefit from training, leading to improved performance, better paid and more stable jobs, and increased job satisfaction (Bloom and Van Reenen, 2007; Zwick, 2005). Over the past two decades, the research focus has expanded from the individual to the organizational level, exploring the potential returns on training investments for firms. Notably, the literature has highlighted the existence of two causal relationships between training and firm performance (Bloom and Van Reenen, 2007). More competitive firms tend to train more, simply because they recognize more benefits from this costly activity.

Hence, we put forward the following hypothesis:

H1: More productive firms train their managers more.

Assessing the impact of training on firm performance is challenging, but empirical evidence consistently shows a significant positive effect (e.g., Bartel, 1994, 2000; Dearden, Reed, and Van Reenen, 2006), suggesting that it enhances firm performance by improving the overall skill level. Nationally, the evidence is less definitive, but it points toward the positive effects of investment in human capital on productivity growth, innovation propensity, and success in research and development (R&D) (Gospel, 2005).

From a theoretical perspective, training is considered as an investment, according to human capital theory, leading to improved employee productivity and better economic performance (Becker, 1964). The literature supports the idea that firm-specific training creates value and can be a source of sustainable competitive advantage, as it generates complex and tacit knowledge that is difficult for competitors to imitate (Rumelt, 1984). Empirical evidence further confirms this perspective (i.e., Bidwell, 2011; Campbell *et al.*, 2014).

In contrast, general training is viewed as a firm's investment that employees can take to other companies, potentially not generating direct economic value for the firm. However, empirical research finds a positive relationship between general training and a firm's financial performance (i.e., Georgiadis and Pitelis, 2014; Feltrinelli *et al.*, 2017; Riley *et al.*, 2017), indicating that competitive advantage can still be gained.

This logic leads to the second hypothesis:

H2: 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 standpoint, 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 at the top levels, and it is hard for them to make their voices 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 that women can make as senior leaders. Moreover, women tend to be more risk-averse than men and thus less inclined to voice innovative ideas in regular working meetings.

During the informal situation created in 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 voices 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 upper echelons' theory.

Moreover, women demonstrate a greater inclination toward formal education, with female leaders often possessing more university degrees and being more likely to hold advanced degrees compared to their male counterparts (Hillman *et al.*, 2002; Carter *et al.*, 2010). This tendency leads to a higher level of dedication to training opportunities and a more profound commitment to learning from them (Severiens and TenDam, 1994), potentially resulting in greater returns from their participation. Conversely, men tend to be more interested in courses that enhance their qualifications. This reasoning leads to the following hypothesis:

H3: Involvement of female managers in training has a positive effect on firms' performance.

4. Methodology

4.1 Regression models

We employ a multi-stage methodology. First, we estimate the TFP. Second, 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.

To estimate TFP, the study employs the Levinsohn and Petrin (2003) method, which effectively addresses a crucial issue in production function estimation-the correlation between unobservable productivity shocks and input levels. This approach accounts for firms' responses to positive productivity shocks by expanding output, which necessitates additional inputs, and vice versa for adverse shocks, leading to contraction in production and a decrease in inputs. Levinsohn and Petrin recommend using an intermediate input as a proxy for investments to mitigate the simultaneity bias associated with input levels. The production technology assumed in this analysis is Cobb-Douglas (Levinshon and Petrin, 2003):

$$y_t = \beta_0 + \beta_l l_t + \beta_k k_t + \beta_m m_t + w_y + \eta_y \quad [1]$$

where y_t is the logarithm of the firm's output (value-added), l_t and m_t are the logarithms of the freely variable input labor and the intermediate input, and k_t is the logarithm of the state variable (total assets). The error has two components: the transmitted productivity component, given as w_t, and an uncorrelated error term with input choices.

We employ the Heckman selection model to address potential selection bias, utilizing a two-step estimation framework (Heckman, 1976). Additionally, we account for endogeneity concerns by using instrumental variables in the second step of the regression model.

The general form of the two estimated models is as follows:

In the first step, we model the probability of firms providing training 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 next phase, we conduct a regression analysis on a set of firms that offer training, where we estimate the TFP using [1] and include various variables. Specifically, we introduce 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 each of the equations, the symbol "*i*" denotes a particular firm and "*t*" denotes a specific year. The variable $TFP_{i,t}$ represents the overall productivity of the given firm in the indicated year. 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. $X_{i,t}$ is a vector of independent covariates: size, age, sector of activity (SIC two-digit level), and the geographical area of activity at NUTS 1 level. To control for the impact of business cycles, the variable τ_t is included as a time dummy. Another variable, denoted by $IMR_{i,t-1}$, is the inverse Mills ratio, calculated based on the regression shown in Equation [2]. This variable is included in the instrumental variable regression model as an independent variable to address potential selection bias.

To mitigate potential simultaneity bias, all independent variables are lagged by one period with respect to the dependent variables. The estimation of Equation [3] employs the IV technique, enabling the management of training variables' endogeneity. This accounts for the possibility that more productive firms engage in more training due to greater resource availability or a better understanding of the value derived from middle manager training. Neglecting this consideration could mistakenly imply a causal relationship between training and productivity. Addressing the endogeneity of the training variable is crucial to avoid

biased estimations. Additionally, we calculate robust standard errors to address heteroskedasticity.

4.2 Choice of instrument

An essential aspect of the current models involves the incorporation of an instrument to address potential endogeneity concerns that exhibit characteristics resembling the theoretical instrument. In the context of our study, endogeneity arises because we aim to isolate the impact of manager training on firm TFP. However, we cannot preemptively exclude the possibility that past TFP influences the level of training activity within a firm. In such a scenario, the "standard" regression coefficients could be biased (Wooldridge, 2002).

Consequently, we employ an external instrument-the yearly sum of money amassed by Fondirigenti for each firm's training activity, referred to as the "conto formazione" (annual funds earmarked for senior manager training). This funding is generated through administrative regulations tied to Fondirigenti membership. Specifically, Fondirigenti sets aside a portion of the annual fee owed by firms-0.30% of the total senior managers' wages paid by a firm each year-in a dedicated fund accessible solely for financing training for senior managers. This fund expires after three years, after which the firm loses access to it, and Fondirigenti reallocates the funds for other purposes.

This variable exhibits a significant correlation with the yearly training hours and expenditure. Simultaneously, its correlations with the utilized performance indicators are negligible and near zero. Consequently, the number of training hours and expenditure are contingent on the annual training budget allocated to each firm, which, ex ante, correlates with training hours but not with firm performance.

5. Data

5.1 Dataset

The empirical analysis is based on a nine-year unique panel dataset, created by merging two complementary datasets from Fondirigenti and the Italian section of the Bureau van Dijk. Fondirigenti is an interprofessional fund established in 2004 to finance senior managers' training in participating Italian firms. The dataset from Fondirigenti provides detailed information on firms' senior management training activities, including the number of managers in training, days spent on training, total hours, and overall training expenditure. Additionally, it classifies firms as "active" or "inactive" based on their credit balance usage, indicating that money availability is not a constraint in the sample. The second data source provides accounting data for firms, enabling the construction of firm-level indicators, such as sector of activity, sales, value-added, fixed capital stock, number of employees, labor costs, and other financial variables. This matching process yields a robust firm-level panel dataset covering

nine years from 2010 to 2018, consisting of 12,234 firms, with reliable and comprehensive information on senior management training practices. The substantial sample size is noteworthy compared to previous training studies, making it comparable to studies on gender diversity[1].

5.2 Descriptive statistics

Table 1 presents the descriptive statistics of the variables analyzed. Approximately 30 percent of the sample consists of "active" firms, which utilized a portion of the training credit balance between 2010 and 2018. Small firms, defined as those with fewer than fifty employees, constitute 48 percent of the total sample, while medium and large firms (more than fifty employees) make up around 91 percent of the firms using training services. The majority of the firms (about 77 percent) are located in the North of Italy, and around 78 percent have been in business for over 14 years. The sample is predominantly composed of firms operating in the manufacturing sector (almost 70 percent), with companies providing services accounting for only 30 percent.

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 percent of the "active" firms involved at least one female manager in training. Of those firms, 38 percent of total training hours were

[1] There are several reasons why this dataset stands out. First, it includes diverse measures of training activity, such as the number of hours or days, the number of participants, activities per manager, and training costs and methods, which are not common in most datasets. Second, the available training variables, such as the length of training (hours or days) and training expenditure, are considered strong indicators according to influential studies in the academic literature. Third, unlike many training studies relying on surveys, this dataset is generated by the firms themselves, ensuring accuracy and reliability as all training plans are submitted, recorded, and triple-checked by the firm, training provider, and Fondirigenti. This minimizes measurement errors and ensures data completeness. Moreover, using a company database avoids biases resulting from individuals' inaccurate recall of training received and variations in training definitions across firms. Fourth, the data is collected in real-time, immediately after the training activity is completed, ensuring thorough and up-to-date information. Fifth, the dataset is fully representative of all managers in the firm, as it includes training activities for every senior manager once the firm joins Fondirigenti.

allocated to women. On average, firms involved 28 managers in training, offering around 20 hours of training per manager. Male and female managers received the same number of training hours.

Managers involved in training had an average age of 50.29 years. Female managers were slightly younger, registering an average age of 48.8 years, while male managers' average age was 50.59 years.

6. Results

Table 2 reports the probit regression results, which 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): larger and older firms utilize more training and are highly 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 hypothesis H1. 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 and 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: Sector 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 effects 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. The 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 hypothesis H1) and justifying the two-step procedure applied. The estimate of the impact of training on TFP is positive (1.615) and significant. Raising the training hours per senior manager by 1 percent increases TFP by around 1.62 percent. This supports hypothesis H2.

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 hypothesis H3. 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.

Tab. 3: The effect of training intensity and women training on the TFP. Dependent variable: Ln[TFP(t)]

Independent variables:	(1)	(2)
Ln of 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.

To facilitate understanding the economic significance of this value, Table 4 provides a hypothetical example. Suppose a firm placed in the bottom 10 percent in terms of firm productivity wishes to improve its performance. By increasing its training intensity by 25 percent, it could reach a productivity level in the bottom 25 percent (i.e., the 25th percentile) of the least productive firms. A firm in the top 50 percent of the most effective firms that would like to boost its productivity further could do

so by increasing its training intensity by 34 percent. This would allow it to reach the top 25 percent (i.e., the 75th percentile) of firms.

Based on the examples in Table 4, a hypothetical firm with a TFP value 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. The same firm could get the 40th percentile if all managers in training were women. To reach a similar improvement without diversity, a firm with only male managers in training would need to increase training intensity by 16 percent. This 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 reached higher efficiency levels than other firms in our 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 value	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) conduct a study in a similar context and find a "too-much-of-a-good-thing" effect. According to this effect, increasing investment in training offers incremental results only until a particular optimum point 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. This indicates that the more the firm invests in training, the better its productivity growth is. Feltrinelli *et al.* (2017) analyze 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 characterizes the latter period. Increasing tension may require firms to turn their attention to training to purposefully acquire the necessary capabilities that help them to compete in the turbulent marketplace (Helfat *et al.*, 2009). These results are in line with the dynamic capability model (Teece and Pisano, 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 levels 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 fully to firms' performance. 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.

This study offers several contributions to the literature. First, the paper contributes to the literature on the impact of management training on firm performance. Previous literature has 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 *et al.*, 2017).

The previous literature has demonstrated the importance of female presence in top management teams and boards 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 its main aims of building skills and transferring knowledge, 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 upper echelons 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 an under-researched category of management, namely, senior management. This group is less studied in the literature but is essential for strategy definition and implementation. Given that the Italian context is characterized by scant investment in employee training, the investment in senior management supported by national law can be seen as a source of firms' competitive advantage.

Finally, previous studies have concentrated on investigating the stars of business-the largest and most high-performing companies. The present inquiry extends the earlier results to the context of "regular" firms. It also confirms that, 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 their overall training and give more space to female leaders as this boosts companies' competitive advantage. However, the fact that 60 percent of firms activate training programs without involving a single woman suggests that there may be no senior-level women who could be involved in the first place.

The 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 so, as training helps women unleash their potential and improve the firm's performance.

Firms' development activities should be carefully planned to involve more diversity in training and create an atmosphere that helps to unleash the participants' inherent capacity. Indeed, the 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 reinvest 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

All studies have limitations, and the present one is no exception. Although the investigation relies on a rich dataset providing detailed information about training activities of managers in Italian firms, 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 whether firms addressed training activities only to male participants because the training was specific for the positions occupied by male managers or whether the lack of involvement of female managers was 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's results, a better distinction between the two types would have helped to test the theory.

Our results 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 and have more experience and investing 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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sinergie
italian journal of management

ISSN 0393-5108
ISSN 2785-549X
DOI 10.7433/s121.2023.10
pp. 201-222

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Founder-Involvement in R&D and SMEs performance: an expanded mediated-moderated framework

Received
15th February 2022
Revised
6th March 2023
Accepted
30th August 2023

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Abstract

Objectives. *The aim of the paper is to shed light on the pivotal role of founders' involvement in R&D and its reflexes on SMEs performance.*

Methodology. *A conceptual framework was outlined and operationalized in terms of a mediation/moderation model. Hypotheses were developed and tested it on a random sample of 350 SMEs locate in low research-intensive areas of 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 influence positively SMEs' performance. We also found evidence that founders' involvement in R&D-SMEs performance association is mediated by R&D resources, Quality of the technological knowledge, and innovation outputs. At the same time the R&D resources - Quality of the technological knowledge association is positively moderated by the share of R&D subsidies.*

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 low-research intensity 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.

sinergie
italian journal of management
Vol. 41, Issue 2, 2023

1. Introduction

Studies of economics, organizational theory, and technology management (Crossan and Apaydin, 2010; Anderson *et al.*, 2014; Botelho *et al.*, 2021) have long acknowledged the essential role of innovation as an engine of economic growth as well as of firms core competencies 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 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; Dallago, 2000; Chege and Wang, 2020; Batrancea, 2022). In the United States, on data released in 2021 by Census Bureau, SMEs accounted for 39% and 47% of the total payroll and the total employment in 2018, respectively. In China, according to the OECD scoreboard 2020, SMEs contribute up to 60% of the GDP and up to 75% of job creation. In Europe, data by the Eurostat released in 2022 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, while representing 99,8% of all non-financial businesses in the EU-27 (see also European Commission, 2021). 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 light of SMEs' limited size, resource poverty, and vulnerability to competitive threats (D'Amboise and Muldowney, 1988; Chen and Lee, 2023), innovation is essential to SMEs' performance (Harrison *et al.*, 1997; Bruque and Moyano, 2007; Haeussler *et al.*, 2019). In particular, SMEs can achieve several unique benefits from innovations (Rosenbusch *et al.*, 2011; Zhang *et al.*, 2022) such as higher quality and better products and services (Damanpour *et al.*, 2009; Demirkan *et al.*, 2022) which, once introduced in specific market spaces, offer SMEs opportunities to grow without experiencing through head-to-head rivalry with main competitors (Porter, 1980; Fabrizio *et al.*, 2022).

However, innovation is also a source of significant complexity for SMEs. Because of their resource poverty, the limited availability of financial and human resources constraints SMEs on the number of innovations that can be introduced (Madrid-Guijarro *et al.*, 2009), not to mention the possibility to alternate from one technology to another over time (Caputo *et al.*, 2002). Moreover, decisions in SMEs are often highly unstructured, the owners-founders resist delegation and play a key role in the decision-making process (Wittmeyer, 2003). Knowledge, skills, and relationships are necessary elements of human capital to generate innovations. Having formed and established their companies, founders human capital is constituted by prior knowledge of technologies and ways to serve markets (Marvel and Lumpkin, 2007; Ng and Kee, 2018), learned skills to handle the firm evolution (Wang *et al.*, 2010; Kato *et al.*, 2015), and established network ties (Tang and Murphy, 2012). Given resource poverty in SMEs and the founder-owner pivotal organizational role in the SMEs, founders'

capabilities that spurred out from their human capital turn out to be an important driver of SMEs innovation (Gao and Hafsi, 2015) to a greater extent than large organizations in which innovations relate more to the overall firm's strategy and organization (Welsh and White, 1981; Kato *et al.*, 2015; Davis and Bendickson, 2021; Grilli *et al.*, 2022). Such a conclusion echoes Schumpeter's (Schumpeter, 1934) observation that in organizations, particularly in startups and businesses of more limited size (Shane, 2012), innovations can be introduced only by «the same people who control the productive or the commercial process (in the enterprise)» (pp. 66-68).

Given the relevance and at the same time, the complexity of innovation in SMEs, understanding whose competencies 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 *et al.*, 2011) and the capabilities-based perspective (Hodgson, 1998; Penrose, 1959), an early study has addressed the positive influence of founders' initial and enduring involvement in inventive activities on high-research intensive SMEs performance (Haeussler *et al.*, 2019). However, such involvement was linked to a founder's participation in patenting activities in high-research intensive organizations as well as founders' centrality in collaborative patented inventive activities (Jiang *et al.*, 2021). Another study addressed the same relation in SMEs operating in low-research intensity regions, considering also two mechanisms, namely R&D expenditures and innovation outcomes, through which founders' involvement in R&D is likely to be channeled to SMEs performance, the latter measured with sales from new products and revenues growth (Vagnani *et al.*, 2022). In our study, considering the pivotal role of owner-founder capabilities for SMEs innovation (Thong and Yap, 1995; Lee and Cheung, 2004; Liu *et al.*, 2022), we contribute to the considered research stream on the linkage between founders' involvement in R&D and firms performance (Fini *et al.*, 2009; Haeussler *et al.*, 2019; Jiang *et al.*, 2021; Vagnani *et al.*, 2022) by theoretically exploring and empirically analyzing an expanding chain of consequences of the strategic decision of founders to be involved and remain engaged in R&D on SMEs' performance, with the latter measured with sales from new products, revenues growth, market share and sales volatility.

Specifically, while already discussed and analyzed the founders' involvement in the R&D-SMEs performance association (Haeussler *et al.*, 2019) and R&D resources and innovation outputs as mediators in the considered association (Vagnani *et al.*, 2022), we introduced the Quality of the technological knowledge as an additional mediator that stands in the R&D resources-innovation outputs linkages. Such an additional mediator is to further capture the quality of orchestrating capabilities fluxing out from founders' involvement in R&D. In addition, because of resource poverty, founders can finance their R&D expenditures with subsidies (Xiang *et al.*, 2022). Whatever is acquired, these subsidies will expose SMEs to other parties' knowledge and skills. Even in the simple case of non-cooperative R&D subsidies, at the early stage, an SME has to make an application, which somehow requires the firm itself to interact with other external

consultants. Once approved, a firm needs to report and thus interact with the granting institutions and their representatives. All these interactions will input external knowledge into SMEs research activities (Durst *et al.*, 2022), which, in turn, mixed with internally developed knowledge, via combinatory processes (Xiao *et al.*, 2022), will enhance the positive effect of R&D resources on the Quality of the technological knowledge.

Our hypotheses were tested on a random sample of 350 manufacturing located in low research-intensive areas of Southern Italy. From the results, we observed that founders' involvement in R&D is likely to increase SMEs' performance. The main effect is mediated by R&D resources, Quality of the technological knowledge, and Innovation outputs. We further observed that the R&D subsidies have a positive moderating effect on the R&D resources - Quality of the technological knowledge association. Our paper delves into the contribution of founders' involvement in R&D on their SMEs' performance. It also elaborates on potential mechanisms, that as mediators, particularly the Quality of the technological knowledge, and as moderators, the share of R&D subsidies, contribute to channeling the positive effect of founders' involvement in R&D on SMEs' performance. Our paper discusses the implications of our findings for scholars and practitioners.

2. Theoretical framework

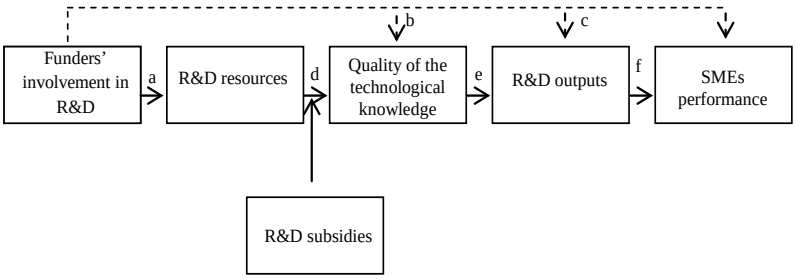
2.1 A theory of resource orchestration

Within the resource-based view, resources include all assets, capabilities, organizational processes, firm attributes, information, knowledge. controlled by a firm on a semi-permanent base that enable a firm to conceive of and implement strategies that improve its efficiency and effectiveness (Barney, 1991). To contribute to firms competitive advantage, owned resources must be strategically important (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 *et al.*, 2011; Sirmon *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, founders with their competencies are relevant. In general, competencies 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, founders contribute with their beliefs and expectations to set up the firm, bring to the firm their competencies and in the firm make their competencies

to develop and enrich in a path-dependent manner. Their competencies, combined with other organizational capabilities, make it possible to shape key elements of the firm, such as its organizational structure, decisions, boundaries, performance, life-cycle, and dynamics (Hodgson, 1998; Colombo and Grilli, 2005; Barroso-Castro *et al.*, 2022). Therefore, founders are the key candidates to play the role of resource orchestrator, especially in the R&D of SMEs (Haeussler *et al.*, 2019; Baier-Fuentes *et al.*, 2023).

Fig. 1: The proposed expanded mediated-moderated framework



Source: our elaboration

Accordingly, an interpretative framework linking founders' involvement in R&D and SMEs performance, given mediators (R&D resources, Quality of the technological knowledge and R&D outputs) and moderator variable (R&D subsidies) 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 framework is that founders' specific competencies are key inputs to transform R&D resources into enhanced SMEs performance.

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 competencies (Gerli *et al.*, 2012; Kato *et al.*, 2015) are valuable, rare, difficult to imitate as well as replace, resources, since these competencies are heterogeneous across different firms and, once combined with other firms resources and capabilities, they become also organizational-specific (Mitchelmore and Rowley, 2010). Far from just stating that founders' competencies matter, extant literature assumes that they produce significant, positive benefits for firms' performance (Chandler and Hanks, 1994) in general, and for SMEs (Man *et al.*, 2002), especially when such competencies are infused into R&D activities (Haeussler *et al.*, 2019; Vagnani *et al.*, 2022). 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 (Vagnani *et al.*, 2022). In structuring R&D activities, founders and other individuals are very different (Liu *et al.*, 2010). 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 *et al.*, 2013), R&D activities deserve attention in terms of resource allocation. In addition, despite resource poverty in SMEs, 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, founders' resource allocation decisions 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 resources to be invested in R&D. Furthermore, although the 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; Haffar *et al.*, 2021), 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 (Crovini *et al.*, 2021). 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's unwillingness to get involved in innovative activities (Kalantaridis, 1999). Moreover, when the 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 *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 *et al.*, 2019; Mueller *et al.*, 2020). Therefore, we suggest the following hypothesis.

H2. SMEs with founders involved in R&D are likely to invest more in 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 in 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 contributes to enriching the R&D activities, thanks to founders' specific capabilities (De Silva *et al.*, 2021), such as technical competencies, the ability to motivate other individuals individually and in work-teams, and human relations skills. In summary, founders can contribute to enhance the Quality of the technological knowledge that stems from 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 *et al.*, 2019, p. 293).

H3. Given founders' involvement in R&D, higher R&D resources are likely to increase to a greater extent the Quality of the technological knowledge in SMEs

Once contributing to structuring inventive activities, Founders' involvement in R&D will further contribute to structure research asset stocks developed out of inventive activities. Through stabilizing, enriching and pioneering (Sirmon *et al.*, 2011), founders can contribute to develop high-quality technological knowledge out of SMEs' inventive activities. Given the inherent stability that founders' grant to inventive activities, research team may have the opportunity to fine-tuning and thus improving existing technological knowledge. At the same time, founders can provide a direction to the creative process which mixes and consistently combines existing and new ideas to generate new configurations of products and processes (Gelderen, 2016), contributing to enriching and pioneering a firm's technological knowledge. Founders' specific capabilities like intuition, imagination, and seeing the big picture about SMEs' potential areas of competitive advantage and an understanding of customers' needs, give a preferred direction to inventive activities toward the production of high-quality technological knowledge. From an empirical perspective, firms' ownership by lone founders positively affects investments in R&D resources and the quality of their outputs (Block, 2012). Therefore, we suggest the following hypothesis.

H4. Given founders involvement in R&D, higher Quality of the technological knowledge will increase the R&D output in SMEs

Since leveraging is the process of using a company's capabilities to achieve performance benefits (Sirmon *et al.*, 2011), an SME 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 competencies 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 *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; Hwang *et al.*, 2020), 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 *et al.*, 2011), founders can contribute with their competencies in searching, seizing, and exploiting market opportunities (Danneels, 2002; Gruber *et al.*, 2013; Glavas *et al.*, 2019; Barrett *et al.*, 2021). Thanks to founders' involvement in R&D, structured resources and developed high-quality knowledge become organization-specific, thus nurturing a firm's 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 *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 (Vagnani *et al.*, 2022). Therefore, we suggest the following hypothesis.

H5. 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, Quality of the technological knowledge and R&D outcomes

In their seminal work, Baron and Kenny (1986) clarified that «a variable functions as a mediator when it meets the following conditions: (a) variations in levels of the independent variable significantly account for variations in the presumed mediator (i.e., Path a), (b) variations in the mediator significantly account for variations in the dependent variable (i.e., Path b), and (c) when Paths a and b are controlled, a previously significant relation between the independent and dependent variables is no longer significant, with the strongest demonstration of mediation occurring when Path c is zero» (pag. 1176). In our theoretical framework, controlling for R&D resources, Quality of the technological knowledge, and R&D outputs, the founders' involvement in R&D-SMEs performance direct effect 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 SME innovation. This is because founders, although involved in R&D, could be unable to make available adequate resources for inventive activities. Even if available, such a greater amount of resources may produce technological knowledge of mediocre quality. Constraints in available resources may also 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, Consequently, founders' involvement in R&D, even if occurring in SMEs, might have very little effect on firm performance, given the supposed mediocre Quality of the technological knowledge and R&D outputs. In other words, what matters for SMEs' performance is the substantial and effective founders' involvement in R&D. A merely formal

participation of founders in SMEs' inventive activities is here conceived as rather irrelevant This discussion leads to the following hypothesis.

H6. Founders' involvement in R&D-SMEs performance relationship is mediated by R&D resources, Quality of the technological knowledge and R&D outputs

2.4 The moderating effect of R&D subsidies

Given resource poverty, SMEs are likely to supplement internal financing of R&D activities with external sources, via R&D subsidies Among different sources to finance R&D, subsidies unleash liquidity constraints faced by SMEs in sustaining their R&D activities without challenging their existing ownership structure or consolidated financial leverage (Guo *et al.*, 2022; Moon, 2022). We advanced that in using government subsidies to finance R&D, SMEs remain exposed to knowledge that is external to the firm (Sala *et al.*, 2016; Afcha and Lucena, 2022). For example, a call for R&D grants application can indicate some specific research directions. The preparation of the application form may require SMEs to interact with external consultants. The subsidy may be associated with some cooperative activities between the applicants and other organizations. In providing evidence of the money spent, SMEs will interact with experts designed by the granting institutions. All these occasions will favor SMEs to acquire external knowledge because it concerns information, data, facts, and circumstances that have not been developed or nurtured within a focal organization (Cassiman and Veugelers, 2006). The role of external knowledge is critical, in general, in fostering valuable innovation (Cohen and Levinthal, 1990; Chesbrough, 2003; Tortoriello *et al.*, 2015; Hervas-Oliver *et al.*, 2021) and it has been considered an essential component of resource orchestration at the firm level (Sirmon *et al.*, 2011).

Once acquired, the level of external knowledge facilitates firms' innovation. March (1991) theorized that knowledge infused in an organization by newcomers does not trade off with a firm's extant knowledge base, facilitating enhancements and changes in firms' activities and outputs. The contribution of external knowledge is relevant to innovative activities (Agarwal and Gort, 2002; Sirmon *et al.*, 2011; Torchia and Calabrò, 2019). The knowledge external to the firm brings general, related-industry, and industry-specific components that once infused into SMEs' inventive activities, will facilitate leveraging of resource asset stocks.

Thanks to non-redundant knowledge about different industries, markets, and institutional contexts, external financing of R&D activities can contribute to injecting within SMEs different visions of how and where to exploit the potential of resource assets stocks (Simons, 1994). This new external knowledge, once combined with existing ones via bricolage processes (Chen, 2021; Baier-Fuentes *et al.*, 2023) will enlarge the set of exploitable alternatives to deploy the outcome of inventive activities into the market. Such potential is vital for managing resource stocks, particularly in SMEs (Ricci *et al.*, 2021). In sum, R&D subsidies will facilitate SMEs acquisition of external-to-the-firm knowledge, which, in turn, will augment

the positive effect of R&D expenditures on the Quality of the technological knowledge. From the discussion, we propose the following hypothesis.

H7. R&D subsidies positively moderate the R&D resources - Quality of the technological knowledge association.

3. Method

To empirically test our hypotheses, a survey is the chosen method. Although data as R&D resources, R&D subsidies, sales from new products, sales growth, market share, and sales volatility are available from public sources, other information such as founders' involvement in R&D, Quality of the technological knowledge and R&D outputs, in particular, the number of innovations produced by R&D activities, remain generally undisclosed, particularly in SMEs located in low research-intensive areas. Moreover, a survey allowed us to better unfold and measure the mediators and moderators that stand in the founders' involvement in R&D-SMEs performance linkage. Data on these mediators and moderators rest undisclosed and thus unavailable from other sources. To address some common biases in surveys, we also combined archival (e.g., R&D expenditures, R&D subsidies, sales growth, turnover from newly introduced products) and non-archival data (e.g., founders' involvement in R&D).

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 *et al.*, 2017), the survey was split into three periods, respectively related to the measurement of R&D resources, Quality of the technological knowledge, R&D outcomes, and SMEs performance.

3.1 Sample

In our study, we first defined the population of interest made by SMEs. An SME is defined as a business, independently operated, with a total number of full-time equivalent employees of less than 250 and with a turnover of fewer than 50 million euros. To reduce unexplained heterogeneity and to test our hypothesis, in areas of low research intensity, the 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 the "Europe 2020 indicators - R&D and innovation" report by Eurostat, the aforementioned areas are positioned in the lowest two quintiles of the distribution of the share of research and development expenditures on regional GDP, the share of resources in science and technology, the share of R&D personnel, the

number of high-tech patented innovations. According to Eurostat, high-tech patents are those concerning computer and automated business equipment, aviation, micro-organism and genetic engineering, laser, semiconductors, communication technology, and biotechnology.

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 employees less than 250 and turnover of less than 50 million of euro. We selected a sample of 10% from the total universe. We also checked if, in each sampled SME, founders were still currently operating in the firm, at least as owner or as director. In cases of founders already left the firm, the organization was substituted by another randomly selected alternative. 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. It must be observed that the latter two industries are generally considered high-research intensive (Haeussler *et al.*, 2019). However, our sample is extracted from a homogeneous geographic area, and SMEs included in the considered two industries show distributions of both R&D intensity and granted high-tech patents that are not significantly different from their counterparts in other industries. 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

The main variables are here defined and measured as in the study of Vagnani *et al.* (2022). In testing the main effect, we introduced two additional measures of performance, namely market share and sales volatility.

Given antecedent variables measured at time t, the former is to capture the competitive position of an SME and it is calculated, at time t + 1, an SME's sales divided by the total sales of the industry in which the focal firm is included. The latter is to capture the risk of an SME and it is calculated as the standard deviation of the focal firm sales over a three-year period, starting from time t + 1.

Tab. 1: Descriptions of all the variables used in the analyses

Definition	Label	Measure	Role in the model
SMEs performance	*Npd*	Share of sales from newly introduced products over total sales at time t+1	Dependent variable
	Sales_g	Sales growth at time t+1 minus sales growth at the industry level	Dependent variable
	Ms	Sales at time t+1 divided by sales at the industry level in which the firm is included in	*Dependent variable*
	Vol	Standard deviation of sales in periods t, t+1, and t+2	Dependent variable
R&D resources	*R&d_i*	Expenditures over total sales at time (average over three years period)	Mediator
R&D outputs	*R&D_o*	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
Quality of the technological knowledge	*TN_q*	"How much an SME knowledge is cutting edge or state-of-the-art in the industry?", ranging from 5 (at all) to 1 (not at all).	Independent variable
Founder involvement in R&D	*I_rd*	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
R&D subsidies	*R&D_s*	Yearly R&D subsidies divided by R&D expenditures in periods t, t-1, t-2, and t-3:	Moderator
Founder gender	*Gender*	1 if founder involved in R&D is male, 0 otherwise.	Control variable
Founder age	*Age*	Age of founder involved in R&D at time t	Control variable
Founder tenure	*Tenure*	Founder involved in R&D number of years of in the firm at time t	Control variable
Founder education	*Education*	Founder involved in R&D highest degree (post graduate, graduate, high-school, mid-school, primary school)	Control variable
Localness of founder previous experience	*Localness*	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	*Size*	Average number of full-time equivalent employees at time t	Control variable
Family involvement in the firm	*Family*	Number of other family members working in the firm at time t	Control variable
Industry	*Industry*	A dummy variable: 1 if the firm belongs to the selected industry, 0 otherwise	Control variable

Source: our elaboration

We further introduced the Quality of the technological knowledge as the availability of a focal SME, at time t, of cutting-edge or state-of-the-art knowledge in the technological field (Han *et al.*, 2018). To measure such a component, we asked the founder to describe and details her SME's available knowledge in its technological field. We asked then each founder to indicate at least two other SME's member to be interviewed on the same topic. We acquired all descriptions, merged them into one document, and then ask a panel of three industry experts to independently rate the Quality of the technological knowledge of each sampled SMEs. We asked experts the following question: «how much is the described knowledge is cutting edge or state of the art in the industry?», using a scale ranging from 1 to 5, where 5 indicated at all and 1 not at all. We calculate also inter-rate agreements between experts, and their level was greater than .98. We further measured the R&D subsidies as the subsidies received by a firm in

the last three years, normalized of the total R&D expenditures. Details of variables are in Tab. 1.

3.3 Regression procedure

To test our hypothesis, 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 can jointly estimate parameters that can be used to separate 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 has also used the SUR for assessing the performance of SMEs (Yan and Guan, 2019; Johann *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 founders' involvement in R&D and potential confounders on the R&D resources; (2) the effect of founders' involvement in R&D, R&D resources, Quality of the technological knowledge, and potential confounders on R&D outputs; and (3) the effect of founders' involvement in R&D, R&D resources, Quality of the technological knowledge, R&D outputs, and potential confounders on SMEs performance.

Using the delta method as operationalized in the STATA command named nlcom (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. Finally, the variance inflation factor (VIF) is introduced to detect multicollinearity in regression estimates (Mansfield and Helms, 1982). Endogeneity in estimates was addressed by using an instrumental variables analysis with a generalized method of moments (gmm) estimator (Greene, 1993). Results are here omitted for space reasons, but available on request from the Authors.

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**
1. *Npd*	1							
2. *Sales_g*	0.15*	1						
3. *Ms*	0.02	-0.14*	1					
4. *Vol*	0.17*	0.22*	0.08	1				
5. *R&d_i*	0.17*	0.10*	-0.02	0.00	1			
6. *R&d_o*	0.27*	0.11*	0.03	-0.01	0.25*	1		
7. *Tn_q*	0.18*	0.07	0.02	0.05	0.43*	0.29*	1	
8. *I_rd*	0.15*	0.14*	0.13*	0.07	0.13*	0.19*	0.15*	1
9. *R&D_s*	0.13*	0.03	0.01	-0.05	0.44*	0.28*	0.36*	0.08
10. *Gender*	0.01	-0.03	-0.01	0.02	-0.01	0.05	0.07	-0.09
11. *Age*	-0.01	0.03	-0.01	-0.18*	-0.01	0.04	-0.01	-0.01
12. *Tenure*	-0.06	0.02	-0.03	-0.22*	-0.04	0.08	0.00	0.00
13. *Education*	0.07	0.02	0.03	-0.06	0.18*	0.08	0.14*	-0.09
14. *Localness*	-0.13*	-0.18*	-0.01	-0.15*	-0.12*	-0.12*	-0.12*	-0.00
15. *Size*	-0.05	-0.24*	0.09	-0.12*	-0.02	0.16*	0.12*	-0.08
16. *Family*	0.01	-0.06	0.05	-0.08	0.05	0.16*	0.22*	-0.04
Mean	*7.47*	*-.01*	*1.26*	*0.40*	*1.69*	*0.46*	*0.15*	*0.36*
SD	*15.56*	*0.80*	*9.44*	*0.40*	*5.63*	*0.18*	*0.25*	*0.48*
	9	**10**	**11**	**12**	**13**	**14**	**15**	**16**
9. *R&D_s*	1							
10. *Gender*	-0.08	1						
11. *Age*	0.02	-0.09	1					
12. Tenure	-0.01	-0.12*	0.17*	1				
13. *Education*	0.19*	0.11*	-0.17*	-0.28*	1			
14. *Localness*	-0.15*	0.12*	-0.14*	-0.12*	-0.18*	1		
15. *Size*	0.08	0.10	0.06	0.06	0.14*	0.01	1	
16. *Family*	0.12*	0.13*	0.05	0.05	0.12*	-0.03	0.54*	1
Mean	*5.66*	*0.75*	*45.51*	*22.66*	*3.11*	*0.66*	*15.48*	*4.21*
SD	*5.09*	*0.42*	*10.50*	*11.439*	*0.73*	*0.47*	*21.89*	*9.13*

* $p < .05$; N = 350; For space reasons, control variables related to the industry are omitted.

Source: our elaboration.

Given correlations, mean and standard deviation values 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. For every model in which the main effect is significant, the delta value calculated according to Oster (2019) is reported. Note, the closer the delta value to zero the more results are likely to be dependent on third unobservable variables (see Tab. 3).

Tab. 3: Impact of founders' involvement in R&D on SMEs performance

Dependent variables:	Model (1) Ndp	Model (2) Sales_g	Model (3) MS	Model (4) Vol
I_rd	4.22**	.21**	2.95**	.04
	(1.76)	(.07)	(1.05)	(.04)
Gender	.95	.04	-.35	.04
	(1.95)	(.09)	(1.21)	(.05)
Age	.21	.01	.06	.01
	(.16)	(.01)	(.09)	(.01)
Tenure	-.24	.01	-.08	-.01**
	(.15)	(.01)	(.09)	(.00)
Education	.92	.05	.07	-.10**
	(1.26)	(.06)	(.77)	(.03)
Localness	-3.69*	-.29**	-.19	-.19**
	(1.80)	(.09)	(1.11)	(.04)
Size	-.04	-.01**	.51†	-.01
	(.04)	(.00)	(.02)	(.01)
Family	.01	.01	-.01	-.01
	(.11)	(.01	(.06)	(.01)
lowRes	8..75*	-.12	1.09	.03
	(3.39)	(.13)	(1.61)	(.06)
Constant	-.81	-.08	-1.46	.99**
	(6.78)	(.33)	(4.08)	(.17)
Industry dummies	YES	YES	YES	YES
R-squared	.10	.11	.03	.12
N	350	350	350	350
Vif	1.81	1.95	1.95	1.98
δ	4.41	12.74	6.91	n.s.

† p < .10 * p < .05; ** p<.01; In control variables, we introduced a dummy whose value is equal to 0 if a sampled SME has R&D expenditures equal to zero and 1 otherwise. Standard errors in parenthesis; coefficients are standardized betas. δ is calculated according to Oster procedure, with R-max set, as suggested, to a value equal to 1,5*Model R-squared.

Source: our elaboration

Only considering direct effects, we observed that founders' involvement in R&D has a positive and significant effect on SMEs' performance, without increasing their risk. Among controls, founders' education, tenure, and localness have a significant effect on reducing SMEs' risk. Concerning all SME's 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 $\chi 2$ endogeneity test between I_rd and SMEs performance that turns to be insignificant. Results are here omitted for space reasons, but available on request from the Authors. As a consequence, the analysis in Tab. 3 provides robust evidence that confirms our hypothesis 1. Thus, founders' involvement in R&D matters also for SMEs' performance.

4.2 Mediation effects

Mediation effects were tested by using SUR, where models from (1) to (6) 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, Tn_q, and R&D_o) and a moderator variable (R&D_s)

Dependent variables:	Model (1) *R&D_i*	Model (2) *Tn_q*	Model (3) *R&D_o*	Model (4) *Npd*	Model (5) *Sales_g*	Model (6) *Ms*
I_rd	1.62**	.04*	.06**	2.17	.16†	5.05*
	(.58)	(.02)	(.01)	(1.73)	(.09)	(2.70)
R&d_i		.02**	.01†	.13	.01	-.05
		(.00)	(.00)	(.16)	(.01)	(.26)
Tn_q			.13**	5.15	.19	19.08**
			(.04)	(3.99)	(.20)	(6.27)
R&D_s		.01				
		(.01)				
R&D_sx R&D_i		.01**				
		(.00)				
R&d_o				18.40**	.46*	2.69
				(4.70)	(.22)	(7.39)
Sex	-.21	.01	.03	.22	.02	.64
	(.64)	(.02)	(.02)	(1.88)	(.10)	(2.95)
Age	.01	-.01*	-.01†	.28†	.01	-.07
	(.05)	(.00)	(.00)	(.15)	(.01)	(.24)
Tenure	-.01	.01†	.01*	-.33*	-.01	.02
	(.05)	(.00)	(.00)	(.14)	(.01)	(.23)
Education	1.12*	.01	.01	.26	.04	-.3.04
	(.41)	(.01)	(.01)	(1.22)	(.06)	(1.94)
Localness	-.56	-.02	-.03†	-2.69	-.27**	-.66
	(.59)	(.02)	(.02)	(1.73)	(.09)	(2.71)
Size	-.01	-.01	.01*	-.05	-.01**	.01
	(.01)	(.01)	(.01)	(.04)	(.00)	(.07)
Family	.01	.01*	.01	-.03	.01	.07
	(.04)	(.00)	(.01)	(.11)	(.01)	(.17)
R&D Dummy		-.01	-.06**	.73	.08	-.40
		(.02)	(.02)	(2.07)	(.10)	(3.26)
Constant	-2.95	.08	.46**	-8.46	-.30	13.28
	(1.25)	(.09)	(.07)	(7.17)	(.37)	(11.27)
Industry dummies	YES	YES	YES	YES	YES	YES
R-squared	.21	.45	.22	.16	.14	.11
N	350	350	350	350	350	350
F-stat	6.68**	16.01**	6.00**	3.59**	3.01**	2.53**

† p < .10; * p < .05; ** p<.01; Standard errors in parenthesis; coefficients are unstandardized betas. Endogeneity also examined by mean the Breusch-Pagan test of independence: $\chi2(15) = 2.58$, $p = 0.99$.

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 (1)-(6) and of the indirect effects represented by R&D_i Tn_q, and R&D_o. On the one hand, Tab. 3 offered empirical evidence of the significant, positive influence of founders' involvement in R&D on SMEs' performance, once controlled for mediators, such significance turns to reduce.

The significance of the indirect effects depicted in Fig. 1 was assessed by the following equation: (βa x βd x βe + βb x βe βc) x βf, with the beta coefficients taken from Tab. 4. The total indirect effect calculated according to the delta method for SMEs performance is equal to 1.61 (Standard error

= .77, p < .05) and with bootstrap procedures is equal to 1.59 (Standard error = .78; p < .05). Within the overall indirect effect, the share of sales of newly introduced products benefits from the highest indirect effect of founders' involvement in R&D and market share the lowest one.

The magnitude of the indirect effects over the total direct effect of founders' involvement in R&D on SMEs' performance was determined by means of the ratio of the indirect effect over the sum of indirect and direct effects, with a resulting value that is equal to 19,21% (=1.61/(1.61+2.17+.16+5.05)).

From our data, consistently with hypotheses 2, 3, 4, and 5, 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 the Quality of the technological knowledge, which will ramp up innovation outputs and, in turn, enhance SMEs performance. In addition, results offer evidence that founders' involvement in R&D-SMEs performance is mediated by R&D resources, Quality of the technological knowledge, and R&D outputs, as predicted by hypothesis 6.

4.3 Moderation effects

We tested the moderating effect of SMEs' use of R&D subsidies on the R&D expenditures over sales - Quality of the technological knowledge association. As expected, the interaction effect between R&D_i and R&D_s is positive and significant at the level of p < .01. To take into account the full effect of the moderating variable, we tested the joint significance levels of R&D_s and I_rd x R&D_i, finding a value of F(2, 1991) equal to 3.82 (p < .02). Our results provide evidence that once founders are involved in R&D and inventive activities are supported by R&D subsidies, the effect of R&D expenditures on the Quality of the technological knowledge will be enhanced. Therefore, hypothesis 7 is confirmed by the data. In testing the moderation effect, as in Vagnani *et al.* (2022), we additionally control for the number of other functions founders were involved in. Despite the introduced new control variable, our main results hold constant.

5. Conclusions

This study tested the effect of founders' involvement in R&D activities on SMEs' performance. After developing six hypotheses, 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 expenditures, Quality of the technological knowledge, and the innovation outputs. In addition, when R&D activities are financed with research grants, the effect of founders' involvement in inventive activities is magnified. Thus, our findings provide evidence that even in low-research intensive areas, where environmental factors do not strongly support and even encourage research and innovation, SMEs can innovate and through their innovations can sustain their performance. In addition, in the same context, there are

individuals, particularly founders, who, despite unfavorable contexts in which they operate (Cabiddu and Pettinao, 2008), possess motivations and capabilities to be involved in inventive activities and such involvement, sustained by effective resource orchestration activities, will have a positive effect on SMEs' performance.

Our analysis has important implications for academics and firms responsible and/or policymakers alike.

Our paper builds on the orchestration theory to discuss and analyze the pivotal role of founders in structuring, bundling, and leveraging inventive resources (Haeussler *et al.*, 2019; Vagnani *et al.*, 2022). We addressed not only who and whose role is important for inventive resource orchestration (Chirico *et al.*, 2011; Haeussler *et al.*, 2019) but also "how" and "under what conditions" such a role is made relevant for SMEs' performance. In this vein, our study connects the research stream on the founders' knowledge and skills and SMEs' performance. We argue that not only what founders know matters (Chandler and Hanks, 1994), but actually what founders do is relevant for SMEs' performance. Our study also suggests that it is not enough for founders to be involved in inventive activities to promote their SMEs' performance (Haeussler *et al.*, 2019), but also how they perform their role is relevant. Concerning "how", we connect to studies on founders' involvement in R&D-SMEs performance association and add that this association is mediated not only by R&D resources and outcomes (Han *et al.*, 2018; Vagnani *et al.*, 2022) but also by the Quality of the technological knowledge and moderated by the share of R&D subsidies. Our study links with the research stream on founders' succession or founders' teaming up with external managers in SMEs (LeCounte, 2022). Thus, within the debate on the founders' role (Zuzul and Tripsas, 2020), whether founders exit (Willard *et al.*, 1992; Loane *et al.*, 2014) or stay in the firm (Haeussler *et al.*, 2019) is better for firm performance, we advanced that SMEs performance will be enhanced if founders got involved in R&D and from their involvement R&D investments, Quality of the technological knowledge and innovation outputs arising from such investments are greatly increased. If either R&D resource, Quality of the technological knowledge, or R&D outputs or both were not enhanced, founders' involvement in R&D would provide no systematic benefit to SMEs' performance. Our study has also implications for the process of resource accumulation. Founders' capabilities are history-developed firm-specific. However, to contribute to SMEs' performance, these capabilities must be nurtured, developed and maintained valuable, rare, difficult to copy, and specific (Dierickx and Cool, 1989). Founders' involvement in R&D will make them learn about new knowledge, play with new practices, and collaborate with different scientists, which all will enrich their available capabilities. In addition, being enmeshed in firms' specific activities, founders' capabilities are likely to accumulate more and more, while keeping their strategic nature, in particular their firms' specific signature. Finally, within the debate around founders' effect on SMEs' risks (Crovini *et al.*, 2021), we offer some initial evidence that founders' involvement in R&D does not increase SMEs' risks while contributing to enhancing their performance.

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. In addition, scholars have theoretically discussed and empirically observed the benefits of experimentation and research thinking in decision-making activities (Camuffo *et al.*, 2020). Being involved in inventive activities, founders can play with scientific methods and learn their inherent procedures and techniques. The acquired knowledge can enhance founders' capability to make more informed decisions, and better gather information about potential alternatives to be developed and their effects, while expanding the scope of their search for more promising innovations. In other words, founders involved in R&D, while orchestrating inventive activities, will be exposed to scientific methods, which, in turn, will further enhance their capabilities to orchestrate research resources, with subsequent benefits for their SMEs. On the other hand, policymakers 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, for example via research grants in collaborative inventive activities in which founders are required to participate. Lastly, our findings are important for education/training programs: founders' involvement in R&D matters, although it requires founders to acquire and develop advanced knowledge and skills. Academic institutions can provide such advanced knowledge, helping founders involved in inventive activities effectively play their role.

Our study is not without limitations. The dependent variable, i.e., SME performance, was operationalized and calculated using different measures, mainly 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 hypothesis, 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.

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sinergie
italian journal of management

ISSN 0393-5108
ISSN 2785-549X
DOI 10.7433/s121.2023.11
pp. 223-246

Original Research Papers

Value creation flies in the sky: the role of resource access and mobilization

Received
9th January 2023
Revised
6th March 2023
Accepted
22nd May 2023

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Abstract

Purpose of the paper: *The aim of this paper is to explore the relationship between access to network resources, resource mobilization and value creation in the context of the airline industry. Hence, this work contributes toward the comprehension of the process of value creation by examining whether airline companies have access to network resources and to what extent they exploit these according to a new configuration that is at the base of resource mobilization.*

Methodology*: This study adopts a quantitative approach in order to reach a broader audience in an efficient way. The idea to proceed with a quantitative methodology originates from the aim to capture aspects that previous studies have not considered. To test the hypotheses, we adopt the partial least squares path modeling algorithm using the module R-package.*

Findings*: The findings underline two important aspects. First, there is a correlation between access to network resources, resource mobilization and value creation in terms of firm performance. Second, this paper reveals that, although airline companies tend to cooperate according to different forms, efforts towards value creation in terms of sustainability do not transpire since companies do not operate in that direction.*

Research limits: *The research limits can be ascribed to the number of companies the sample contains. Furthermore, future research on the topic may be enriched through the adoption of a qualitative methodology, such as interviews with managers, that can capture additional dynamics.*

Practical implications*: The results indicate future directions for managers in the airline industry. These should be in the field of value co-creation in relation to sustainability.*

Originality of the paper: *This paper captures the nature of value creation at the network level in terms of both firm performance and sustainability.*

Key words: value creation; airline industry; resource access; resource mobilization

1. Introduction

The issue of value creation has been studied according to different perspectives and levels of analysis (Lepack *et al.*, 2007) Network value creation arises from the metaphorical widening of a firm's borders because the exploitation/exploration mechanisms lead companies to search for resources outside their internal context. This process highlights both the lack of certain resources inside the firm and the systematic nature of value creation.

Despite the extensive body of literature (Gulati *et al.*, 2000; Lavie, 2007) on the subject, some points regarding value creation at the network level remain unexplored. Indeed, scholars agree that how firms mobilize their resources (Casanueva *et al.*, 2014), and knowledge, competences and expertise sharing is not always obvious (Della Corte, 2020). However, there is still confusion regarding this topic, as several works (Koka and Prescott, 2002; Dhanaraj and Parkhe, 2006; Min and Mitsuhashi, 2012) concentrate on the access to rather than the mobilization of network resources and, consequently, these studies use access to partner resources as proxy for mobilization without separating the two aspects. This has generated a general confusion in which the issue of resource mobilization is still a "puzzle" (Casanueva *et al.*, 2014). Hence, the relationship of the overall process that involves resource access and mobilization and leads to value creation is not yet well understood (Drencheva *et al.*, 2022).

Indeed, in today's dynamic and complex scenario, firms tend to have simultaneously different partners to maintain the possibility of wider access to resources (Wassmer and Dussauge, 2011), but the real issue remains the one regarding the capitalization of opportunities through the exploitation and use of the network's resources (Pironti, 2006; Bolívar *et al.*, 2022). Hence, the access to partners' resources is not sufficient per se and is not either synonymous or a proxy for mobilization, but rather as a single construct.

The first difference is semantic and involves specific content. Resource access includes the identification of resource holders (Muñoz *et al.*, 2018) and the way of accessing those resources (Casanueva *et al.*, 2015). Resource mobilization represents the effective capitalization of resources when there is the identification of their quality and utility (Muñoz *et al.*, 2018) and the transfer from resource holders to other actors of the network (Clough *et al.*, 2019) and/or to the network itself. The second difference is pragmatic, since the resources to which firms have access can also be partially mobilized (Casanueva *et al.*, 2014; Bolivar *et al.*, 2021). The effective new use of these resources corresponds to mobilization.

This is why this paper intends to separate the two different aspects. Indeed, the aim of this work is to explore the relationship between access to network resources, resource mobilization and value creation in the context of the airline industry, and answer the following research question: How can inter-firm collaboration among airline companies affect value creation through network resource mobilization?

This study analyzes the airline industry for several reasons. First, it is a global industry, at a mature stage, with a strong rivalry between airlines (Bolivar *et al.*, 2021). Second, it is characterized by high fixed costs that determine the management structure and strategic choices (Del Gaudio, 2015). Third, despite the strong competition between companies, they also forge inter-firm relationships (Oum et al, 1993; Chakrabarty and Kutlu, 2014). Fourth, literature on value creation in the airline industry is mainly based on case study analysis (Navarro-Meneses, 2022) and, hence, quantitative research is required. These features are well suited for analyzing the relational dynamics and issues underlying resource access and mobilization. In the airline sector, scholars have often highlighted the

importance of resource access and mobilization (Casanueva *et al.*, 2013, 2014; Bolívar *et al.*, 2022). These topics have been examined in both tourism (Casanueva *et al.*, 2014) and strategic management literature (Wassmer *et al.*, 2017). From a tourism point of view, they discuss the first variable in terms of access for the development/enhancement of a destination (Della Corte, 2020) that can reach a wide range of foreign markets (Wassmer and Dussauge, 2012). From a strategic management perspective, the airline industry offers a series of ideas to consider, such as the alliance portfolio mechanisms (Wassmer and Madhok, 2017; Kasanzu and Wanjira, 2021), operational strategies (Castiglioni *et al.*, 2018), and the role of resource complementarity within code-sharing agreements (Cobeña *et al.*, 2019).

Based on both perspectives, the focus of this study is on airline companies, specifically code-share agreements, which are considered the "most common type of alliance within the airline industry" (Domínguez-CC *et al.*, 2021), in order to examine how access to network resources can generate resource mobilization that influence value creation.

This paper is structured in three parts. The first section presents a literature review on the topic of value creation at the network level and resource mobilization. The second deals with the method and a discussion of the results from the quantitative analysis. The third part outlines the conclusions and future research directions.

2. Literature review

2.1 Value creation at the network level

Literature on value creation through "network resources" (Gulati *et al.*, 2000; Lavie, 2006; Wassmer and Dussauge, 2011; Vesalainen and Hakala, 2014) has gained increasing attention over the years in the strategic management community. The reason for this interest can be linked to the assumption that new sources of value are also generated through the exchange and combination of resources in novel different ways (Goshal and Moran, 1996) and the activation of different relations outside the firm's boundaries. Starting from this point of view, a network can be a new way of exchanging and combining resources to generate value (Dyer and Singh, 1998). In terms of the relational perspective, a network is a way to generate relational rents that are distributed amongst partners and whose benefits can occur at both a common and a single level (Dyer and Singh, 1998).

The locus of value creation, as some scholars (Gulati, 1998; Gulati *et al.*, 2000; Lavie, 2006) highlight, can reside in the network in different forms. The nested value in such networks can be exploited by the firms and/or actors involved and needs to be mobilized to assert its real capture.

A network is considered the unit of analysis for rent-seeking opportunities as some scholars conceive it as facilitator of knowledge transfer and exchange (Tsai, 2001; Mitton *et al.*, 2007). According to this view, networks must be able to deploy capabilities that allow the acquisition, generation and combination of knowledge and resources (Zheng *et al.*, 2011), since they are conceived as a core component in the creation and appropriation of value.

Value is, hence, created by the network where this network is the expression not only of the sum of the different resources provided by the single firms within the relational aggregate, but also of the new resources and opportunities generated by the network itself.

This reflection underpins the question of value capture since it is important to understand to what extent such created value is then spread between the firms and the network itself. The issue of value is also complex since in this case there is not a single source of value creation and, consequently, the understanding of "value slippage" (Lepak *et al.*, 2007), as described in the value appropriation literature, becomes more difficult to analyze.

The created value within the network expresses the collective soul (Lavie, 2007). Thus, the focus on value creation must take into account the resource mobilization of both firms and the network as a whole. As such, it is necessary to understand what such mobilization depends on.

First, firms' heterogeneity and complementarity, in terms of their strategic resource endowments, place them in different bargaining positions (Zaheer and Bell, 2005; Ferretti *et al.*, 2016). Second, bargaining power is linked to the ability of top managers in leveraging partners' endowments (Gulati *et al.*, 2009). Third, in inter-organizational networks, a focal partner may appropriate more value than others, capturing what Lavie (2007) calls the "lion's share of relational rents". In addition, a key component in both value creation and capture within networks is the governance actor and configuration, which can be meaningful to the whole set of relations.

Some firms develop a specific capability in managing the development of the network and, hence, deploy specific "networking capabilities". Along this line, Möller and Svahn (2004) introduce the concepts of "network visioning" and "network orchestration" as dynamic capabilities concerning the network that are necessary for both its formation (visioning) and development (orchestration). More precisely, the network-visioning capability refers to the analysis of the environment and the ability to evaluate opportunities and threats regarding the emerging value network, while the orchestration capability involves the dynamic understanding and coordination of strategic network resources (Ciampi *et al.*, 2021). Hence, the value is what companies create by working together through collaboration. These outcomes can be captured at different levels (i.e., the firm, network, society, customers, suppliers, etc.). This paper focuses on some outcomes at the firm (performance) and network levels (environmental and social sustainability).

Other important aspects in the value creation process are the resulting outcomes. Traditionally, the first ones that literature recognizes in the field of value creation are the economic gains, even if today the actual tendency is to recall the productivity measures rather than static measures (i.e., Economic Value Added, return ratios, profits, residual income, stock price, etc.), defining it as dynamic value creation (Lieberman *et al.*, 2018). The literature underlines the power of the network for the creation of ecological and social value creation (Aquilani *et al.*, 2016; Schaltegger *et al.*, 2016; Lüdeke-Freund and Dembek, 2017).

This typology of created value must simultaneously converge at both the firm and network levels, since environmental and social outcomes have to be integrated and/or in line with a single firm's purposes. Indeed, the created value in terms of sustainability does not differ for each company, but is the combination of different types of value, practices and/or ideas belonging to single firms of the network (Freudenreich *et al.*, 2020).

To summarize, this paper takes into account the outcomes of dynamic value creation with productivity measures and sustainable value creations with a brief look at co-shared initiatives for environmental and social responsibility.

2.2 Resource access and resource mobilization

Resource mobilization is derived from resource-based theory (RBT). According to this theory, a firm's competitive advantage can be traced through the VRIO framework (Barney, 2001), in which resources generate a strategic competitive advantage if they are valuable (V), rare (R), inimitable (I) and exploited by the organization (O) (Barney *et al.*, 2011). According to the resource mobilization view (McCarthy and Zald, 1977), existing resources acquire a new form through their redirection. The first step is access to partners' resources. What is particularly important is the specificity of resource mobilization, as "mobilization emphasizes access to needed resources, not on the allocation of resources among different parties. The resource mobilization metaphor hinges thus on working with external parties that control resources, not working for them" (Villanueva *et al.*, 2012, p.28).

Some scholars emphasize that it is not the attributes of resources that create value, but rather the linkages between them (Bingham and Eisenhardt, 2008). The unit of analysis of RBT was originally the firm, but in 1998, Dyer and Singh stressed the importance of extending RBT to inter-firm collaboration (Matarazzo and Resciniti, 2014).

The debate on resource mobilization needs to be analyzed in the light of the activities that take place within the network. The resource deployed depends on the goals that the network intends to achieve and on the capabilities for the creation of interactions among resources and on who combines and controls these resources (Baraldi and Strömsten, 2009). Although some studies view the access to resources as a proxy for mobilization (Koka and Prescott, 2002; Min and Mitsuhashi, 2012), we share the idea of some scholars (Casanueva *et al.*, 2014; Bolívar *et al.*, 2022) that they represent two different stages.

Indeed, actors of a certain network can have access to partners' resources, even if the level depends on the single partner capabilities to exploit them (Lin, 2001). These capabilities are expressions of resource mobilization and explain why some companies can mobilize resources better than others (Lin, 2001). With this view, we are in line with the definition of Bolívar *et al.* (2022), "network resources mobilization has been defined as the organizational ability and willingness to capitalize on the opportunities offered by the firm's set of partners in an alliance network setting, which in this case translates into the utilization of assets owned and controlled by partners in the net".

Before mobilizing resources, partners have to own the access to them. Our research model (Fig. 1) and hypotheses originate from this idea. We thus generate the following hypothesis:

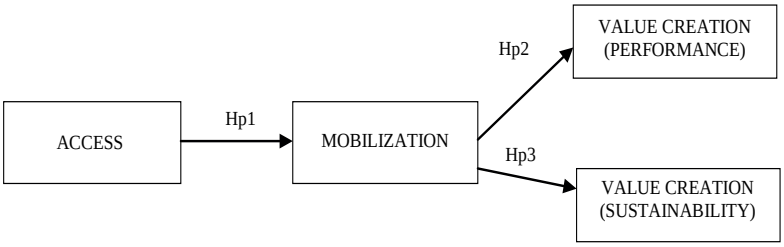
Hp1: Access to resources positively influences the mobilization of network resources.

2.3 Resource mobilization and performance

Resource mobilization consists of the exchange and sharing of diverse resources by mobilizing the bundle of resources as well as the competences of the actors involved into collective actions through the understanding of common goals (Ritvala and Salmi, 2011). Resource mobilization is a strategic choice connected with a firm's operational capabilities to exploit partners' resources. Although the idea of resource mobilization may be linear, it remains a buzz concept (Matinheikki *et al.*, 2017). As Bolivar *et al.* (2021) underline, there are some aspects that should be clarified, such as the level of the mobilization of these resources and whether and to what extent the access to these resources depends on the composition of the network and the related performance.

Given that it is not mobilization per se but rather the resource integration that creates value (Kleinaltenkamp *et al.*, 2012), some scholars have connected the topic of resource integration with the one of density for the creation of value, since "density expresses the degree to which resources are accessible for integration in a specific actor" (Storbacka, 2019). This is also linked to the topic of resource orchestration within the network (Sirmon *et al.*, 2011) and implies how the actors of the network organize, bundle, and leverage a firm's and network's resources.

Fig. 1: The proposed model



Source: Our elaboration

The issue of the actors involved is central in the resource mobilization process. Indeed, value creation depends on how the firms combine these resources. This interaction involves specific antecedents, such as the organizational model of each firm as well as of the network, the area of expertise (Storbacka, 2019), and the degree of willingness to collaborate. Firms mobilize their resources which affect performance, as suggested by the resource-based view (Barney, 1991; Wassmer and Dussauge, 2012).

The access and mobilization of external resources is strongly connected with the bundle of internal resources that together can have positive

impacts on performance (Casanueva *et al.*, 2015). Organizational ties play a key role in the process of value creation and capture since they enable gaining the competitive positions (Casanueva *et al.*, 2015) that lead to superior performance. The effective mobilization of firms' resources allows for fostering performance by absorbing knowledge and heterogeneous resources embedded in the network. Resource mobilization can lead to both firm performance and network performance (Bayne *et al.*, 2017), improving network effectiveness in achieving the desired goals. We therefore posit the following hypothesis:

Hp2: The mobilization of network resources positively influences value creation in terms of firm performance.

2.4 Resource mobilization and sustainability

Most of the literature concerns the link between resource mobilization and firm performance (Kleinaltenkamp *et al.*, 2012; Casanueva *et al.*, 2015) rather than the creation of value in terms of sustainability (Payán-Sánchez *et al.*, 2022), and this is because these studies have explored the conditions under which the competitive advantage occurs rather than focusing on sustainability issues. This paper aims to fill this gap by introducing and exploring the link between resource mobilization and sustainable results.

The issue of resource mobilization and its implications in the sustainability field has been studied in relation to the implementation of water systems in rural areas (Behnke *et al.*, 2017), sustainable tourism (Inogwabini *et al.*, 2020), and solutions for ecological problems (Scheidel *et al.*, 2018), etc.

Among the variety of theoretical lenses, this paper adopts the concept of resource mobilization for the creation of value for different beneficiaries (Singh and Singh, 2016), not only the firms, but also for the relevant ecosystem (i.e., the environment, the social community, etc.).

The topic of resource mobilization and its impact on sustainability has also been studied in the field of social entrepreneurship (Hota *et al.*, 2019) for the creation of social value. Hence, resource mobilization can lead to the enhancement of sustainability initiatives (Järnberg *et al.*, 2023). The idea of network resource mobilization generates social innovation and other useful sustainable practices for both the individual firm and the network (Spiegler and Halberstadt, 2018). There is sometimes a tendency to talk of "social mobilization" (Bui *et al.*, 2020) that emphasizes the purpose of the mobilization itself in fostering social goals (income, occupation, fairness income, etc.).

In the airline sector, the pillars of sustainability have grown in importance, given the current relevance of some topics, such as control over CO2 emissions (Hadi-Vencheh *et al.*, 2020), operational sustainability (Raynes and Tsui, 2019), and noise reduction (Jäger *et al.*, 2021), etc.

This is why this paper aims to verify the following hypothesis:

Hp3: The mobilization of network resources positively influences value creation in terms of sustainability.

3. Methodology

3.1 Data collection

Airline companies have been selected as the units of analysis. Hence, the airline industry has been chosen to test the three research hypotheses. The validity of this industry is confirmed by several studies (Casanueva *et al.*, 2014; Bolivar *et al.*, 2021; Bolívar *et al.*, 2022) that have used the airline industry as an exploratory context. This study ranges from the consideration of a single company to different kinds of collaborations in their various forms (i.e., frequent flyer programs, global alliances, marketing, codeshare, franchises, feeder and cargo, Casanueva *et al.*, 2014), for the years 2017–2020.

Following the work of Bolívar *et al.* (2022), we built a sample matching the top 100 airlines as indicated in the Airline Business Journal and adding other airlines belonging to one of the multi-global alliances (i.e., One World, Star Alliance, Sky Team). We excluded domestic airlines from the database, obtaining a final sample of 88 companies.

We obtained financial data from the single companies' balance sheets and other operational data from the International Civil Aviation Organization.

Tab. 1 contains the sample description.

Tab. 1: Sample description

Age range	N. of airlines
>=9	4
10–19	12
20–29	14
30–39	7
40–49	10
50–59	8
60–69	15
70–79	9
80–89	7
90–99	2
Affiliation	
SkyTeam	36
Star Alliance	22
One World	30
Region	
Asia and Oceania	42
Africa	1
Europe	31
The Americas	14

Source: Our elaboration

3.2 Method

This study adopted a quantitative approach in order to reach a broader audience in an efficient manner (Enright and Newton, 2004).

Previous works on the topic have exploited quantitative methodologies such as regression and structural equation models Casanueva *et al.*, 2014; Bolivar *et al.*, 2021; Bolívar *et al.*, 2022). Indeed, the idea to proceed with a quantitative methodology originates from the aim to capture aspects the previous studies have not caught. To test the hypotheses, we adopted the partial least squares path modeling (PLS-PM) algorithm using the module R-package.

The PLS estimation method was first formalized by Herman Wold (1973) for use in multivariate analyses. Its application in structural equation modeling (SEM) was also developed by Wold (1975) and the main references on the PLS algorithm include Wold (1975). The purpose of PLS-PM is to estimate the relationships among Q blocks of variables.

In SEM techniques there are two families: covariance-based techniques, as represented by linear structural relations (LISREL), and variance-based ones, of which PLS path modeling is the most prominent representative (Hair *et al.*, 2021). In the PLS approach, there are fewer probabilistic hypotheses, data are modeled by a succession of simple or multiple regression and there is no identification problem. This paper uses the PLS approach because it has less stringent assumptions about the distribution of variables and error terms and PLS can handle both reflective and formative measurement models (outer models). We selected the reflective mode for the seven latent variables (LVs) because we suppose that the causal relationships extend from the manifest variables (MVs) to the LVs.

PLS path modeling does not provide any global goodness-of-fit criterion. As a consequence, the evaluation model takes place in a two-step process: the assessment of the outer model and the assessment of the inner model. At the beginning, the model assessment focuses on the measurement models. A systematic evaluation of PLS estimates reveals the measurement reliability and validity according to certain criteria that are associated with formative and reflective outer models.

A PLS path model involves two parts: the measurement model (or outer model), which defines the relationships between the MVs and their respective LVs, and the structural model (or inner model), which defines the relationships between the LVs.

The PLS algorithm considers two double approximations for the LVs: a) external estimation, obtained as the product between the block of MVs and the outer weights, and b) internal estimation obtained as product between the external estimation and the so-called inner weights. The parameter estimation is then performed through the alternation of the external and the internal estimations, iterating until convergence.

The paths among LVs are obtained through the ordinary least squares (OLS).

3.3 Measurement model

The overall fit of the model has been evaluated by a combination of indexes recommended by Hair *et al.* Before testing the hypotheses, we have verified the unidimensionality of the MV blocks by means of Dillon-

Goldstein's (DG) rho, with values above the expected minimum level of 0.70 for all the observed MV blocks. In order to assess the validity, we consider both the convergent and discriminant validity. The convergent validity can be evaluated by the average variance extracted (AVE). The AVE measures the level of variance captured by a construct versus the level due to measurement error. Values above 0.7 are considered very good, whereas the level of 0.5 is acceptable. All the loadings are significant.

Tab. 2: Validity and reliability evidence

Items	Outer weights	DG rho	AVE
acc-x1 degree centrality	0.8882*	0.952	0.797
acc-x2 closeness centrality	0.9118*		
acc-x3 betweenness	0.8572*		
acc-x4 beta centrality	0.9069*		
acc-x5 eigenvector	0.8989*		
mob-X6 number of routes	0.8510*	0.931	0.773
mob-X7 number of other airlines the company mobilizes	0.8865*		
mob-x8 the relationships between number of shared routes and number of partners	0.8901*		
perf-x9 sales per employee	0.839*	0.881	0.778
perf-x10 revenue passenger kilometers	0.875*		
perf-x11 passenger load factor	0.929*		
sost-x12 environmental sustainability	0.92	0.894	0.815
sost-x13 social sustainability	0.907		

Source: Our elaboration

The discriminant validity (Tab. 3) is well established by comparing the square root of each AVE in the diagonal with the correlation coefficients (off-diagonal) for each construct in the relevant rows and columns (Fornell and Larcker, 1981).

Tab. 3: Fornell-Larcker criterion analysis for checking discriminant validity

	Access	Mobilization	Performance	Sustainability
Acc.	0.88			
Mob.	0.31	0.89		
Per.	0.66	0.50	0.81	
Sus.	0.54	0.34	0.71	0.65

Source: Our elaboration

3.4 Measures

The research model is shaped by two variables: access and mobilization. According to the proposed model, mobilization acts as a mediator and has a positive influence on value creation. The validity of each variable has been measured through a composite measurement model. In order to calculate the access variable, this paper uses companies which are part of code-sharing agreements. In this kind of network, each airline is a node that can have access to a certain type of resource owned or controlled by a partner. Hence, one of the indicators is the total destination of the partner.

According to some scholars (Everett and Borgatti, 2005; Bolívar *et al.*, 2022), companies belonging to a multilateral network can exploit partners' resources, considering the occupied position, the related role, and the structural dimension that underpins specific dimensions of the social network analysis such as beta centrality, degree centrality, closeness centrality, betweenness, and the eigenvector. Beta centrality measures the centrality of each partner, betweenness the number of airline companies needing an intermediary, the degree centrality the number of total ties, and closeness centrality the closeness with each actor of the network, while the eigenvector refers to the total closeness to all other members of the network.

In regard to the mobilization variable, the related indicators are the number of routes, including those operated using third-party resources, the number of other airlines the company mobilizes, and the relationships between the numbers of shared routes and partners.

Furthermore, in order to define the dependent variable of value creation, it is essential to point out that it is measured in terms of firm performance and sustainability (environmental and social). In regard to firm performance, this paper took inspiration from the study of Casanueva *et al.* (2014), taking into account sales per employee, revenue passenger kilometers and the passenger load factor (Rajasekar and Fouts, 2009). In terms of sustainability, the related indicators are the Atmosfair Airline Index (Araghi *et al.*, 2014) and the number of social initiatives. Tab. 4 summarizes the variables used and the relevant indicators.

Tab. 4: Variables and indicators

Variable	Indicators	Source
Access	Beta centrality Betweenness Closeness Degree centrality Total destinations of the partner	Casanueva *et al.*, 2014; Bolívar *et al.*, 2022
Mobilization	Mobilized partners Mobilized operations (routes) Operations mobilized (routes)/ Partner	Bolívar *et al.*, 2022
Firm performance	Sales per employee, Revenue Passenger Kilometers Passenger Load Factor	Casanueva *et al.*, 2014
Sustainability	Atmosfair Airline Index Total of social initiatives	Araghi *et al.*, 2014; Payán-Sánchez *et al.*, 2021

Source: Our elaboration

The period considered is 2017–2020, since scholars suggest a mean average of three years for the different measures (Casanueva *et al.*, 2014).

The model fit indices are reported in Tab. 5. As regards the loading coefficients, the summary in the table demonstrates their significance since t-statistics is >2. Thus, the t-statistics have been calculated to evaluate the overall significance.

Tab. 5: Model fit summary

	Original	Mean boot	Std. error	T-statistics
acc-x1	0.857	0.8064	0.125	6.856
acc-x2	0.861	0.8169	0.127	6.779527559
acc-x3	0.972	0.177	0.223	4.358744395
acc-x4	0.511	0.4528	0.203	2.517241379
acc-x5	0.566	0.4877	0.238	2.378151261
mob-X6	0.732	0.0651	0.123	5.951219512
mob-X7	0.982	0.8303	0.341	2.879765396
mob-x8	0.867	0.0589	0.124	6.991935484
perf-x9	0.894	0.7349	0.335	2.668656716
perf-x10	0.843	0.2533	0.325	2.593846154
perf-x11	0.623	0.6997	0.24	2.595833333
sost-x12	0.833	0.448	0.184	4.527173913
sost-x13	0.805	0.3058	0.135	5.962962963

Source: Our elaboration

3.5 Structural model

The second step consisted of testing the hypotheses. In accordance with the pre-eminent scientific literature, a bootstrap procedure with 5000 re-sampling was utilized (Hair *et al.*, 2019). The bootstrapping technique is used to validate the significance of path coefficients. This method allows for assessing the accuracy of statistical estimations (Efron and Tibshirani, 1998) and to generate the distribution of a statistic (Mooney *et al.*, 1993). Through bootstrapping, PLS creates a distribution for each path coefficient. Tab. 6 and Fig. 2 show the results of PLS-SEM. These demonstrate a direct and positive relationship between resource access and resource mobilization. Furthermore, there is a positive relationship between mobilization and value creation in terms of firm performance. Hence, both Hp1 and Hp2 are confirmed. However, Hp3 is not confirmed.

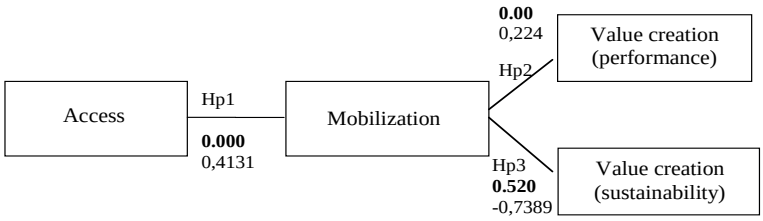
Tab. 6: Results of PLS-SEM

Hp	Direction	Original	Mean boot	Std error	T-statistics	P-value
1	Access-->mobilization	0.4131	0.462	0.18	2.295	0.000
2	Mobilization-->value creation (economic performance)	0.224	0.233	0.0889	2.519685039	0.00
3	Mobilization-->value creation (sustainability)	-0.7389	-0.464	0.508	-1.454527559	0.520

Source: Our elaboration

Access is significantly and positively associated with mobilization, thus providing support for Hp1 (path coefficient 0.4131; confidence interval (CI)=0.18). The path coefficient of resource mobilization on firm performance is significant (path coefficient 0.224; CI=0.0889), confirming Hp2. The path coefficient of resource mobilization on sustainability has a negative relationship (path coefficient CI=0.508), so Hp3 is not supported.

Fig. 2: Structural model results



Source: Our elaboration

4. Discussion and conclusions

The empirical findings indicate that resource access is positively related to resource mobilization, which has a positive effect on firm performance. Both access and mobilization affect firm performance and mobilization acts as a mediator. This result is in line with previous studies (Lai *et al.*, 1998; Batjargal, 2003) that also examine the airline industry (De Man *et al.*, 2010).

This means that the more an airline company is able to have access to and mobilize resources that can be exploited through its partners' alliances, the better its value creation in terms of firm performance will be. Thus, Hp1, "Access to resources positively influences the mobilization of network resources", is confirmed This nexus is not so obvious. For example, airline companies can have access to resources through global alliances (SkyTeam, One World, Star Alliance), but this does not mean that the individual airline companies choose to share their resources. Indeed, resource mobilization requires the willingness to make available some of the firm resources in order to create value, such as new services for their customer. For example, KLM and Air France have created a joint frequent flyer program called "Flying Blue" that creates a sense of attachment and fidelity from the customers of both airline companies. This requires the mobilization of resources rooted in the marketing activities of both airline companies' value chain.

This study has shown a positive relationship between access to and the mobilization of resources. This is in line with previous works (Casanueva *et al.*, 2014; Bolívar *et al.*, 2022) that show that a network's resource endowment does not correspond to the ability to mobilize rather than the simultaneity of resources owned/controlled by the network.

In regard to Hp2, "The mobilization of network resources positively influences value creation in terms of firm performance", the PLS-SEM

results confirm this hypothesis. This outcome highlights the ability of single airline companies to mobilize the bundle of network resources.

On the contrary, Hp3, "The mobilization of network resources positively influences value creation in terms of sustainability", is not confirmed since there is no significance in the relationship. This could be linked to the fact that airline companies tend to promote sustainable initiatives at the firm level rather than through co-shared activities between alliances partners. For example, an important co-joint initiative in the field of environmental sustainability was founded in 2021 when Virgin Atlantic, Air France-KLM and Delta Air Lines, in collaboration with Boston Consulting Group, created the Aviation Climate Task Force for the safeguarding of the environment, with particular attention to CO2 emissions.

This taskforce represents a major breakthrough in the airline world, as highlighted by the chief executive officers (CEOs) and managers of this alliance. Indeed, Shai Weiss, CEO at Virgin Atlantic, stated that it involves "working with industry partners to accelerate technological innovation and reduce carbon emissions over the next 30 years" (aviationclimatetaskforce.org). Amelia DeLuca, Managing Director of Sustainability, Delta Air Lines, highlighted "We're still too far from real, scalable solutions to clean air travel" (news.delta.com/delta-invests-net-zero-aviation-through-aviation-climate-taskforce). Finally, Benjamin Smith, CEO of the Air France-KLM Group, noted "We are signing this commitment because we are confident in our ability to make this transition collectively, together with our people, our customers and all our partners" (airfranceklm.com/en/air-france-klm-accelerates-its-environmental-transition-and-commits-science-based-targets-initiative).

These statements underline, on the one hand, the necessity of operating collectively in the direction of sustainable actions and, on the other, the absence of collaborative actions before this initiative. This is why this work has not captured the link between resource mobilization and value creation in terms of sustainability. Indeed, the cited operation started in 2021, while period considered in this paper was 2017–2020.

The value of this paper resides, first of all, in the distinction between access to and the mobilization of network resources. The analysis of code-sharing alliances has allowed us to gather a series of findings that relate to value creation through resource mobilization.

From a theoretical point of view, the foundation has been laid for the distinction of different facets of value creation. Indeed, future research should further explore the outcome of value creation in terms of sustainability. This study has, furthermore, confirmed the fact that access and mobilization have their own semantic and ontological identities. This work confirms that access per se does not involve the capabilities to orchestrate resources that mobilization does. Mobilization acts as a moderator between access to resources and value creation. This paper also underlines the dynamicity of mobilization since it underpins the dynamic capabilities.

From a managerial point of view, this paper has shed light on future challenges in the airline industry. Although the issue of sustainability has been widely discussed in both literature and the managerial world, little has

been done in terms of concrete actions at the network level. Even if a firm decides to not mobilize its bundle of resources, this can also be considered a strategic choice. These results open up new horizons to firms that do not desire to give access to and/or mobilize resources to preserve their internal bundle. In terms of the companies that are reluctant to cooperate, this paper shows the strategic path for value creation at the network level.

However, this paper has some limitations. The research limits can be ascribed to the number of companies the sample contains and to the lack of control variables. Furthermore, future research on the topic could be enriched through the adoption of a quantitative methodology, such as interviews with managers, that is able to capture additional dynamics. This work has not considered some antecedents of inter-firm collaboration (i.e., experience, trust, governance structure, etc.) that can accelerate or influence the overall path from access to network resources to their mobilization. Additional studies could enlarge the dataset, adding control variables and exploring the antecedents of collaboration, in order to better understand the whole process leading to both firm and green/social performance.

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italian journal of management

ISSN print 0393-5108
ISSN online 2785-549X
DOI 10.7433/s121.2023.12
pp. 249-269

Exploring young adults' unwillingness to adopt COVID-19 contact tracing apps: a mixed-method study[1]

Received
15th February 2023
Revised
15th May 2023
Accepted
12th July 2023

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Abstract

Frame of the research: *The field of research that investigates responses to external threats has recently provided evidence concerning consumer responses to COVID-19-related threats. Drawing on psychological reactance theory, we focus on how young adults respond to government-imposed containment measures that threaten individual freedom.*

Purpose of the paper: *We investigate how and when young adults' unwillingness to adopt COVID-19 contact tracing apps (CTAs) reflects their focus on government-imposed containment measures and the perceived difficulty in restoring freedom. We also develop empirically based clusters of young adults who differ in terms of their focus on containment measures, the difficulty in restoring freedom, and CTA adoption intentions.*

Methodology*: We use a mixed-method approach. Through an initial qualitative study featuring in-depth interviews, we explore young adults' perceptions of government-imposed containment measures and their difficulty in restoring freedom to examine how and when these perceptions reflect reduced CTA adoption intentions. Next, through a survey, we conduct a k-means cluster analysis to identify different groups of young adults.*

Findings*: The perceived restrictive nature of government-imposed measures threatens young adults' freedom and diminishes their CTA adoption intentions. The difficulty in restoring freedom defines when psychological states of reactance (vs. helplessness) occur. Finally, four clusters of young adults emerge: engendered dissidents, apathetic, optimistic adopters, and lost needing guidance.*

Research limits: *Future research might include consumers of diverse generations to explore age-based differences or use representative samples of diverse countries to account for cultural variations.*

Practical implications: *The findings contribute to understanding the failure of CTA adoption among young adults during the COVID-19 pandemic. Additionally, they offer relevant knowledge to promote CTA adoption if future pandemics occur.*

[1] This paper is the result of the joint effort of four authors: Camilla Barbarossa, Michela Patrizi, Maria Vernuccio, and Maria Carmen Di Poce. In the manuscript, however, paragraphs §1, §2, §3, §5.2, §5.4, and §6.1 may be attributed to Camilla Barbarossa, paragraphs §4.3, §5.1, and §5.3 may be attributed to Michela Patrizi, paragraphs §4.1 and §4.2, may be attributed to Maria Vernuccio, and paragraph §6.2 and §6.3 may be attributed to Maria Carmen di Poce.

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italian journal of management
Vol. 41, Issue 2, 2023

Originality of the paper: *In addition to privacy concerns and usability issues as main barriers to CTA adoption, we offer a complementary perspective leveraging psychological reactance.*

Key words: Contact tracing apps; COVID-19; psychological reactance; helplessness; consumer behaviour; mixed-method

1. Introduction

During the COVID-19 pandemic, state governments promoted the adoption of contact tracing apps (CTAs) to identify people at risk of infection. Available COVID-19 CTAs rely on Bluetooth technology or geolocation to alert users that they are close to people who have tested positive (Georgieva *et al.*, 2021). Although contact tracing is a "key to reining in the virus", it "has fallen flat in the West" (The New York Times, 2020), with CTA adoption rates at 20% or lower in 2021 in many European countries (EIT Digital, 2021). Despite the pandemic crisis getting ahead, investigating consumers' CTA hesitancy is crucial, as governments are likely to face future pandemics. COVID-19 is not the only pandemic that has had a major impact on the world, as there have been many before, such as the Spanish flu, the SARS epidemic, the Ebola, and the avian flu.

Recent studies in public policy (e.g., Abbaspur-Behbahani *et al.*, 2022), marketing (e.g., Hauff and Nillson, 2021; Jahari *et al.*, 2022; Robin and Dandis, 2022), and information systems and technology (e.g., Akinbi *et al.*, 2021; Chan and Saqib, 2021; Velicia-Martin *et al.*, 2021) reveal that privacy concerns, usability issues, and reduced perceived benefits may prevent consumers from adopting CTAs. Citizens are worried that governments might gain access to their personal data and use it for purposes other than safeguarding public health (Geber and Friemel, 2022). Low perceived effectiveness (i.e., CTAs' limited capacity to manage the spread of the virus) and usability issues (i.e., Bluetooth incompatibility, lack of technical knowledge, and excessive battery consumption) also prevent citizens from using CTAs (Fernandes and Costa, 2021; Trang *et al.*, 2020).

Along with the contributions of these studies, however, two relevant gaps remain unaddressed. First, while existing studies have investigated privacy concerns, usability issues, and reduced perceived benefits as the main inhibitors of CTA adoption intentions, they have neglected to link reduced CTA adoption intentions to aversive psychological states that citizens may have experienced during the COVID-19 pandemic when facing unprecedented threats to their freedom. Individuals have felt their freedom threatened to the extent that they have experienced the 'pains of imprisonment' because of government-imposed containment measures (Dhami *et al.*, 2020). These threats have triggered psychological states of reactance towards the government (Díaz and Cova, 2021; Krpan and Dolan, 2020), which may have led to defiance regarding other government-advocated containment measures, such as CTAs. This research gap is thus unfortunate because it limits a full understanding of the cognitive and emotional factors that may prevent individuals from adopting CTAs beyond privacy concerns and usability issues.

Second, while existing studies have investigated the social acceptability of CTAs among consumers in general (e.g., Georgieva *et al.*, 2021; Trang *et al.*, 2020), they have neglected to investigate young adults in this context. Similarly, no previous studies have profiled young adults regarding their hesitancy towards adopting CTAs. This gap is unfortunate because young adults are more socially active than older generations and contribute more to the spread of the virus (Centers for Disease Control and Prevention, 2020; *The New York Times*, 2020). Furthermore, young adults value freedom, autonomy, and choice more than older generations do and benefit from an active lifestyle (Berger, 2017). Therefore, they are more likely to develop psychological reactance and engage in defiant behaviors if government-imposed containment measures restrict their freedom (Eurotopics, 2020). Finally, young adults are digitally savvy and use mobile apps intensively, more than older generations. Therefore, they can play a crucial role in diffusing COVID-19 CTAs into the mainstream through intergenerational learning (Fernandes and Costa, 2021; UNECE, 2019).

Leveraging psychological reactance theory (Brehm, 1966) and focusing on young adults, we aim to investigate how and when young adults' adoption intentions towards COVID-19 CTAs reflect their focus on government-imposed containment measures and the perceived difficulty in restoring freedom. Furthermore, we aim to provide an empirically based typology of young adults based on their intentions to adopt CTAs and the underlying motivations (i.e., focus on government-imposed containment measures and the perceived difficulty in restoring freedom).

The findings from our study offer relevant theoretical contributions. First, previous studies focused on usability issues and privacy concerns as the main barriers to CTA adoption (e.g., Chan and Saqib, 2021; Velicia-Martin *et al.*, 2021). With a complementary perspective, we conceive psychological reactance as another key CTA adoption inhibitor. Furthermore, we investigate young adults' CTA adoption intentions rather than those of consumers in general (e.g., Hauff and Nilsson, 2021; Fox *et al.*, 2021). We explore the CTA-related factors that motivate young adults' CTA hesitancy and present a new typology with practical and theoretical significance. Gaining comprehensive knowledge of these groups is essential to understand their behavior and providing policymakers with insights into how to develop tailored communications that will more effectively persuade these crucial segments.

2. Theoretical background and objectives of the study

The field of consumer research that investigates responses to external threats (Campbell *et al.*, 2020) has recently provided evidence concerning consumer responses to COVID-19-related threats (Kirk and Rifkin, 2020; Panarese and Azzarita, 2021). In this work, we focus on the threats to individual freedom that arise from government-imposed containment measures and the response of consumers-specifically young adults. We are interested in understanding how and when government-imposed containment measures may threaten young adults' freedom and motivate

their resistance towards other government-advocated containment measures, such as CTAs. Previous studies have shown that although government measures have the laudable goal of promoting public health and safety, they may have unintended results, such as citizens' defiant behaviors (e.g., Grandpre *et al.*, 2003; Hornik *et al.*, 2008). For example, LaVoie *et al.* (2017) showed that individuals' exposure to graphic labels in anti-smoking campaigns caused an increase in perceived threat to freedom, resulting in more smoking behaviors. Similarly, Irmak *et al.* (2020) highlighted how government laws restricting cell phone use while driving restricted citizens' perceived freedom, which made them more likely to use the phone. In sum, policymakers' attempts to regulate individual behavior to ensure the public interest can be met with resistance if individuals focus on the restrictive nature of the recommendations and perceive these recommendations as threats to their freedom (Irmak *et al.*, 2020). We address this issue in the context of COVID-19 CTA hesitancy by adopting the psychological reactance theory (Brehm, 1966). Psychological reactance theory (Brehm, 1966) predicts that when people perceive that their freedom is threatened, they enter an aversive motivational state of reactance (Rosenberg and Siegel, 2018). Psychological reactance is described as a mix of negative emotions (e.g., anger) and negative cognitions (e.g., counterarguments) that contribute equally to regaining threatened freedom (Dillard and Shen, 2005). The government's efforts to contain the virus by imposing measures on their populations during the COVID-19 pandemic have frequently resulted in psychological reactance (Krpan and Dolan, 2020; Sprengholz *et al.*, 2021; Taylor and Asmundson, 2021). Such threats could be particularly salient for contemporary young adults (Panarese and Azzarita, 2021), who are confident, independent, and goal-oriented and value freedom, autonomy, and choice (Eisner, 2005). In contrast to older generations, young adults may not adhere to formalities when communicating with authoritative figures and may challenge the legitimacy of institutional authority (Berger, 2017). Along these lines, we contend that the focus on the restrictive nature of COVID-19 government-imposed containment measures may influence young adults' perceptions about their freedom being threatened. Increased perceived threats to freedom, in turn, may hamper young adults' alignment with government-advocated recommendations, such as CTA adoption. To our knowledge, no prior studies have investigated how young adults focus on the restrictive nature of government-imposed containment measures during the COVID-19 pandemic may hamper their CTA adoption intentions through increased psychological reactance.

Psychological reactance may result from perceived threatened freedom, but to date, no previous studies concerning CTAs have investigated the conditions under which this reaction may prevail. The perceived difficulty in restoring freedom may play a key role in this regard (Brehm and Brehm, 2013). Previous research has shown that reactance may vanish when freedom is lost (vs. threatened) (Brehm and Brehm, 2013). This proposition is in line with the energization model of motivation (Brehm and Self, 1989), which suggests that the intensity of an individual's aversive reaction depends on the difficulty in restoring their freedom. That is, individuals may exhibit

higher psychological reactance when they feel they can regain threatened freedom. Conversely, when the individual realizes that it is impossible to restore threatened freedom, the motivation for reactance should diminish or even disappear (Mikulincer, 1988). In this case, a state of passive discomfort, known as "helplessness", may arise. Font and Hindley (2017), for example, tested the psychological consequences of threatening tourists' freedom of travel. They found that when tourists are informed that visiting a disappearing destination is still possible, albeit difficult, they experience psychological reactance; psychological reactance in turn enhances tourists' desire to travel. Conversely, when tourists are informed that they cannot further visit the destination (i.e., restoring freedom is impossible), they feel psychological helplessness and devalue the unavailable location. Along these lines, we argue that the perceived difficulty in restoring freedom plays a relevant role in regulating the adoption of COVID-19 CTAs. When young adults perceive that they can still restore the freedom that the government-imposed containment measures have threatened, they experience reactance. Conversely, when young adults believe that it is impossible to restore their freedom, they feel helpless. To our knowledge, no contribution has examined perceived difficulty in restoring freedom as a boundary condition under which one of these two psychological reactions prevails over the other. Specifically, this is the first study to investigate how the perceived difficulty in restoring freedom during the COVID-19 pandemic influences the occurrence of psychological states of reactance and helplessness and how these psychological states affect young adults' CTA adoption intentions. Consequently, this study aims to investigate how and when young adults' adoption intentions toward COVID-19 CTAs reflect their focus on government-imposed containment measures and the perceived difficulty in restoring freedom.

Furthermore, in the context of COVID-19, no study has proposed a segmentation of young adults to define the psychological processes they undergo and the importance they attribute to managerially relevant CTA-related variables. This research gap limits our knowledge of this crucial target and prevents policymakers from effectively persuading young adults to adopt CTAs. Therefore, we also aim to identify relevant clusters of young adults who differ in their focus on government-imposed COVID-19 containment measures, perceived difficulty in restoring freedom, and willingness to adopt CTAs.

3. Methodology overview

To generate reliable conclusions and provide a more comprehensive depiction of the phenomenon under study, we employed a mixed-method approach (Davis *et al.* 2011).

Considering the paucity of studies adopting a psychological reactance approach to investigate resistance towards CTAs, in Study 1, we first relied on a qualitative approach. Through conducting in-depth interviews (N = 35), we explored how and when young adults' adoption intentions towards COVID-19 CTAs reflect their focus on government-imposed containment

measures and the perceived difficulty in restoring freedom.

Next, in Study 2, we conducted a survey (N = 821) and a cluster analysis to enhance the generalizability of our findings and identify groups of young adults who differ in their intentions to adopt COVID-19 CTAs and motivations to do so (i.e., focus on government-imposed containment measures and perceived difficulty in restoring freedom). In addition, we profiled these segments based on the predominant psychological processes (as emerged in Study 1) and managerially relevant CTA-related variables.

4. Study 1 – Exploring young adults' unwillingness to adopt CTAs

4.1 Overview and sample

Given that CTAs are new technology-based containment measures with limited existing empirical knowledge on young adults' CTA adoption in a pandemic context, we first conducted exploratory qualitative research aiming at understanding how young adults perceive government containment measures, whether they experience difficulty in restoring their freedom, and how these factors may contribute to developing their CTA adoption intentions. We reached theoretical saturation (Glaser and Strauss, 2017) after 35 in-depth interviews with Italian young adults (28 nonusers, 7 users) aged between 18 and 41 years old (Whang and Im, 2021) who owned a smartphone and who were aware of Immuni, the Italian CTA (see the sample characteristics in Appendix, Table 1). We identified Italy as the geography of interest because this country has been hit dramatically by the pandemic and still exhibits one of the highest rates of coronavirus deaths among its population in the European Economic Area (Statista, 2023). Immuni sends users notifications on possible infections and recommendations on the best behaviors to be implemented; it works with Bluetooth Low Energy Technology, and it does not involve any identification or geolocation of the user. In addition, the Italian government has widely recognized the crucial role of young adults in promoting the diffusion of Immuni among the national population. In particular, the Italian government has developed public communication to encourage young adults to be Immuni ambassadors (Italian Ministry of Health, 2020). However, the Italian Ministry of Health himself defined the adoption of Immuni among younger citizens as a total failure (Open, 2020). Understanding why individuals who are highly familiar with mobile apps may conversely refuse to adopt CTAs (e.g., Immuni) is thus crucial.

4.2 Procedure and analysis

To elicit respondents' accounts of their spontaneous thoughts and experiences, we developed a brief interview guide based on open-ended questions (in addition to the fixed data) that covered three key points: 1) perceptions about the government containment measures and the difficulty in restoring one's freedom amid the COVID-19 pandemic; 2) psychological reactions, opinions, and experiences related to government-

imposed containment measures; and 3) the adoption of Immuni. The interviews were carried out through video conferencing systems between November 2020 and March 2021 and had an average duration of 45 minutes. At the time of our study, the government's restrictive measures included mandatory green pass exhibition, mask usage, isolation, quarantine, and a 10 p.m. curfew.

The interviews were transcribed, resulting in 335 pages of 1.5 line-spaced content in 12-pt font, and then analyzed through a multiphase coding process that included thematic analysis. The "corpus" was sorted into content segments (one or more sentences) assigned to thematic categories (King and Horrocks, 2010). We proceeded with a line-by-line analysis of the text and first outlined "descriptive codes" (i.e., concise codes delineating specific text portions). Based on this codification, we adopted a process of progressive abstraction and merging, which led us to first identify the "integrative themes" (i.e., the key concepts) and, next, the "overarching themes". This procedure led to defining the key themes that characterize the thinking of the respondents.

Two research team members conducted the coding process independently and compared the results after each coding step. Moreover, to enhance the reliability of our findings, we followed the code-confirming approach (King and Horrocks, 2010), in which two independent coders who were experienced in marketing and received methodological training validated the associations. The interjudge reliability (i.e., agreement ratio) was satisfactory (89%).

4.3 Study 1 - Findings

Based on the multistage analysis process, we identified two overarching themes: the "focus on the beneficial effects of government-imposed containment measures" and the *"focus on the restrictive nature of government-imposed containment measures"*. Related to the latter, the content analysis revealed four key concepts (i.e., "integrative themes"), that is, "freedom deprivation", "psychological reactance", "helplessness", and "perceived difficulty of restoring freedom". Our analyses focus on informants who mainly perceived the government-imposed containment measures as highly restrictive. In what follows, we provide a detailed description of the themes identified.

The thematic content analysis revealed that the majority of interviewees focused on the restrictive nature of government-imposed containment measures. Particularly, these informants referred to how these governmental measures restricted their self-actualization and intimacy needs, in that they limited mobility, the chance to receive proper higher education or work, the pursuit of personal and professional goals, and the freedom of intimate relationships and social contacts.

"*Thinking about the measures enacted by the government to contain the COVID-19 pandemic, the first word that comes to mind is restriction. Restriction because I can't travel or even walk freely in the street, I can't attend courses at the university... I had so many personal and professional plans that I won't realize because now we cannot do anything! I'm limited in*

my contact with my nearest and dearest, I cannot go out with my friends and have dinner with them. Even the Christmas vacations, for example, I won't be able to spend them with my relatives" (Interviewee 8).

On the other hand, some other interviewees focused on the beneficial effects of government-imposed containment measures, as they recognized several positive outcomes of these measures for personal and public safety.

"*I think that the measures enacted by the government are essential, only in this way can we contain the spread of the virus and get out of the pandemic. They are essential because they support the safety of the individual citizen and the entire community*" (Interviewee 17).

Consistent with the goal of this study (i.e., explaining CTA adoption hesitancy), we focused our analysis on informants who mainly perceived the government-imposed containment measures as highly restrictive, as all of them were Immuni nonusers and stated that they were unwilling to adopt them.

Respondents who perceived government-imposed containment measures as restrictive suffered freedom deprivation, which they expressed in terms of limitation of choice, imposition of individual decisions, manipulation, and pressure. As noted by Interviewee 30:

"*The restrictive measures limit my freedom of choice because they are choosing what I can and cannot do! In other words, they are [government members] manipulating and pressuring my freedom. In this sense, I feel a lack of freedom*" (Interviewee 30).

As a result of freedom deprivation, most interviewees expressed two different psychological states, i.e., *psychological reactance and helplessness*. Regarding psychological reactance, some informants revealed that they felt anger and that this emotional state was directed towards the source of the restraint, i.e., the government. Additionally, they exhibited negative attitudes towards the government and its containment measures: they ascribed greater failure to solve the aversive situation to the incompetence of the state government, which they claimed to be inexpert and unqualified.

"*I always feel angry! My anger is toward those [government members] who tried and failed to manage the pandemic situation. I am angry with them because although they deprived me of freedom, nothing changes, the situation is still the same! All the containment measures have not brought the results they hoped for; this is a clear sign that the measures have been ineffective! Therefore, the government is inexpert and incompetent to manage the situation. […] The Immuni app, as well as all the other measures, is yet another clumsy attempt by the government. Therefore, I'm not going to adopt it*" (Interviewee 2).

Regarding helplessness, other interviewees disclosed being profoundly hopeless, defenseless, and demoralized. These retreat emotions emerged as crucial because these respondents, who felt at the mercy of events, were unable to achieve personal and professional goals, which were salient for their self-identification and status affirmation. As Interviewees 5 and 27 stated,

"*I feel strongly defenseless and demoralized because I find myself catapulted into this situation of freedom deprivation, and there is nothing I can do to get out of it. […] What would be the point of using Immuni?*

Nothing because the situation would not change. Therefore, I'm not going to adopt it soon" (Interviewee 5).

"*I am helplessly at the mercy of events. I cannot achieve the personal and professional goals I set for myself. At this point in my life, I should be showing everyone what I'm worth, but I cannot. Because of this, I am deeply discouraged*" (Interviewee 27).

Therefore, the words of the interviewees revealed how both reactance and helplessness negatively correlated with the willingness to adopt Immuni, since informants who experienced these psychological states expressed their disinterest in using this CTA.

Furthermore, the content analysis allowed us to identify the theme of the *perceived difficulty in restoring freedom*, which respondents expressed as the impossibility of returning to and restoring the pre-COVID-19 situation because of endless waves of contagion. Respondents believed that government containment measures would have lasted for many months or years.

"*I think it's hard to regain a situation of full freedom in the sense that you cannot go back, and you cannot restore the pre-COVID-19 situation since, despite all the measures, the reported cases are increasing day by day. Therefore, I think that the restrictions will last for a long time, for months, for years…*" (Interviewee 24).

Finally, the interviews revealed that the different levels of perceived difficulty in restoring freedom could trigger either reactance or helplessness. Specifically, we found that the majority of individuals who exhibited very high levels of difficulty in restoring freedom were highly discouraged and demoralized and exhibited states of helplessness. Conversely, those who exhibited less intense difficulty in restoring freedom were also more likely to show psychological reactance in the form of anger and negative cognitions towards the government. As Interviewees 32 and 11 said,

"*What do I think of the government? Inadequate and incompetent, that is all I have to say because I'm angry! [...] It will be difficult to return to the pre-COVID-19 situation, but not impossible*" (Interviewee 32).

"*I am deeply discouraged… which is why I think we will never return to pre-COVID-19 normalcy*" (Interviewee 11).

5. Study 2 - Identifying young adult clusters

The second objective of this study was to identify an empirically based typology of young adults who differed in their focus on government-imposed containment measures, perceived difficulty in restoring freedom, and willingness to adopt CTAs. We thus adopted a quantitative approach, surveyed Italian young adults, and conducted a cluster analysis. We also profiled the identified segments of young adults according to sociodemographic data, the predominant psychological processes they undergo, and the importance they attribute to managerially relevant CTA-related variables.

5.1 Data collection

We recruited Italian young adults (aged 18-41 years) who were aware of the existence of Immuni, through Prolific, a participant recruitment company. Using a purposive sampling strategy, we obtained 900 responses. Seventy-nine respondents were disqualified because they provided incomplete answers or failed attention checks, resulting in a final sample of 821 valid responses (gender: women = 42.2%, nonbinary = 1%; educational level: 2.1% = primary school education, 33.1% = high school diploma, 60.4% = bachelor's or master's degree, 4.1% = Ph.D.). Respondents were highly familiar with mobile app usage (M = 6.54, SD = 1.02), but the vast majority of them (78.1%) did not use Immuni.

5.2 Procedure and measures

The questionnaire included close-ended questions divided into three sections. The first section included the measurement scales for the clustering variables: the focus on government-imposed containment measures, the perceived difficulty in restoring freedom, and the willingness to adopt CTAs. The second section presented the measurement scales used as qualitative descriptors in the cluster analysis, e.g., perceived freedom deprivation, psychological reactance, helplessness, resilience, trust towards the government, attitudes towards containment measures, and CTA privacy concerns (see Appendix, Table 4 for more details). Finally, in the last section, we collected sociodemographic data (i.e., age, gender, and educational level).

Concerning the clustering variables, we relied on the insights gathered from the qualitative Study 1 to develop a six-item, 7-point Likert scale to measure participants' focus on the restrictive nature of government-imposed containment measures (e.g., "The containment measures mandated by the government strongly limit my freedom of choice"), which also echoes input from White *et al.* (2008); and the four-item, 7-point Likert scale pertaining to the perceived difficulty in restoring freedom, which also reflects input from Dillard and Shen (2005) (e.g., "There is no chance to return to a pre COVID-19 normality"). Finally, we measured the willingness to adopt (WTA) Immuni by adapting Chan and Saqib's (2021) three-item, 7-point semantic scale (e.g., "Not at all interested/Very interested to use Immuni in the near future").

Concerning the descriptive variables, we measured perceived freedom deprivation by adapting White *et al.*'s (2008) four-item, 7-point Likert scale (e.g., "The government containment measures manipulate me"). Moreover, we treated psychological reactance as a multidimensional construct composed of two dimensions: anger and negative cognitions. We used Xie *et al.*'s (2015) three-item scale to measure felt anger and Ball and Goodboy's (2014) four-item, 7-point semantic scale to measure negative cognitions about the government. We measured helplessness by adapting Gelbrich's (2010) three-item, 7-point Likert scale, resilience by adapting Smith *et al.*'s (2008) three-item, 7-point Likert scale, and trust towards the government by adapting Chan and Saqib's (2021) one-item, 7-point

semantic scale. Finally, we measured the negative attitude towards wearing masks, social distancing, lockdowns, and vaccines by adapting Taylor *et al.*'s (2020) scales, whereas we measured CTA privacy concerns by adapting Chan and Saqib's (2021) measurement scale.

5.3 Measurement model assessment

We first conducted a confirmatory factor analysis (CFA) to assess the reliability and validity of the measurement model running LISREL software (Jöreskog and Sörbom, 2006). Specifically, we assessed the measurement model related to the three variables used to identify the clusters (i.e., focus on the restrictive nature of government-imposed containment measures, perceived difficulty in restoring freedom, and willingness to adopt CTAs). The results showed an acceptable model fit: $\chi 2(62) = 884.851$, root mean square error of approximation (RMSEA) =.07, square root mean residual (SRMR) =.07, confirmatory fit index (CFI) =.91, and nonnormed fit index (NNFI) =.90. The standardized factor loadings were all greater than .70, and all standardized item loadings significantly loaded onto their indented constructs (p <.01). The average variance extracted (AVE) for each variable was greater than .50 (.57 ≤ AVE ≤.89), and the composite reliability (CR) was greater than .70 (.87 ≤ CR ≤.96). Moreover, the Cronbach's alpha values were all greater than .70 (.86 ≤ α ≤.96) (Appendix, Table 2). Additionally, the shared variance between pairs of factors was always less than the corresponding AVE, thus showing discriminant validity (Fornell and Larcker, 1981). The means, standard deviations, and bivariate correlations among the three constructs are reported in Appendix, Table 3. "Overall, these findings confirmed that the hypothesized measurement model was reliable and valid". (Bagozzi and Yi, 1988)

To identify distinct groups of young adults, we conducted a nonhierarchical k-means clustering procedure (Ward's method), which was based on the respondents' standardized mean scores related to (1) their focus on the restrictive nature of government-imposed COVID-19 containment measures, (2) the perceived difficulty in restoring freedom, and (3) their willingness to adopt CTA (Immuni). The clustering procedure yielded a four-cluster solution, the generalizability of which to the entire population was confirmed by an adequate Rand index (.76) (Rand, 1971).

5.4 Study 2 - Findings

We labeled the four clusters according to three clustering variables: *Endangered dissidents, Apathetic, Optimistic adopters, and Lost needing guidance* (Appendix, Table 4).

Endangered dissidents (24%): Young adults in this segment expressed the strongest focus on the restrictive nature of government-imposed COVID-19 containment measures (1.07). Additionally, they scored higher than the average on the perceived difficulty in restoring freedom (.56). They exhibited the lowest willingness to adopt CTAs of all clusters (-.96).

Apathetic (24%): Young adults in this segment seemed indifferent to the restrictive nature of government-imposed containment measures (-.46).

Similarly, they did not exhibit high concerns about the impossibility of restoring the threatened freedom (-.35), scoring below the average on both factors. Additionally, they seemed not interested in adopting CTAs, as their willingness to adopt CTAs was below average (-.78).

Optimistic adopters (26%): This segment included young adults who did not focus at all on the restraining aspects of government containment measures. They exhibited the lowest scores of all clusters in terms of focus on the restrictive nature of government-imposed containment measures (-.73) and the perceived difficulty in restoring freedom (-.91). Additionally, they exhibited the highest willingness to adopt CTAs (.82).

Lost needing guidance (26%): Finally, this segment of young adults felt lost and pessimistic about the possibility of restoring their freedom in the near future. They focused more than the average on the restrictive nature of government-imposed containment measures (.19) and, importantly, showed the highest score on the perceived difficulty in restoring freedom among all clusters (.78). Interestingly, they also showed rather high scores on the willingness to adopt CTAs (.79), such that they appeared to seek guidance from governmental authorities in times of uncertainty.

The four clusters differed significantly in terms of age ($F(3, 817) = 6.48$, $p < .01$) and gender ($\chi^2(6, 821) = 39.97$, $p < .01$), even if the differences were rather small, while no difference regarding educational levels emerged ($\chi^2(9, 821) = 3.69$, $p = .93$) (Appendix, Table 4). In addition to the sociodemographic variables, we used descriptive qualitative characteristics to profile the segments, such as freedom deprivation, reactance, helplessness, and resilience. Furthermore, we profiled the segments with individual measures that refer to trust towards the government and negative attitudes towards government containment measures, such as lockdowns, masks, social distancing, and vaccines. Finally, we included measures of consumers' perceptions of CTAs (Immuni) in terms of their awareness, perceived usefulness, privacy concerns, and current usage.

An analysis of variance with Fisher's LSD post hoc comparisons revealed significant differences across clusters (Appendix, Table 4). Endangered dissidents scored highest on freedom deprivation and reactance and above average on helplessness. Their lack of trust in the government was manifested in their negative attitudes towards containment measures (i.e., masks, social distancing, lockdowns, and vaccines). Concerning Immuni usage, these endangered dissidents scored quite low on Immuni awareness, strongly disregarded its effectiveness, and expressed the highest privacy concerns among all clusters. The percentages of Immuni users, which differed significantly among the four clusters ($\chi^2(3, 821) = 147.89$, $p < .01$), were the lowest among engendered dissidents. Overall, these findings confirmed that the perceived technical liabilities and privacy concerns linked to using CTAs could be related to a deeper state of psychological reactance felt by young adults.

The *apathetic* expressed no specific concerns in terms of freedom deprivation, nor did they exhibit higher scores of reactance or helplessness. However, despite their lack of strong aversion to government containment measures, they perceived Immuni as ineffective and were unwilling to use

it. In turn, they accounted for the second-lowest percentage of Immuni users among all clusters.

Conversely, the *optimistic adopters* did not perceive freedom deprivation, did not show reactance or helplessness, and exhibited the highest resilience scores of all clusters. Additionally, they showed the highest trust in the government and acceptance of government containment measures. They were highly aware of Immuni, perceived it to be useful, and were not particularly concerned about privacy. The percentage of Immuni users in this cluster was the highest among all clusters.

Finally, the *lost needing guidance* scored above average on freedom deprivation and reactance and exhibited the highest helplessness scores. Despite being deeply hopeless and highly demoralized, these consumers trusted the government and exhibited rather positive attitudes towards government-imposed containment measures. They knew Immuni and perceived it to be useful (as much as the optimistic adopters did) and exhibited low privacy concerns. Finally, the percentage of Immuni users in this segment was the second highest among all clusters. These findings showed an unexpected role of helplessness being positively correlated with the willingness to adopt CTAs. When young adults experienced helplessness, they appeared to seek guidance and welcome government containment measures, CTAs included.

6. Conclusion

6.1 Discussion and theoretical implications

Governments have strongly promoted CTAs as a tool to limit the propagation of the COVID-19 virus (Georgieva *et al.*, 2021). Despite such expensive and dedicated promotional efforts, CTAs have failed to leave much of a mark, even among digitally savvy young adults (Open, 2020). Drawing on psychological reactance theory, we conducted a mixed-method study to determine how and when young adults' reduced adoption intentions towards CTAs reflected their focus on government-imposed containment measures and their perceived difficulty in restoring freedom. Second, we provided an empirically based typology of young adults according to their focus on the restrictive nature of government-imposed containment measures, the perceived difficulty in restoring freedom, and the willingness to adopt CTAs. Finally, we profiled the identified clusters in terms of (a) sociodemographic data, (b) the psychological processes they experienced, and (c) the importance they attributed to managerially relevant and CTA-related variables.

The findings from this mixed-method approach establish two notable theoretical contributions related to the adoption and social acceptability of CTAs. First, in addition to technical features and privacy concerns as the main barriers to COVID-19 CTA adoption (e.g., Chan and Saqib, 2021; Hauff and Nillson, 2021; Trang *et al.*, 2020; Velicia-Martin *et al.*, 2021), we offer a complementary perspective in which both the focus on government-imposed containment measures and the perceived difficulty in restoring

freedom explain how and when young adults are unwilling to adopt CTAs. Specifically, young people's focus on the restrictive nature of containment measures triggers their perceptions of freedom deprivation. As freedom deprivation is experienced, two different psychological states arise, i.e., *psychological reactance* and *helplessness*, with reactance predominating over helplessness when young adults perceive that they still have some chances to restore threatened freedom. Existing studies have mainly focused on anger as a relevant emotion (e.g., Dillard and Shen, 2005); we also identify helplessness as influential. Detangling between reactance and helplessness is crucial. Indeed, the results of the cluster analysis show that the two psychological states have asymmetric relationships with CTA adoption intentions; while reactance negatively correlates with CTA adoption intentions, helplessness positively correlates with them. To our knowledge, this study is the first to apply psychological reactance theory to assess how and when young adults' focus on the restrictive nature of COVID-19 containment measures and their perceived difficulty in restoring freedom might explain CTA adoption failure.

Second, our choice of investigating young adults informs the field of studies that examine CTA adoption among individuals in general (e.g., Hauff and Nilsson, 2021; Fox *et al.*, 2021). Deepening the perspective of young adults is essential, as their adoption intentions and underlying psychological mechanisms may differ from those of older generations. Young adults tend to value freedom, autonomy, and choice more than older generations and benefit from an active lifestyle (Berger, 2017). As such, understanding how and when they might oppose CTAs for reasons that go beyond privacy concerns (Fernandes and Costa, 2021) is a critical step toward achieving mainstream diffusion of CTAs. We identified novel typologies of young adults (*engendered dissidents, apathetic, optimistic adopters,* and *lost needing guidance*) who differ in terms of theoretically and managerially relevant CTA factors. Our findings provide a more fine-grained picture of young adults' attitudes and behavioral intentions towards CTAs that are needed to communicate more effectively with these targets.

6.2 Managerial implications

Our findings have relevant implications for practice. Continued discussions about the failure of the adoption of CTAs should not only consider privacy and usability issues (e.g., Akinbi *et al.*, 2021; He *et al.*, 2021). Conversely, policies promoting CTA social acceptability should also consider the deeper psychological states that young individuals may experience. The results of the cluster analysis indicate four segments of young adults, which questions the effectiveness of any "one-size-fits-all" communication strategy. Practitioners can use our findings to develop more effective communication messages tailored to each segment.

Endangered dissidents and *apathetic* people show low usage intentions and adoption behavior. Endangered dissidents seem more difficult to convince, however, as they express the strongest perceptions of freedom deprivation and reactance, along with strong counterarguments against

CTA effectiveness. When targeting this group, policymakers could develop retrospective explanations (Gelbrich, 2010) that include information about why a containment measure was necessary to ensure public safety. Such messages could reduce reactance by increasing young adults' understanding of government constraints (Davidow, 2003). Another option might be focusing on the benefits of CTAs, such as by using terms associated with enhanced freedom of movement and traveling. The *apathetic* feel less endangered by government containment measures, but they are rather unwilling to adopt CTAs. As young adults, they might be convinced by campaigns that feature influencers (The Conversation, 2020); as apathetic people, behavioral nudges that increase their feelings of ownership and perceived effectiveness could be effective.

Optimistic adopters and those *who lost the need for guidance* indicate high usage intentions and adoption behaviors. Optimistic adopters do not feel endangered by government-imposed containment measures. They experience low reactance and helplessness and high resilience. Considering this target's belief that CTAs are useful for themselves and society in general, policymakers might offer these committed citizens a moral reward that motivates them to be CTA ambassadors, such that they could feel proud of spreading CTA adoption to the mainstream. Those who *lost the need for guidance* exhibit high usage intentions and adoption behavior; however, they are driven by different motivations and need aid and guidance to reduce their helplessness. Policymakers could target this segment by developing prospective explanations that emphasize how CTAs will give citizens control and power now and in the future. For example, interactive communications with these users through CTAs could encourage resilience and wishful thinking to motivate them to become optimistic adopters.

Our findings also have implications for society at large. Global pandemics such as COVID-19 have disruptive effects on businesses, consumers, and society. Healthcare authorities, policymakers, and governments can limit such disruptive effects by reducing the spread of the virus. Persuading young adults is a crucial step toward reaching this goal. Young adults are socially active and contribute more to the spread of the virus. The adoption of CTAs is crucial to limit and track the spread of the virus. Additionally, young adults use mobile apps more than older generations, and might promote CTA adoption diffusion into the mainstream. Our study proposes communication strategies that are tailored for different segments of young adults, which help CTA adoption among this younger population and, in turn, the population at large. The findings of our study will also help policymakers deal with new global crises that may occur in the future for which Italy is still unprepared (Global Health Security, 2021).

6.3 Limitations and future research

This study has some limitations that provide avenues for future research. First, this study investigates young adults' CTA adoption intentions in the context of COVID-19. Future research may consider investigating different generations of consumers to determine differences between younger and older generations through age-based multigroup analyses.

Second, our empirical study is conducted in Italy. Country populations differ in terms of cultural dimensions and levels of trust towards the government, which may all influence CTA adoption intentions. To enhance the robustness of our findings, future research might conduct cross-cultural studies with representative samples of national populations and assess how relevant cultural dimensions (e.g., individualism/collectivism, uncertainty avoidance, power distance) may affect CTA adoption intentions.

Third, we use a mixed-method approach, including qualitative interviews and cluster analysis, albeit our findings cannot fully demonstrate causality, as our study is correlational in nature. Future research can consider adopting an experimental approach to reveal the causality between freedom deprivation caused by government-imposed containment measures, perceived difficulty in restoring freedom, and CTA adoption.

Finally, this research provides a limited number of profiling variables. To better understand the characteristics of the identified segments, additional descriptive variables might be used. On a related note, we identified four clusters of young adults and suggested specific communication strategies that may enhance each segment's CTA adoption. Although we speculate about some communication strategies that seem likely to be effective for each segment, we call for additional experimental research that tests the effectiveness of the proposed communication strategies across diverse consumer segments.

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Appendix

Tab. 1: Overview of interview participants

Interviewee ID	Age	Gender	Educational qualification	Profession	Status
1	28	F	Master's degree	Student	Non-user
2	20	M	High school graduate	Musician	Non-user
3	25	M	Master's degree	Unemployed	User
4	30	F	High school graduate	Shop assistant	Non-user
5	32	F	PhD	Teacher	Non-user
6	24	M	Bachelor's degree	Student	Non-user
7	21	M	High school graduate	Singer	Non-user
8	23	F	Bachelor's degree	Student	Non-user
9	29	M	High school graduate	Clerk	User
10	30	M	High school graduate	Unemployed	Non-user
11	18	F	Secondary school graduate	Student	Non-user
12	20	F	High school graduate	Student	User
13	32	M	High school graduate	Freelancer	Non-user
14	36	M	Master's degree	Software developer	User
15	25	M	Master's degree	Student	Non-user
16	26	F	High school graduate	Shop assistant	Non-user
17	39	M	Bachelor's degree	Clerk	User
18	18	M	Secondary school graduate	Musician	Non-user
19	31	F	High school graduate	Entertainer	Non-user
20	25	F	Master's degree	Clerk	Non-user
21	23	F	High school graduate	Shop assistant	Non-user
22	18	F	High school graduate	Swimmer	Non-user
23	26	M	Bachelor's degree	Freelancer	Non-user
24	37	F	Bachelor's degree	Kindergarten teacher	Non-user
25	18	F	Secondary school graduate	Student	Non-user
26	27	M	Master's degree	Data scientist	Non-user
27	22	M	Bachelor's degree	Student	Non-user
28	29	M	Master's degree	Clerk	Non-user
29	24	F	Master's degree	Unemployed	Non-user
30	29	M	Master's degree	Business consultant	Non-user
31	28	F	Bachelor's degree	Student	User
32	21	F	Secondary school graduate	Student	User
33	26	M	Master's degree	Consultant	Non-user
34	29	M	Bachelor's degree	Dancer	Non-user
35	41	F	High school graduate	Shop assistant	Non-user

Source: our elaboration

Tab. 2: Measurement models assessment

Constructs	Measurement items	λ	α	CR	AVE
Focus on the restrictive nature of government-imposed COVID-19 containment measures (7-point Likert scale, 1=strongly agree, 7=strongly disagree)	The government containment measures		.89	.89	.57
	1. impose too many restrictions on my freedom of movement.	.71			
	2. limit my freedom of choice excessively.	.76			
	3. take me away from my loved ones.	.72			
	4. constrain my social contacts.	.72			
	5. prevent me from achieving my goals.	.83			
	6. prevent citizens from achieving their goals.	.79			
Perceived difficulty of restoring freedom (7-point Likert scale, 1=strongly agree, 7=strongly disagree)	1. It is impossible to return to pre-COVID-19 normality.	.88	.86	.87	.63
	2. There is no chance of restoring pre-COVID-19 normality.	.85			
	3. It is very hard to return to what we called normality.	.80			
	4. I doubt that things will return to normality, as there will be government restrictions for many months, if not years, to come.	.61			
Willingness to adopt Immuni (7-point semantic scale)	How likely/willing/interested are you to adopt Immuni in the near future?		.96	.96	.86
	1. Not at all likely/Very likely	.94			
	2. Not at all willing/Very willing	.94			
	3. Not at all interested/Very interested	.95			

Source: our elaboration

Tab. 3: Mean scores, standard deviations, and bivariate correlations among constructs

	FOCUS REST M=4.24 SD=1.48	DIFFIC RESTOR M=4.04 SD=1.65	WTA M=4.03 SD=2.09
FOCUS REST	1		
DIFF REST	.28**	1	
WTA	–.25**	–.10**	1

Notes: FOCUS REST = focus on the restrictive nature of government-imposed COVID-19 containment measures; DIFFIC REST = perceived difficulty of restoring freedom; WTA = willingness to adopt Immuni. M=mean, SD=standard deviation. **Correlation is significant at p=.01, *Correlation is significant at p=.05, (ns)=Correlation is not significant. The matrix is diagonal

Source: our elaboration

Tab. 4: Cluster descriptions

	Cluster a		Cluster b		Cluster c		Cluster d			
	Endangered dissidents		Apathetic		Lost needing guidance		Optimistic adopters		Test statistic	
N (%)	196 (24%)		197 (24%)		213 (26%)		215 (26%)		F(3,817)	Significance
Clustering variables	M z score		M z score		M z score		M z score			
FOCUS REST	1.07		−.46		.19		−.73		244.05	<.01
DIFFIC REST	.56		−.34		.73		−.91		262.84	<.01
WTA	−.96		−.78		.79		.82		665.83	<.01
Sociodemographic variables	M	SD	M	SD	M	SD	M	SD		
Age (years)	27.47_{d}	7.42	28.35_{c}	6.57	$26.57_{b,d}$	6.06	$29.30_{a,c}$	6.79	6.48	<.01
Gender (within cluster)										
Men	75 (38.3%)		92 (46.7%)		62 (29.1%)		117 (54.4%)			
Women	120 (61.2%)		103 (52.3%)		150 (70.4%)		92 (42.8%)			
X	1 (0.5%)		2 (1.4%)		1 (0.5%)		6 (2.8%)			
Education (within cluster)										
Junior high school or lower	6 (3.1%)		6 (3.0%)		4 (1.9%)		3 (1.4%)			
High School	66 (33.7%)		67 (34.0%)		66 (31.0%)		73 (34%)			
Bachelor's or master's degree	118 (60.2%)		114 (57.9%)		134 (62.9%)		130 (60.5%)			
Higher education	6 (3.1%)		10 (5.1%)		9 (4.2%)		9 (4.2%)			
Descriptive qualitative variables	M	SD	M	SD	M	SD	M	SD		
Perceived threatened freedom	$5.25_{b,c,d}$	1.35	$3.09_{a,c,d}$	1.39	$3.63_{a,b,d}$	1.43	$2.30_{a,b,c}$	1.86	173.41	<.01
Reactance	$5.13_{b,c,d}$	1.09	$4.07_{a,c,d}$	1.18	$4.53_{a,b,d}$	.99	$3.44_{a,b,c}$	1.06	89.06	<.01
Helplessness	$4.64_{b,d}$	1.66	$3.63_{a,c,d}$	1.57	$4.87_{b,d}$	1.36	$3.12_{a,b,c}$	1.47	62.10	<.01
Resilience	4.42_{d}	1.20	4.54_{d}	1.21	4.44_{d}	1.13	$5.00_{a,b,c}$	1.14	11.31	<.01
Trust toward the government	$3.13_{b,c,d}$	1.42	$3.58_{a,c,d}$	1.42	$3.90_{a,b,d}$	1.21	$4.42_{a,b,c}$	1.29	33.81	<.01
Negative attitude toward wearing masks	$2.31_{c,d}$	1.61	$1.74_{a,d}$	1.08	$1.53_{a,d}$	.90	$1.39_{a,b}$	.85	25.17	<.01
Negative attitude toward social distancing	$2.47_{b,c,d}$	1.62	$1.68_{a,d}$	1.01	$1.65_{a,d}$	.98	$1.36_{a,b,c}$	.74	35.60	<.01
Negative attitude toward lockdowns	$3.70_{b,c,d}$	1.90	$2.13_{a,d}$	1.26	$2.08_{a,d}$	1.38	$1.65_{a,b,c}$	1.01	79.53	<.01
Negative attitude toward vaccines	$2.49_{b,c,d}$	1.62	$1.94_{a,c,d}$	1.40	$1.65_{a,b,d}$	1.02	$1.34_{a,b,c}$	.81	31.13	<.01
CTA awareness	$5.28_{c,d}$	1.57	$5.31_{c,d}$	1.56	$6.06_{a,b}$	1.10	$6.16_{a,b}$	1.20	24.60	<.01
CTA effectiveness	$2.54_{c,d}$	1.55	$2.73_{c,d}$	1.26	$4.79_{a,b}$	1.47	$4.63_{a,b}$	1.48	140.73	<.01
CTA privacy concerns	$4.18_{b,c,d}$	1.98	$3.22_{a,c,d}$	1.79	$2.31_{a,b,d}$	1.47	$1.97_{a,b,c}$	1.24	83.25	<.01
Number (percentage) of CTA users	4 (0.49%)		11 (1.34%)		75 (9.14%)		90 (10.96%)			

Notes: M z score = standardized mean score, where average = 0, standard deviation = 1; M = mean, SD = standard deviation. Subscript letters indicate significant differences between the cluster of reference and the other clusters at the .05 significance level (Fisher's LSD post hoc test). FOCUS REST = focus on the restrictive nature of government-imposed COVID-19 containment measures; DIFFIC REST = perceived difficulty of restoring freedom; WTA = Willingness to adopt. We measured trust toward the government by one item on a 7-point Likert scale ("How much do you trust your state government?", Chan and Saqib, 2021); negative attitudes toward (e.g., "I am against…) wearing masks, social distancing, lockdown, and vaccines were measured via two-item, 7-point Likert scales; Taylor and Asmundso, 2021; Taylor *et al.,* 2020); CTA awareness was measured on a three-item, 7-point Likert scale (e.g., "I am aware of the possibility of using CTA"); CTA perceived usefulness was measured via a three-item, 7-point Likert scale (e.g., "CTA is useful"; Chan and Saqib, 2021); privacy concerns when using CTA was measured on a three-item, 7-point Likert scale (e.g., "I am concerned that CTA collects too much personal information about me", Smith *et al.,* 1996). Current CTA usage is a dichotomous variable: "Are you currently using CTA?" 1 = yes, 2 = no.

Source: our elaboration

sinergie
italian journal of management

ISSN print 0393-5108
ISSN online 2785-549X
DOI 10.7433/s121.2023.13
pp. 271-293

Sinergie Italian Journal of Management

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Registered with Law Court of Verona, Italy, reg. no. 570, 1 April 1983

20 copies printed by

GRAFICHE BAIETTA -Via Carcirago, 14, 37022 Fumane (VR) Italy - Tel. 045 770 2088
September 2023

€ 66, 00

Sinergie italian journal of management

Official Journal of Italian Society of Management
Vol. 41, Issue 2 - May/Aug 2023 - ISSN 0393-5108 ISSN 2785-549X

Quadrimestrale - Poste Italiane s.p.a. - Spedizione in Abbonamento Postale D.L. 353/2003 (conv. in L. 27/02/2004 n. 46) art. 1, comma 1, DCB VERONA