

# PICCOLA IMPRESA

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RIVISTA INTERNAZIONALE DI STUDI E RICERCHE

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- Marketing automation, AI and entrepreneurial heuristics
- Corporate sustainability paradoxes in SMEs
- Entrepreneurship & networks in peripheral areas
- Sustainable landfills and opportunities for SMEs
- Business incubators driving eco-innovation
- The influence of AI on entrepreneurial authenticity
- Women entrepreneurs' learning from external shocks



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EDITORIAL  
MARKETING AUTOMATION,  
AI AND ENTREPRENEURIAL HEURISTICS

Simone Guercini  
simone.guercini@unifi.it  
University of Florence

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Abstract

**Purpose.** This editorial sets out some reflections and arguments on the impact of marketing automation (MA) on the role of entrepreneurial marketers and on the marketing content of the entrepreneurial roles in small firms.

**Design/methodology/approach.** The relevant literature covers the role of artificial intelligence (AI) in marketing, which we examine here specifically in relation to MA, understood not only in its more established sense of operational and routine activities, but also in those aspects of strategic marketing and decision-making that carry greater importance and added value. In addition to the literature, we draw on the findings of surveys and studies carried out with consultants specialising in MA and small businesses operating as international traders and in digital advertising.

**Findings.** The relationship between the use of AI in MA is integrated in hybrid forms with the role of the human element. Competences become fundamental – not only those to be acquired, but also those to be preserved in a context of integration with AI. The argument under discussion is that AI does not conflict with heuristic models of decision-making, but rather establishes a complex relationship with them – a relationship that can give rise to paradoxes and opportunities.

**Practical and Social implications.** The integration of MA is a topical business issue, with some companies – including small ones – embarking on significant exploration and learning initiatives, at least in certain sectors that are more exposed to technology and international markets. A key issue is that of the competences to be developed and maintained.

**Originality of the study.** The study is original in that it offers some previously unpublished reflections on the relationship between AI, MA and heuristic decision-making processes, putting forward a number of hypotheses which could be the subject of future research.

## 1. Introduction

The relationship between marketing and entrepreneurship has for many years been the subject of study from various perspectives: in marketing within small and medium-sized enterprises; in the relationship between marketing and innovation; and in the role of marketing within entrepreneurship. Today, the potential of artificial intelligence (AI) enables extensive automation processes in marketing. How does this automation impact the relationship between marketing and entrepreneurship, particularly on the decision-making processes of entrepreneurial marketers?

This is a very broad topic, and this editorial merely aims to offer some reflections based not only on the relevant literature but also on a number of recent projects we have carried out in collaboration with consultancy firms and small businesses that utilise forms of AI in their marketing processes, operating as intermediaries in international markets and as service providers for programmatic advertising.

AI is often introduced into companies through the adoption of software that uses various types of algorithms to execute, manage and optimise marketing workflows in real time (such as lead scoring, classification and dynamic content distribution) (Pamungkas, 2023; Guercini, 2022). Naturally, these specific systems – often introduced with the support of consultants and suppliers – complement the large language models (LLMs) widely used by the general public, highlighting a relative similarity between the position of business owners and that of consumers when faced with large platforms, a circumstance that has been noted for several years now (Kozinets and Gretzel, 2021; Puntoni et al., 2021).

By its very nature, marketing automation involves identifying antecedents according to a logic of ‘causation’ (Sarasvathy, 2001). It presupposes, in fact, that once a sufficient quantity of profile and behavioural data has been collected, customers’ judgements and choices can become predictable, enabling systems to achieve results through predetermined rules and linear pathways (Mero et al., 2020). Conversely, entrepreneurs operating in contexts characterised by high speed and a scarcity of historical data (such as early-stage start-ups) cannot rely sufficiently on historical data, as they are navigating largely uncharted territory. Instead, they tackle uncertainty by resorting to heuristics — cognitive shortcuts or ‘rules of thumb’ that enable rapid, adaptive and ecologically rational decision-making, based on limited data and simple processing models (Gigerenzer & Gaissmaier, 2011).

*How does the introduction of marketing automation affect the entrepreneur’s heuristic-driven decision-making process?* With regard to this question, our thesis is that marketing automation does not replace entrepreneurial heuristics, but rather requires new and different ones and /or alters their scope

of application (Guercini, 2023a), calling for a new form of alignment between decision-making and behavioural models and contextual conditions (Marewski et al., 2024).

Albeit briefly, let us examine the role of AI in marketing automation from various perspectives. Firstly, from the perspective of the potential offered by technologies (for example, in recent forms of agent-based AI). Secondly, from the perspective of the decision-making models of entrepreneurial marketers and the role of their personal skills and the competences incorporated or developed within the business organisation.

## **2. Marketing automation and AI**

Long regarded as a process for replacing people in the performance of tasks with limited added value, such as sending emails and managing digital direct marketing (Little et al. 2001), marketing automation (MA) has recently come to take on a broader meaning, encompassing more strategic tasks. In particular, the theme of replacement has increasingly been complemented by that of integration and hybridisation between human and machine components, even in processes of higher added value and of a strategic nature, within a framework of 'conjoined agency' (Murray, Rhymer and Sirmon, 2021) and hybridisation (Guercini and Sestino, 2026).

Marketing automation predates artificial intelligence, given that the term first appeared in the literature between the two world wars to refer to the use of vending machines. Today, however, the term is linked to digitalisation and, even more so, to AI applications. Biegel (2009) cites the Winterberry Group's definition, according to which marketing automation can be defined as the use of marketing technology solutions to automate marketing processes, including (but not limited to) planning, budgeting, segmentation, database management, analysis, creative execution, resource management, campaign execution, lead management and reporting (Guercini, 2023b). These marketing technologies comprise a combination of software, networks and hardware that enable the input, processing and output of marketing and business information and content (Biegel, 2009, p. 2003). Since then, marketing automation has been conceptualised as closely linked to a category of software that optimises, automates and measures marketing activities and workflows to enable companies to improve their efficiency and increase revenue more rapidly (Miller, 2013).

In some respects, the use of AI involves a certain degree of replacement and/or integration of the human element, even in decision-making activities. Whilst marketing automation is often discussed in relation to operational activities, such as email management, customer interaction via telephone and online chat, and the integrated management of social me-

dia communication, automation has for some time now extended to strategic marketing functions such as classifying customers for the purposes of segmentation, targeting and positioning (Guercini, 2023a), as well as the management of creative content (Pagani and Wind, 2025). In summary, therefore, AI can extend the scope of MA to complex processes of a strategic nature. Although automation systems were conceivable even before this, it was in the early 2000s that we witnessed the creation and utilisation of systems to monitor the behaviour of internet users. It is in this context that marketing automation systems originated (Świeczak, 2013), capable of tracking the behaviour of email recipients on a specific website. The information obtained makes it possible to identify needs and provide a timely response with a level of personalisation that only automated systems are capable of managing.

More broadly, this concerns the integration of AI into business processes – not only in marketing, but also in specific contexts such as international-business, where the availability of data on linguistic and cultural contexts can, when combined with human expertise, support efforts to adapt the product or service offering, as well as the management of logistics systems and operations within an increasingly complex environment.

The focus on MA therefore sits within a broader context that presents clear opportunities and raises challenges within what has recently been termed the ‘ideology of automation’ (Fisher and Fleming, 2026). This term, distinct from ‘technological imagery’ (Kazansky and Milan, 2021) and ‘technological pre-framing’ (Razazade and Mehrizi, 2023), refers to those ‘managerial threats of future technological unemployment – whether realistic or not – that inform present power relations between workers and management’ (Fisher and Fleming, 2026, p. 714). This is a highly significant issue that arises at various operational levels, but it can certainly involve the executive level due to its potential importance in helping to shape the business model.

In this context, the issue of MA arises at the corporate level as a new area in which decisions must be made. On the other hand, AI is reshaping the very way in which decisions can be made. Automation therefore does not only affect low-value-added operational routines, but may also impact more important, high-value-added processes that require a new form of integration with the human element. MA therefore addresses strategic issues such as customer classification based on segmentation, targeting and positioning; recommendation systems; and programmatic or real-time advertising (Guercini, 2023b).

Experience with small businesses suggests that the advance of new forms of AI has varied effects. The experience of many of us who are involved not only in academia but also in working with businesses on research or consultancy projects shows that, despite the documented backwardness

of some parts of the business world, in other cases small businesses can be surprisingly quick to experiment with and adopt certain solutions, especially if these are available at low cost or can be put to immediate use to support decision-making processes. As previously noted (Guercini, 2022), the adoption of automated, digitalised systems alters the decision-maker's 'operating environment'. This interaction does not diminish the value of heuristics; on the contrary, it turns them into a breeding ground for innovation by reconfiguring their scope — that is, the boundary conditions within which a heuristic rule can be successfully applied (Marewski et al., 2024).

An automation system cannot construct its own conceptual framework autonomously. Before a marketing automation (MA) tool can assign a score to a lead or trigger an email sequence, the entrepreneur must set the initial parameters. In the context of a start-up, where historical consumer data is scarce, these parameters are based on heuristic beliefs (for example, *"If a customer requests a demo within 24 hours of visiting our pricing page, they are a highly intent buyer"*).

This is a classic application of the recognition heuristic or the intelligent cue heuristic (Gigerenzer, 2022). The decision-maker – typically the entrepreneur in a small business – draws on their tacit knowledge of the sector to construct decision-making and behavioural models. In an MA context, this could involve transforming subjective intuition into codified algorithmic logic. MA goes beyond an intelligent CRM to influence the very orientation of marketing itself, in which the technological dimension is not merely a supporting element, but a reality whose characteristics can mediate and shape a certain type of relationship between the business and the market within a context of digitalisation (Brock and Von Wangenheim, 2019).

### **3. AI and entrepreneurial heuristics**

AI supports MA by enhancing the capacity to collect and process data for the formulation of judgements and choices, thereby supporting the marketing decision-making process of human actors, potentially either by integrating with or replacing it during an automation phase. In this context, decisions that were already more data-driven in the past are the prime candidates for becoming automated decisions (Bucklin, Lehmann and Little, 1998). MA derives its rationale from certain characteristics of particular interest to business management. Specifically, MA: (1) can offer efficiency gains, managing marketing processes more effectively whilst saving time and costs; (2) can enable decisions based on models capable of providing better forecasts than those made by managers, thanks to the ability to utilise a broader database with more powerful data acquisition and processing capabilities; and (3) offers the capacity to deliver decisions in real time (Morgan et al., 2022).

As is well known, particularly—though not exclusively—in small businesses, the marketing aspect of the entrepreneurial role encompasses the formation and application of market knowledge and its contribution, for example, to the generation of innovation. In this context, the role of intuition has always been emphasised, as have heuristic decision-making models, based on the use of limited data and simple processing procedures. Whilst there is a debate, particularly within psychology, as to whether these models involve systematic errors in the form of bias or whether they can be ‘fast, frugal and smart’, all parties to the debate agree on their widespread use and adoption by human decision-makers, to the extent that some authors refer to heuristics as ‘natural’ decision-making (Klein, 1998), or identify biases in the application of judgemental heuristics as a form of cognition typical of ‘humans’ (Thaler and Sunstein, 2008).

As demonstrated by Mero et al. (2020), entrepreneurs do not always adopt AI for MA by following a rigid, causal master plan. On the contrary, they often experiment with the software using a ‘trial and error’ approach (employing the *tolerable loss* heuristic), discovering the technology’s unexpected potential as they interact with it. For example, before making a decision, those using forms of generative AI may find it acts as a sort of interlocutor to consult or from whom to obtain assistance, both in guiding them towards knowledge-based activities and in formulating draft plans to be reviewed with the appropriate expertise, subsequently adopting, integrating or correcting them.

It can be assumed that in all sectors where decisions must be based on the use of data, and where the greater the need to process large amounts of data in a short time, the greater the potential role of AI in forms of MA. When decisions cannot be based solely on data, the human decision-maker can continue to play an important role, fuelling an emerging dichotomy between more or less pronounced forms of automation in marketing processes (Van Bruggen and Wierenga, 2010).

Given the growing capacity of machines to process data, it is conceivable that all decisions intended to be data-driven over time may be supported, if not taken exclusively, by machines and AI. This raises a number of questions: what role remains for the human decision-maker? What form will human intervention in these processes take? The human decision-maker will likely be concerned, rather than with decisions based on information, with monitoring outcomes and the empirical rules to be followed, in the light of which to evaluate processes and decide when to ‘disengage’ the ‘autopilot’. To this end, our argument in this article is that the ‘heuristic decision-making process’ should take on greater significance, in particular by enhancing those decision-making modes that characterise human decision-makers and which are fundamentally defined as ‘fast thinking’ by Kahneman – that is, heuristics, considered an element capable of making

decision-makers intelligent (Gigerenzer, 2022).

Indeed, heuristics are defined here as algorithms that can be easily applied by human actors in terms of simplicity, robustness and transparency (Katsikopoulos et al., 2020). Automation is already, today, and will become even more so in the future, of such importance that it represents a key differentiating factor within marketing practice and research. This is occurring whilst other traditional differentiating factors tend to be less relevant. For example, today the same platforms (such as AdWords) are used by both consumer and business buyers, leading to a convergence of certain aspects of the purchasing process. Many companies in business-to-business markets are now also entering the consumer market via these platforms, often with their own online shop, leading to an integration of business and consumer marketing expertise. In discussing these aspects, an emerging distinction is proposed regarding the degree of ‘automation’ present in the relationships between market players, which can be very high or lower, relying on AI and big data, or on personal interaction and heuristics. These two components can be integrated in different ways, with implications for the evolution of marketing professionals.

The idea of a trade-off between automation and personal interaction – whereby a higher degree of ‘automation’ can be achieved through the use of AI and big data, or a lower degree through personal interaction and heuristics – may prove to be incomplete and misleading. These two components can be integrated in different ways, certainly giving rise to potential paradoxes but also opportunities, with significant implications for marketing practitioners. For example, our recent collaboration with a consultancy firm specialising in MA revealed the widespread adoption of forms of AI in decision-making processes, not only as a source of data but also as a source of proposals or as an ‘advisor’ to obtain opinions and elements of support or criticism regarding potential judgements and choices.

The survey also revealed that companies’ approaches to adopting AI for MA processes – and in particular for marketing decision-making – varied considerably. Alongside companies that are more culturally behind, many firms are in fact making extensive use of AI tools. In some cases, adoption may be surprisingly advanced, indicating the presence of small companies utilising various combinations of large language models (LLMs) and AI agents to carry out operations, particularly in the areas of international market analysis, training and the management of communication processes. In this context, our survey—conducted in collaboration with specialist consultants—reveals that the use of AI tends to be underreported compared to its actual usage in practice (Guercini, Milanese and Sorrentino, 2026).

These differences in approach also lead to a reconfiguration of competitive processes, which have always viewed technological evolution as a powerful driver of change. The replacement of tasks carried out by hu-

mans with automated marketing processes is taking up an increasing share of traditional marketing activities, whether in the areas of research, strategy or the marketing activities themselves (Huang and Rust, 2021). This is particularly, though not exclusively, the case in 'algorithm-based' business models, where the use of automation linked to big data and artificial intelligence is having an increasingly evident impact on marketing literature (Huang and Rust, 2021).

The relationships between stakeholders, based on processes that are potentially becoming increasingly automated and on the use of big data and automation, are leading to the adoption of similar practices that are ever more advanced and adapted to a marketing context that is potentially automatable. Indeed, on the one hand, the full potential of automation lies precisely in the management of larger volumes of data, which require a growing effort in terms of processing capacity. On the other hand, the future trend towards the commoditisation of decision-making processes based on the use of big data is linked to an increase in the value of decisions which, for the time being, are not automated. The activities that will remain the preserve of humans could retain greater added value. The competences that remain the preserve of humans also suggest that relationships will continue to be based on interaction between human actors and the use of simplified (heuristic) decision-making rules, as delegating these to machines is not considered effective. More generally, the issue of competences in the context of MA processes appears particularly important, both in terms of developing new competences and in recognising the impact of these new competences on existing ones, which in some cases may also prove significant for the future (Guercini and Lechner, 2023)

In addition to the functional level, MA also affects the decisions that the entrepreneur must make regarding the market and the market knowledge they acquire, which, as we have said, defines entrepreneurial marketing as a key aspect of the top-level management role. This type of role has traditionally relied on intuitive decision-making and gut feeling, with heuristics applied in conditions of uncertainty (Guercini, 2012), alongside networks of personal contacts (Carson, 1985). Various models of automation can therefore be identified (Guercini, 2023b). The choice of how to position one's organisation in terms of the role to be assigned to AI in decision-making processes, within a set of possible process models, is a significant choice that may affect the entrepreneurial role itself. At the same time, it is the entrepreneur themselves who uses, or may use, AI to develop their market knowledge and as a process to support their own decisions.

#### 4. Some conclusions

The argument we put forward, based on the above considerations, is that automation in marketing does not mean that entrepreneurial marketers will move beyond the use of heuristic decision-making; rather, it presents a new challenge for the adaptive toolbox, as it is managed by adapting the heuristics used and their scope of application.

A number of anecdotes from the business world highlight hypotheses and possible avenues for discussion and future research. One of these concerns the relationship between data and decisions, which appears to be reversed. Whilst traditionally we have data on which decisions are based, here a situation seems to emerge in which the use of systems requires the adoption of decisions on which the data depends – data which should then form the basis for subsequent decisions. In this decision-data-decision chain, the role of heuristics may change whilst remaining fundamental.

As we mentioned earlier, some of the literature provides evidence that entrepreneurs, when introducing AI to manage the marketing content aspect of their role, do not follow a rigid, causal master plan. On the contrary, they often experiment with the software using a ‘trial and error’ approach (employing the *tolerable loss* heuristic), discovering the technology’s unexpected potential as they interact with it. In a book published a few years ago, Gigerenzer (2022) highlighted how the widespread perception of AI tended to obscure the characteristics of human intelligence compared to algorithms, and how certain simple models of decision-making and behaviour were fundamental in relation to big data-based artificial intelligence. This offers a perspective that emphasises the role of human input in future MA processes in relation to the application of entrepreneurship.

In summary, the relationship between marketing automation and entrepreneurial decision-making represents an important area for future research for those involved in marketing and entrepreneurship. Research into the adoption of AI in MA within small businesses can make a significant contribution, no less important than the study of the technology’s potential for the future of our economic system – starting at the local level and extending to influence the economic and social landscape as a whole. In particular, the ability of small businesses to respond positively to these changes can have important implications for their competitiveness and for the quality of the economic system in which they operate.

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## RESEARCH ARTICLES

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## A MULTILEVEL PERSPECTIVE ON CORPORATE SUSTAINABILITY PARADOXES IN SMES

Elisa Carloni  
elisa.carloni@unibs.it  
University of Brescia

Martina Contardi  
martina.contardi81@gmail.com  
University of Bologna

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### Abstract

**Purpose.** The transition toward sustainability requires companies to reconcile competing demands across economic, environmental, and social domains, often giving rise to paradoxical tensions. Despite increasing attention to sustainability paradoxes, the context of small- and medium-sized enterprises (SMEs) remains underexplored. This study investigates how SMEs approach corporate sustainability paradoxes across multiple organizational levels, including individual, firm-level, inter-organizational, and systemic dimensions.

**Design/methodology/approach.** Drawing on existing theoretical and conceptual studies, this research develops a framework tailored to SMEs, focusing on the multilevel and multi-process nature of sustainability paradoxes. Empirically, the framework is applied through a single case study of an SME active in the chemical manufacturing sector.

**Findings.** Sustainability paradoxes span the individual, firm, inter-organizational, and systemic levels. Paradoxes are rarely limited to a single level or process but show characteristics of vertical and horizontal interdependence.

**Practical and Social implications.** This research offers managerial guidance for SMEs, emphasizing the role of leadership commitment and strategic vision in addressing sustainability challenges and the need for capability development through training and team building.

**Originality of the study.** The study provides a contextual adaptation of existing paradox frameworks to the underexplored SME context. Through in-depth case analysis, we reveal SME-specific patterns in how sustainability paradoxes manifest and are managed under conditions of resource constraints, informal structures, and concentrated decision-making.

## 1. Introduction

Environmental concerns, regulatory pressures, and shifting consumer expectations (Delbridge et al., 2024; Schulte and Paris, 2024) have brought corporate sustainability (CS) to the forefront of business strategy, aiming to balance economic performance with environmental and social responsibility. Pursuing CS is far from easy as firms must reconcile conflicting demands, such as short-term profitability with long-term sustainability goals, align diverse stakeholder expectations, and innovate under resource constraints (Van der Byl and Slawinski, 2015). These tensions are not just trade-offs but rather paradoxes - contradictory yet interdependent forces that coexist and require simultaneous attention (Smith and Lewis, 2011; Carmine and De Marchi, 2022).

The paradox lens has gained prominence in sustainability research aimed to explore how firms can proactively approach the tensions brought about by CS (Hahn et al., 2014; Heucher et al., 2024). While theoretical and analytical frameworks (See Hahn et al., 2015, 2018; Van der Byl and Slawinski, 2015; Alosi et al., 2023) have been put forward, empirical applications remain limited and mainly centered on large corporations, leaving the small- and medium-sized enterprise (SME) context underdeveloped (Argento et al., 2022; Heucher et al., 2024).

This gap is particularly significant given that SMEs are the backbone of the European economy, representing 99.8% of firms in the European Union and contributing substantially to employment and value creation (Schulze Brock et al., 2025). Although their individual impact might be deemed modest, collectively they contribute significantly to environmental and social consequences (Loucks et al., 2010). Also, due to their flexibility, SMEs are often viewed as more agile and potentially better positioned to pursue sustainability-related opportunities (Hockerts and Wüstenhagen, 2010). Thus, they are critical in achieving improvement in sustainable performances (Biondi et al., 2002).

SMEs differ from larger firms in terms of relationships, strategy, and integration of new practices (Discua Cruz, 2020), and they face distinct sustainability paradoxes due to their unique structural, financial, and operational characteristics (Soundararajan et al., 2018). While large corporations often have dedicated departments and structured strategies, SMEs must face these challenges with limited resources, relying on personal relationships, informal decision-making structures, and through the active management operated by owners (Discua Cruz, 2020). Furthermore, SMEs might engage informally in CS driven by the values of the founders and commit resources and time without explicitly using the CS label (Fitzgerald et al., 2010).

This study investigates how SMEs detect, make sense of, and respond to

CS paradoxes across multiple organizational levels. The research question to be addressed is the following: How do SMEs address the paradoxical tensions of CS in their decision-making and strategic responses across individual, firm-level, inter-organizational, and systemic levels?

To answer this question, we develop a literature-informed analytical framework that integrates organizational levels with paradox management processes and apply it empirically to a European chemical manufacturing SME. This approach reveals context-specific patterns in paradox emergence and management and provides evidence of cross-level dynamics that have remained largely conceptual in prior literature.

The paper is organized as follows. The next section reviews literature on the paradox theory and perspectives on corporate sustainability in SMEs. Section 3 develops the framework. Section 4 details the methodology employed in the empirical study conducted. The case study is presented in Section 5 alongside the empirical results, while their discussion follows in Section 6. The last section presents concluding remarks, theoretical and managerial implications, and limitations.

## **2. Framing the paradox theory in the context of sustainability**

CS refers to the intentional integration of environmental and social considerations into a firm's operations and relationships (Bansal, 2005). Approaches to CS in SMEs vary due to differences in size, resource availability, and managerial priorities (Hockerts and Wüstenhagen, 2010).

Engaging in CS requires firms to simultaneously balance potentially conflicting - but inherently inextricable and interdependent - environmental, social, and economic considerations (Hahn et al., 2014). These contradictions often stem from diverse stakeholders' expectations (Björklund et al., 2024) - as suppliers prioritizing cost efficiency while firms aim to reduce carbon emissions -, generating diverse and sometimes conflicting demands (Hahn, 2015).

Previous literature has framed contradictions emerging from sustainability initiatives as paradoxes, that is the recognition of tensions as interrelated and requiring simultaneous consideration (Carmine and De Marchi, 2022; Björklund et al., 2024), while creating "almost impossible choices" (Putnam et al., 2016: 75). In their seminal work, Smith and Lewis (2011: 382) approached paradoxes as "contradictory yet interrelated elements that exist simultaneously and persist over time". Three core dimensions characterize paradoxes as opposed to tensions, that is, opposition, where elements seem logical in isolation but absurd together, interdependence, and persistence over time (Carmine and De Marchi, 2023). Applying a paradox lens to CS challenges "either/or" approaches, which prioritize one

objective at the expense of others, in favor of a “both/and” orientation that enables organizations to develop innovative strategies simultaneously meeting competing objectives (Björklund et al., 2024; Heucher et al., 2024).

### 3. Framework development

We propose a framework that integrates and adapts existing theoretical perspectives on sustainability paradoxes to the SMEs context. Integration and adaptation rely on the review of constructs from multiple theoretical streams and on their adaptation to new contexts. First, we purposefully selected contributions from complementary research streams; second, we adapted these to account for SMEs-specific characteristics. In particular, we drew on three research streams based the following criteria: a) seminal theoretical contributions providing the conceptual foundation for understanding tensions and their management (Poole and Van de Ven, 1989; Smith and Lewis, 2011; Hahn et al., 2015); b) sustainability management research extending paradox thinking to the corporate sustainability domain (Hahn et al., 2014, 2015; Alosi et al., 2023); and, c) studies on SMEs and sustainability transitions, documenting the organizational characteristics that shape how tensions manifest in this context (Álvarez Jaramillo et al., 2019; Discua Cruz, 2020). From the paradox literature, we identified the recurring analytical dimensions of levels and processes as the framework structure. From the SME literature, we identified the contextual characteristics, as resource constraints, informal structures, and concentrated decision-making, that shape how paradoxes manifest differently than in large corporations.

The proposed framework (Fig. 1) integrates two dimensions: organizational scope (individual, organizational, inter-organizational, and systemic) and process (detecting, sensemaking, and responding). For the scope dimension, we observed that sustainability tensions are consistently examined at multiple levels in the literature. The individual level appears prominently in studies of managerial cognition and sensemaking (Aguinis and Glavas, 2012; Hahn et al., 2014). The firm level is central to most organizational sustainability research (Hahn et al., 2015; Joseph et al., 2020). The inter-organizational level has been explicitly called for as underexplored (Carmine and De Marchi, 2023) and is addressed in supply chain and stakeholder studies (Björklund et al., 2024). The systemic level captures institutional and regulatory pressures emphasized in sustainability transitions research (Delbridge et al., 2024). These four levels represent the primary areas where sustainability paradoxes have been theorized and observed, while also mapping onto the nested structure of SME decision-making.

For the process dimension, we drew on Smith and Lewis (2011), who identify recognition and response as core processes in paradox management, and on Hahn et al.'s (2015) integrative framework, which emphasizes sensemaking as mediating between tension identification and strategic response. The three processes represent the temporal sequence through which organizations engage with paradoxes, from initial awareness through interpretation to action.

The framework provides a lens to investigate sustainability paradoxes in SMEs, where informal structures and routines, resource constraints, and the role of individual decision-makers necessitate adapting existing paradox frameworks. Paradox theory, developed primarily in large firm contexts (Lüscher and Lewis, 2008; Jarzabkowski et al., 2013), has inherent limitations when applied to SMEs. The theory assumes formal organizational processes for paradox recognition, deliberate management strategies requiring dedicated resources and specialized expertise, and distinct organizational processes for detection, sensemaking, and responding. These assumptions may not hold in resource-constrained SMEs where paradoxes operate through implicit, tacit, and relationally embedded processes, and where detection, sensemaking, and responding are often conflated within individual decision-makers due to concentrated authority. The proposed framework addresses these limitations by focusing on how paradoxes emerge and are managed through tacit, experiential, and relationally embedded processes rather than formal analytical frameworks.

### *3.1 The organizational/scope dimension*

The organizational dimension of the framework identifies the different levels at which paradoxes manifest and interact in the context of SMEs: individual, firm, inter-organizational, and systemic.

At the individual level, paradoxes relate to how managers and employees experience and act upon sustainability challenges. In SMEs, decisions about sustainability often rest with individuals - particularly founders or CEOs (Van Gils, 2005; Lee and Klassen, 2008) - who shape strategic direction based on personal values, aspirations, and perception of their role (Aguinis and Glavas, 2012; Dahlmann and Grosvold, 2017). Individual-level paradoxes may arise from conflicting motivations, cognitive frames, or tensions between personal ethics and organizational demands (Hahn et al., 2024), with influence amplified in SMEs due to flatter hierarchies and concentrated decision-making authority.

The firm-level involves internal organizational processes, resource allocation, and teamwork. SMEs often experience paradoxical tensions between advancing environmental and social practices and maintaining op-

erational efficiency (Joseph et al., 2020) or between ensuring product quality and using recycled/recovered raw material (Daddi et al., 2019; Shu, 2022). Organizational culture, leadership, coordination, internal decision-making processes, and formal power are key in managing paradoxes at this level (Hunoldt et al., 2020), highlighting the role of the human resource department and manager in CS paradoxes (Poon and Law, 2022).

The inter-organizational level captures paradoxes emerging from relationships with suppliers, customers, and partners. Sustainability transcends the boundaries of individual organizations and requires collaborative approaches (Inigo et al., 2020). Thus, relations with stakeholders at an inter-organizational level are considered, responding to the call of Carmine and De Marchi (2023), who underlined how this level of analysis has so far been little explored.

The systemic level focuses on the contribution of firms' CS to society, highlighting how firms are influenced by sustainability challenges and contribute to them (Hahn et al., 2015). This allows examination of how SMEs interact with and adapt to external systems. For example, SMEs' compliance with stringent environmental regulations might prompt innovation but also constrain financial resources.

The interconnectedness among levels is recognized and accounted for (Bengtsson and Raza-Ullah, 2025): individual decisions made by SME leaders can cascade, influencing firm-level strategies, shaping inter-organizational relationships, and ultimately contributing to systemic sustainability outcomes. Similarly, systemic pressures, such as new environmental regulations, can drive changes at the inter-organizational level and prompt firm-level adaptations, which are operated by individual actors.

### *3.2 The process dimension*

The process dimension describes how SMEs engage with CS paradoxes, focusing on how they detect, make sense, and respond to them (Hahn et al., 2014; Carmine and De Marchi, 2023).

Detecting involves the scanning and recognition of paradoxical tensions across environmental, social, and economic goals. This process sets the groundwork for how the organization will respond through mechanisms such as operational decisions, strategic planning processes, and interactions with stakeholders. SMEs' capabilities to detect paradoxes are influenced by the entrepreneur's personal awareness, by their possibly limited scanning capabilities, and absence of formal assessment tools, leading to a detection through intuitive and *ad hoc* means, such as personal relationships.

Sensemaking involves interpreting and understanding the identified paradoxes. Paradoxes can be framed as performing, belonging, learning, and organizing (Lüscher and Lewis, 2008; Björklund et al., 2024). Performing paradoxes stem from contradictory stakeholder demands that push organizations to pursue competing goals and strategies. Belonging paradoxes emerge from identity-based tensions and relational dynamics. Learning paradoxes reflect the challenge of leveraging existing knowledge while also updating it and developing specialized sustainability-related knowledge to be able to innovate and adapt to new ideas. Organizing paradoxes focus on structural and process-related issues - balancing collaboration with competition, centralization with decentralization - and requiring firms to adapt structures and existing processes to manage sustainability paradoxes while ensuring full operational efficiency (Björklund et al., 2024). In SMEs, systematic sensemaking and paradox categorization are potentially limited as decisions are often made informally and rely on personal experience rather than structured reporting framework and processes. This means paradoxes may remain implicitly experienced through behavioral patterns and operational frictions rather than explicitly recognized and formally addressed.

Responding involves strategies ranging from acceptance (opposition) or resolution (separation and synthesis) (Poole and Van de Ven, 1989; Smith and Lewis, 2011). Acceptance is chosen when the company cannot take action to resolve tensions or considers it too risky, and means acknowledging paradoxes as persistent and non-resolvable (Smith and Lewis, 2011). Resolution strategies, in contrast, aim to transform the paradox into a manageable situation (Hahn et al., 2015). Separation can refer to space and/or time (Siegner et al., 2018). Structural or spatial separation refers to the allocation of social and commercial responsibilities to distinct organizational units, while time separation is often used at the managerial level to solve the incompatibility between financial and social goals by placing them at different points in time, for instance, by differentiating between short-term and long-term objectives. Finally, synthesis occurs when paradoxical tensions are addressed, trying to generate synergies between them (Siegner et al., 2018). We advance that SMEs, due to their resource constraints, may favor adaptive strategies that blend elements of opposition and resolution, rather than pursuing large-scale structural changes (González-González et al., 2019).

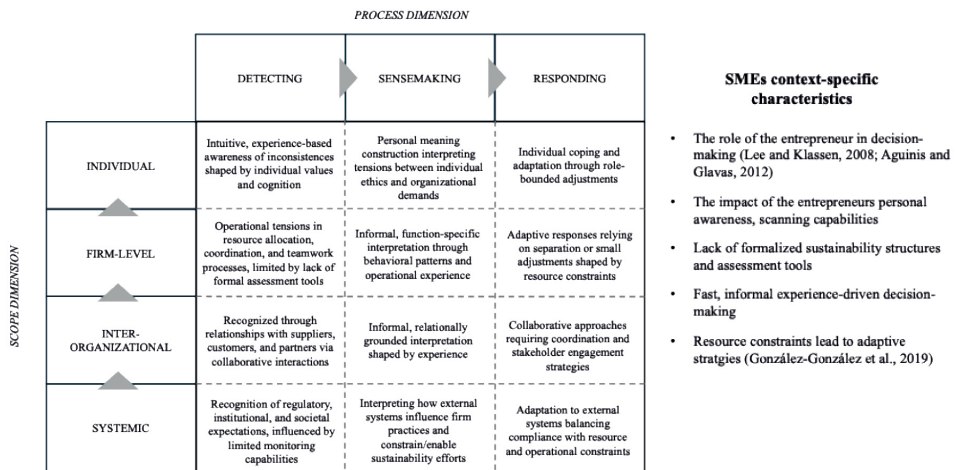
Processes are explored individually, but interconnectedness is also recognized and accounted for as tensions also co-evolve through the interaction among processes (Jarzabkowski et al., 2013): detecting paradoxes triggers sensemaking efforts, while responding feeds back into renewed detection as conditions change.

While detecting, sensemaking, and responding occur across all levels

and serve analogous functions, their manifestations differ in form and mechanisms. At the individual level, detection arises from experiential awareness of inconsistencies in day-to-day work, whereas at the organizational and systemic levels, it reflects more formalized monitoring of sustainability standards and stakeholder feedback. Similarly, sensemaking shifts from personal meaning construction to collective framing processes involving multiple actors, and responses evolve from individual coping practices to organizational routines and systemic coordination. Thus, the processes maintain functional similarity across levels but differ in their mechanisms and degree of formalization (Jarzabkowski et al., 2013; Hahn et al., 2015). The framework holds analytical value as it allows examining how the same process operates differently across levels.

Furthermore, SMEs' characteristics might create important boundary conditions for paradox theory developed primarily in large firm contexts. In resource-constrained SMEs, paradoxes more often remain implicit, experienced through behavioral friction and operational tensions rather than formally acknowledged. Paradox engagement thus relies on experiential judgment and informal coordination, meaning that detection, sensemaking, and responding are frequently conflated within individual decision-makers rather than unfolding as distinct organizational processes.

Fig.1. The resulting framework.



Source: Authors' own elaboration. The grey triangular arrows represent interconnections among levels and processes.

## 4. Methodology

### 4.1 *Research design and case study selection*

This study adopts a qualitative methodology (Maxwell, 2008) based on a single case study. The framework developed in Section 3 provides the multi-level analytical structure to examine how paradoxes manifest and are managed across organizational levels, while the case study methodology enables the application of the framework and an examination of these dynamics within the SME context.

The empirical setting under investigation is that of *Alfa* (anonymized to ensure confidentiality), a European chemical manufacturer. The case selection strategy followed theoretical sampling principles (Eisenhardt and Graebner, 2007), guided by three main criteria: (1) qualifying as an SME; (2) efforts towards transitioning to a structured CS approach; (3) operating in an industry characterized by inherent sustainability tensions. The suitability of *Alfa* is due, first, to its transitional state, exhibiting both informal, sustainability practices embedded since its foundation and recent formal structuring through its CSR Roadmap, making paradoxes visible across organizational levels. Second, *Alfa* operates in an industry characterized by tensions between environmental impact and product performance requirements, making paradoxical interactions observable in concrete operational decisions. Third, the firm is large enough to experience organizational complexity yet small enough to retain the concentrated decision-making, resource constraints, and informal structures typical of SMEs. This size makes vertical interactions between levels particularly traceable. Fourth, its long-term supplier partnerships and customer relationships provide access to inter-organizational paradoxes.

### 4.2 *Data collection*

Data were collected through semi-structured interviews, participant observation, a questionnaire, and document analysis (Piekkari et al., 2010). Five interviews were conducted in Autumn-Winter 2024 with purposefully selected informants within the company. Informant selection was guided by a criterion of informational relevance, prioritizing individuals who, due to their organizational position and level of involvement in CSR-related initiatives, were able to provide meaningful empirical insights into the process of integrating CSR into daily work activities. A preliminary meeting with the CSR manager served as the entry point for this selection process. Drawing on his cross-functional oversight of CSR initiatives, he identified and mapped relevant organizational functions based on three criteria:

(1) direct involvement in sustainability-related decisions or initiatives; (2) functional diversity to capture different organizational perspectives (purchasing, HR, innovation); and (3) varying tenure to include both long-term institutional memory and newer perspectives on recent formalization efforts. The resulting sample includes five interviews spanning critical functions: innovation/CSR management, purchasing (2 informants with 30+ and 20+ years tenure respectively), and HR (2 informants with <5 and 15+ years tenure). This mapping also revealed that other departments, such as Quality Control and Sales, were at an early stage of engagement and had not yet been operationally involved, as their participation was planned through future CSR training activities.

Each interview contained open questions covering perceptions of CS, organizational structure and responsibilities, leadership engagement, employee participation, barriers and challenges, interdepartmental coordination, and perceived progress.

To mitigate recall bias in retrospective accounts of events over the previous decade and following Huber and Power (1985), respondents were selected based on tenure and functional diversity to ensure informed recollection. Interviews were designed to elicit detailed, time-specific accounts and were occasionally conducted in pairs to enable collective recall.

The second data source is active participant observation, conducted by one of the authors for two months in Autumn 2024. Observation was casual in nature, without a formal protocol (Yin, 2009) and occurred through direct contact with the CSR manager and participation in the company's activities, meetings with external consultants, internal operational and strategic meetings, and informal interaction. Field notes documented practical and strategic decisions related to *Alfa's* sustainability transition and were shared with co-authors and triangulated with interviews and documents.

Third, a survey was distributed to 87 employees across all organizational functions, yielding 37 complete responses via Google Forms (43% response rate). To ensure confidentiality, no demographic or departmental data were collected, precluding analysis of potential non-response patterns across functions. While the response rate may introduce non-response bias, this was mitigated through triangulation with interview and document data, using the survey primarily to identify broad patterns. Convergence between questionnaire trends (e.g., uneven perceptions of sustainability integration) and interview accounts supports the credibility of interpretations.

The questionnaire consisted of 15 items covering: (1) employees' perceptions of sustainability and its relevance for SMEs; (2) the strategic priority and cultural importance of sustainability within the company; (3) perceived drivers and barriers to adopting sustainability practices; (4) the integration of sustainability into daily work; (5) the importance assigned

to key sustainability areas (e.g., environmental practices, diversity and inclusion, health and safety, work–life balance, communication); (6) the evaluation of existing sustainability initiatives; and (7) the perceived role of employees as contributors to sustainability efforts. Two brief introductory sections recalled key sustainability concepts to ensure meaningful engagement from respondents with limited prior familiarity.

Likert-scale responses were analyzed descriptively (frequencies and means) to identify general trends in CSR awareness, perceived leadership engagement, and the integration of sustainability into daily work practices. Open-ended responses were thematically coded following the same procedure used for interviews, ensuring analytical consistency across data sources.

The questionnaire data were then integrated into the analysis through triangulation: survey tendencies were compared with interview and document evidence to corroborate or contrast emerging themes. For instance, the questionnaire confirmed the uneven perception of sustainability as part of employees' responsibilities and reinforced interview findings regarding limited leadership communication and involvement in CSR. The questionnaire was instrumental in gaining access to the "individual" level of the theoretical framework, capturing the perspective of employees.

Document analysis was conducted using corporate documents (e.g., the CSR roadmap, internal presentations, code of conduct), the company's website, and sustainability reports. These sources served as secondary data sources to verify and contextualize information obtained through interviews, questionnaire, and observation. For example, the website was used to retrieve information about the history of *Alfa* and information concerning the effort of the company on sustainability issues. The code of conduct was used to understand inter-organizational paradoxes emerging when negotiating with suppliers. Document analysis served as a source of factual information and as a means to contextualize data obtained through interviews.

### 4.3 Data analysis

Data analysis followed an iterative coding technique, involving triangulation of primary and secondary data (Patton, 1999; Jonsen and Jehn, 2009). The coding process was conducted manually by both authors using a shared digital workspace. The analysis followed three stages:

1. Open coding: we identified initial concepts related to sustainability paradoxes, generating first-order codes grounded in empirical data. For example, the quote "there is also some resistance from employees and managers towards change and new practices" was coded as behavioral resistance to sustainability integration.

2. Axial coding: we grouped empirical examples into broader thematic categories, creating second-order codes that bridge empirical observations with theoretical concepts. For instance, codes about behavioral resistance, capability gaps, and resource constraints were grouped into the thematic category “detecting internal barriers to sustainability at the individual level”.
3. Selective coding: we refined the second-order themes into higher-order analytical dimensions aligned with the framework. The thematic category above contributed to identifying the paradox of change vs. continuity.

First-order codes were independently identified and then jointly reviewed to ensure no relevant concepts were overlooked. Second-order codes were developed through iterative discussion, with both authors comparing interpretations and refining thematic categories until consensus was reached. The coding structure underwent multiple revisions as we iteratively refined the alignment between emergent themes and our analytical framework. Tensions were first inductively identified from respondents’ descriptions of conflict or ambiguity. In a subsequent analytical phase, these empirically grounded tensions were compared with established paradox typologies (i.e., Björklund et al., 2024) to assess theoretical alignment. The coding structure is provided in Appendix A.

## 5. Empirical results and analysis

### 5.1 *Corporate sustainability in Alfa*

*Alfa* is a medium-sized manufacturing enterprise founded as a family-owned business, active in chemical manufacturing. Its CS trajectory combines long-standing informal practices with recent formalization efforts. Long-tenured purchasing employees emphasized that principles aligned with CS - such as preferring local suppliers and cultivating long-term partnerships - have characterized *Alfa* since its foundation. In contrast, HR respondents indicated that more explicit sustainability structuring has emerged only recently, largely in response to customer expectations.

*Alfa*’s first formal recognition of sustainability commitments occurred in the early 2000s through the achievement of triple certification (ISO 9001, ISO 14001, ISO 45001). This commitment intensified with the development of the “CSR Roadmap 2023–2028”, developed with an external consulting firm. Implementation is distributed across functions: the purchasing department revised supplier selection criteria through a CSR questionnaire, and HR launched initiatives to strengthen work quality and employee engagement.

Internal and external factors drive *Alfa*'s CS trajectory. Internally, employees (30 respondents) cite regulatory compliance as a major driver, but also highlight the strategic relevance of sustainability. The explicit link between CS and innovation - reinforced by the CSR manager overseeing both sustainability and innovation projects, also represents a CS driver. Externally, rising customer demand for sustainable products and evolving market standards and regulations have promoted the company's CS.

Barriers to CS are also evident. Internally, limited human resources, technical skills, and awareness constrain CS. As noted by the purchasing manager. We need training. It is not at all easy to integrate all this into daily activities. Priorities have to be set". Surprisingly, financial constraints were not identified as a direct obstacle to CS; instead, HR respondents emphasized insufficient leadership involvement as a bigger obstacle, as "we can implement initiatives without necessarily having a large budget".

Externally, market demand - while being an important driver - also represents an obstacle, as customers show resistance to sustainability-oriented offerings or a lack of knowledge on the topic. Regulatory pressure, particularly the Corporate Sustainability Reporting Directive (CSRD), simultaneously supports and constrains *Alfa*'s CS. While legitimizing and driving CS efforts, it is rigid, generic, and lacks transparency around non-compliance penalties.

## *5.2 Detecting, sensemaking, and responding to sustainability paradoxes*

Our analysis reveals how sustainability paradoxes manifest and are managed across organizational levels, following the three processes of detecting sustainability paradoxes, sensemaking through characterizing paradox types, and responding by implementing management strategies.

### *5.2.1 The detecting of paradoxes*

At the individual level, a *paradox of change vs. continuity* emerges from tensions between employees' traditional roles and sustainability requirements, with three characterizing dimensions. First, behavioral resistance to change or low motivation, as "People who have been here a long time and are used to doing things as they have always done" (Interview with HR). At the same time, 90% of the respondents to the questionnaire agree that employees can drive change, but half also believe that this requires additional resources. Despite this prevailing continuity orientation, a few respondents, especially newer employees, expressed curiosity and willingness to engage more actively with CS, indicating signals of an emerging change orientation. Second, a capability-intention gap emerged: although

employees recognize the importance of CS, they struggle to translate it into action. Engagement tended to occur only when CS aligned with existing tasks. Third, a resource dimension of this paradox is visible in the multidisciplinary team created for the roadmap implementation. The team comprises members from departments considered crucial for the implementation and management of CS initiatives (i.e., marketing, human resources, purchasing, and sales). While strategically important, its effectiveness appears to be limited by members' existing responsibilities, and it is seen as an acceptable temporary solution by the purchasing team, whereas the HR team believes that, if properly coordinated and monitored, this solution could prove effective, as it would guarantee broader and shared involvement, avoiding exclusive management by a single department.

At the firm level, a *paradox of integration vs. fragmentation* emerges. Although the multidisciplinary CS team signals an integration-oriented approach, the absence of a dedicated CS department complicates responsibility allocation and accountability. An HR respondent notes, "We each work in our own area, and we don't always formalize things. We need regular CSR coordination". Participants described siloed practices and weak cross-departmental coordination; yet, some respondents reported localized initiatives such as training and supplier assessment procedures that partially bridge these divides.

At the inter-organizational level, we identify a paradox between the search for suppliers committed to CS and the time and effort required to assess them - labeled as *paradox of responsible partnership vs. efficiency*. The introduction of stricter CSR criteria and a CSR-focused section in the pre-negotiation questionnaire lengthened supplier evaluation and reduced procurement agility. Moreover, larger suppliers were generally more prepared to meet CSR requirements, whereas smaller suppliers often lacked familiarity with reporting frameworks, making uniform standards difficult to apply across the network.

This paradox is particularly salient in supplier relations, with a purchasing manager noting that "being demanding from this perspective reduces the number of suppliers that can be selected", affecting commercial conditions. Smaller suppliers often struggle with CSR reporting, while larger partners leverage compliance strategically to negotiate commercial advantages. As the purchasing manager explained, "We tell suppliers it takes us long to approve them, but once they are approved, we remain loyal to them". This reflects a paradox between procedural rigor and relational continuity: the company seeks to standardize assessment through supplier questionnaires and audits, yet depends on long-term trust-based relationships to sustain its operations. Thus, inter-organizational paradoxes materialize not only through compliance processes but also through everyday procurement interactions.

At the systemic level, we observe the *paradox of environmental and social responsibility vs. market competitiveness* arising from the conflict between product performance, environmental standards, and price sensitivity. This is evident in the attempt to develop and launch more sustainable alternatives: “We tried launching more sustainable products, like water-based products, [...] But the issue is that the water-based formulation hasn’t been as effective. When it rained, the product ran” (Informant from the purchasing team). This highlights a product-performance gap between sustainable and traditional formulations, particularly in contexts, where high humidity conditions revealed the limitations of the eco-friendlier version. This is further exacerbated by *Alfa* operating in a business “Where we sell consumables, not high-value-added products. You use the thing and then discard it. This means it’s difficult to set high prices on products, even if they are more environmentally friendly” (Informant from the purchasing team). Despite initial struggles, the product was later adapted to a less demanding sector (construction) and remains in the portfolio with gradually improving sales.

### 5.2.2 Sensemaking processes: characterizing paradox types

Our analysis highlights how SMEs interpret sustainability-related tensions by identifying distinct paradox types and characterizing them across organizational levels.

Sensemaking is predominantly observed at the firm-level, where the lack of coordination and leadership in implementing CS emerges as a key challenge. In the sensemaking process, the paradoxical tension already identified between integration and independence, where employees are expected to engage in sustainability initiatives within their respective areas but without formalized guidance or accountability mechanisms, is framed and understood by individuals within the organization. As the sustainability manager described, “In CSR, a demand comes from the board to change something, to achieve some goals; then there should be a phase in which a plan is drawn up to activate the CSR plan. There is a kind of disconnection between the two, which brings out conflicts and tensions”. Employees expressed frustration, which diminished the perceived importance of CS in their daily work. One employee commented, “We need someone who can drive the change and push things forward. Right now, we’re making decisions at our level only”. Others emphasized leadership’s responsibility: “If it is not yet truly concrete at the management level, why should it be concrete for us?”. Thus, the role of leadership emerges as key in shaping how sustainability paradoxes are perceived and managed. In *Alfa*’s case, the absence of strong, coordinated leadership has led to a fragmented approach where

employees operate within their departments, without a “grand picture”.

Following Björklund et al. (2024), belonging paradoxes appear in tensions between the CSR manager’s individual identity and organizational structure, leading to a *paradox of formal responsibility vs. real authority*. The CSR manager experiences frustration with the lack of formal recognition of the role, which is neither included in the organization chart nor formalized in a specific department. He describes feeling “floating on air” and perceives CSRD compliance as his only legitimately recognized role. While tasked with coordinating CS-related initiatives, limited support reinforces a compliance-oriented approach. At the same time, some employees noted growing managerial attention to sustainability communication, suggesting leadership engagement may be evolving unevenly across functions.

Organizing paradoxes appear in two forms at the firm level. First, leadership-related issues and unclear guidance generate a *paradox of strategic intent vs. operational reality* with a disconnect between high-level sustainability ideals and ground-level implementation. A second organizing paradox concerns *external vs. internal communication asymmetry*. A recurring element that emerged from the interviews is the lack of internal communication on CS. While recognizing that the company has launched numerous initiatives in the field of sustainability, the interviewees from the purchasing team point out that these have never been formalized nor adequately communicated internally, preventing the creation of value within the organization and raising awareness among members. Meanwhile, external communication has shifted from a low-profile approach to a more assertive sustainability-oriented stance.

The need to develop CS-related capabilities highlights a learning paradox between the immediate demand for sustainability-related expertise and the time and effort required to build it, which we label the *paradox of capability urgency vs. capability development*. This is evident in the multidisciplinary team that was created to drive CS initiatives, but without providing members with specialized training, and in the expectation placed on the commercial team to integrate sustainability into business practices without adequate training or skills development. This learning paradox reflects a resource misallocation, with leadership recognizing the values of CS and promoting its adoption, yet hesitating to invest in training, leading to a cycle where the lack of human resources with technical skills hinders the adoption of CS practice, knowledge and skills leads to a superficial implementation, which in turn reinforces the perception of CS being a mere compliance activity.

### 5.2.3 Responding to paradoxes

*Alfa* adopts mainly defensive strategies for managing sustainability paradoxes. Paradoxes are detected but not addressed, aligning with the notion of opposition. For example, external communication of sustainability initiatives indicates commitment without fully addressing structural issues. Similarly, CSRD compliance reflects attention to regulatory requirements rather than substantive integration of sustainability into business practices.

Data also shows instances of synthesis and separation. The lack of a dedicated CSR department reflects structural separation, with sustainability-related responsibilities spread across different teams. The marketing department implements a synthesis strategy, addressing the tension between sustainability and competitiveness by introducing additional sustainable product offerings together with traditional ones.

Externally, *Alfa* takes a more proactive stance by fostering collaborative relationships with suppliers and working together with other companies to create value and stimulate innovation. A purchasing team member noted: “Our relationships with suppliers are usually long-term and based on a real partnership. It takes a while to approve a relationship, but once it’s done, we keep being loyal to them and exchange with them on future projects and developments”. This suggests that while *Alfa* defaults to defensive responses internally, it recognizes the potential for synergies in its external partnerships.

Table 1 summarizes the paradoxes identified across levels of analysis and the main ways in which they were managed within *Alfa*.

Table 1. Overview of paradoxes, processes, and responses in Alfa

| Paradox                                                                      | Empirical evidence                                                                                                                                            | Level                | Process                | Response                                        |
|------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------------|-------------------------------------------------|
| <i>Change vs. continuity</i>                                                 | Employees recognize sustainability relevance but experience continuity of short-term pressures; sustainability enacted “when convenient”                      | Individual           | Detecting              | Opposition / Acceptance                         |
| <i>Integration vs. fragmentation</i>                                         | No central CSR structure; sustainability dispersed unevenly across HR, quality and CSR manager; lack of coordination.                                         | Firm-level           | Detecting, sensemaking | Structural separation                           |
| <i>Responsible partnership vs. efficiency</i>                                | CSR criteria slow down procurement; supplier assessment questionnaire increases workload; tension between speed and responsibility.                           | Inter-organizational | Detecting              | Externally: synthesis<br>Internally: opposition |
| <i>Environmental and social responsibility vs. marketing competitiveness</i> | EU regulatory requirements increase expectations; customers remain highly price sensitive, with limited willingness to pay for sustainability.                | Systemic             | Detecting              | Synthesis                                       |
| <i>Formal responsibility vs. real authority</i>                              | CSR manager is formally responsible for sustainability but lacks decision-making power, resources, and organizational support; experiences “floating on air.” | Individual           | Sensemaking            | Opposition / Acceptance                         |
| <i>Strategic intent vs. operational reality</i>                              | Leadership signals sustainability, but teams face operational constraints and resource shortages                                                              | Firm-level           | Sensemaking            | Opposition / Acceptance                         |
| <i>External vs. internal communication asymmetry</i>                         | Work done on external communication contrasted with limited internal alignment and practices                                                                  | Firm-level           | Sensemaking            | Opposition / Acceptance                         |
| <i>Capability urgency vs. capability development</i>                         | Immediate need for sustainability expertise vs. absence of training; multidisciplinary team without preparation                                               | Firm-level           | Sensemaking            | Opposition / Acceptance                         |

## 6. Discussions

Our study shows that sustainability-related paradoxes are rarely limited to a single level or process, but display interdependencies (Hahn et al., 2014, 2015; Putnam et al., 2016). The analysis reveals how paradoxes cascade and evolve through cross-level and cross-process dynamics. Cross-dimensional dynamics can take two different forms: vertical and horizontal.

Vertical interactions span organizational levels, where the paradoxical tensions identified at one level can influence other levels (Jarzabkowski et al., 2013; Bengtsson and Raza-Ullah, 2025). For example, the *paradox of integration vs. fragmentation* at the firm level creates a downward cascading effect that shapes individual-level experiences of sustainability. The absence of a dedicated CSR department results in fragmented individual accountability, leaving individuals to deal with sustainability responsibilities without formal guidance or support. As a result, individual actors experience frustration and disengagement and tend to act on CS upon convenience.

Horizontal interactions occur across detecting, sensemaking, and responding processes, yet we observe misalignment between detection and response: although *Alfa* recognizes systemic-level paradoxes – such as sustainability standards vs. market pressures – its responses remain defensive and compliance-driven, rather than aimed at exploring more innovative solutions. This misalignment points to incomplete paradox management cycles or to a paradox recognition trap. In resource-constrained settings, paradoxes are experienced through operational friction and recognized, but a lack of formal sensemaking structures impedes translation into action (Lüscher and Lewis, 2008). This suggests that organizational context might determine if detection can convert into response capability.

To unpack how these interconnections operate, we identify three mechanisms through which paradoxes cascade and evolve. These mechanisms emerged inductively from our data and resonate with established insights from paradox and sensemaking research (Smith and Lewis, 2011; Jarzabkowski et al., 2013; Hahn et al., 2015).

1. *Translation through sensemaking* connects individual and collective interpretations, shaping how tensions detected at one level are re-framed and acted upon in another. Individual-level capability gaps create firm-level coordination challenges when formal sensemaking structures are absent as reflected in the CSR manager's attempts to reinterpret sustainability ambiguities and make them operational despite lacking formal authority.
2. *Leadership framing and resource signaling* exert top-down influence across both levels and processes. Symbolic leadership commitment without resource allocation intensifies firm-level fragmentation and

amplifies paradoxes across levels. Firm-level resource allocation decisions amplify inter-organizational paradoxes by constraining the capacity to meet supplier CSR requirements while maintaining operational flexibility, particularly when leadership communicates sustainability as priority but provides minimal tangible resources.

3. *Informal relational diffusion* allows paradoxes to circulate laterally and vertically through everyday interactions, transmitting interpretations and routines that can either reproduce or modify existing tensions. Systemic regulatory pressures create divergent individual-level interpretations when concentrated decision-making lacks formal communication channels. When CSRD requirements are filtered through few actors (board, CSR manager) without formal communication mechanisms, divergent understandings emerge across the organization, as seen in employees' varying interpretations of sustainability responsibilities, which reproduce rather than resolve paradoxical tensions.

Second, the analysis highlights the role of leadership in shaping how paradoxes are interpreted and managed. In SMEs, limited formal structures make leadership engagement key to shifting from reactive adjustments to more proactive strategies. In *Alfa*, the lack of clear strategic coordination and top-level involvement resulted in fragmented actions, reflected in employees' calls for someone "to drive the change and push things forward", pointing to a leadership void that amplifies organizational inertia. Furthermore, the belonging paradox in *Alfa* centers on the CSR manager's struggle to sustain legitimacy and identity within a structure that formally tasks him with coordinating sustainability but offers little actual authority or support. His description of feeling "floating on air", with sustainability reduced to CSRD compliance, reflects more than role ambiguity or resource constraints and illustrates what Carollo and Guerci (2018) term as identity work, that is, the ongoing process of preserving meaning and legitimacy while navigating competing institutional logics; here, the normative expectations of sustainability and the pragmatic logic of efficiency and compliance.

Three features of the CSR manager's experience mark this as identity work rather than simply a structural problem. First, a tension between personal commitment and organizational recognition: he expresses genuine engagement with sustainability values while perceiving that the organization values only compliance outputs. Second, his "floating on air" metaphor represents an active meaning-making attempt to articulate and make sense of his liminal position. Third, there is boundary negotiation between the normative logic of sustainability and the pragmatic logic that governs organizational priorities. In SME contexts, where decision-making authority is concentrated, such individual identity conflicts can cascade into organizational

gridlock and paradox amplification (Spence and Rutherford, 2001).

Third, the analysis shows that SMEs' structural and relational conditions-formal sustainability departments, structured reporting mechanisms, and dedicated resources (Bos-Brouwers, 2010; Soundararajan et al., 2018) - make paradoxes more visible in everyday operations, as employees and managers must reconcile long-term sustainability goals with short-term operational demands in real time. Yet these conditions can enable flexibility and relational coordination. Cross-functional collaboration, though informal and limited in scope, proved crucial in establishing early sustainability initiatives and responding to emerging customer demands.

These conditions explain why *Alfa's* approach mainly reflects defensive strategies, oriented towards preserving the status quo and minimizing reputational or regulatory risks. This short-term approach, or temporal myopia (Daddi et al., 2019), prioritizes immediate conflict mitigation while dismissing long-term sustainability implications.

The predominance of defensive responses in *Alfa* reflects not only resource constraints but also limited organizational reflexivity. When paradoxes remain implicit, as with the *change vs. continuity paradox*, collective sensemaking is inhibited, making proactive management difficult. This holds implications for innovation. The predominance of short-term, risk-averse responses limits experimentation and the development of innovative solutions to sustainability challenges. Yet paradoxes can also serve as a potential source of innovation when organizations engage them proactively. In *Alfa*, innovation projects often emerged indirectly from sustainability pressures, for example, reformulating products or improving process efficiency, rather than from a deliberate innovation strategy. This suggests that sustainability paradoxes can both hinder and stimulate innovation, depending on whether they are managed defensively or integratively, in line with prior research on paradoxical tensions as drivers of creative adaptation (Hahn et al., 2015; Bechtel et al., 2025).

## 6. Conclusions

This study, through the case of *Alfa*, examined how SMEs detect, make sense of, and respond to CS paradoxes across multiple organizational levels.

Two contributions are put forward. First, by adapting and applying a multilevel framework tailored to SMEs, this study addresses calls for contextual adaptation of paradox frameworks (Soundararajan et al., 2018; Carmine and De Marchi, 2023) and provides empirical evidence of how established paradox constructs manifest under SME-specific characteristics, thus validating existing theory in a new organizational context. Second, it identifies how sustainability paradoxes cascade across organizational

levels through three mechanisms: *translation through sensemaking*, *leadership framing and resource signaling*, and *informal relational diffusion*. By examining these mechanisms in the SMEs context, the study shows how organizational structure shapes not just whether paradoxes are managed, but how they propagate vertically and horizontally through the organization, thus consolidating current understanding of cross-level dynamics in settings characterized by resource constraints and informality.

From a managerial perspective, the study points to the importance of leadership commitment and strategic vision as drivers of CS to foster a culture of accountability among middle managers and employees (Madrid-Guijarro and Duréndez, 2024). Yet, it also suggests that leadership commitment as symbolic support alone is insufficient if not translated into feasible expectations, resource allocation, and practical routines and communication channels (Aragón-Correa et al., 2008). Managers should therefore remain actively involved in the process of sensemaking and management by creating spaces such as team reviews, project debriefs, or informal forums, where conflicting pressures can be discussed openly, allowing shared understanding and coordinated responses to emerge. Second, the analysis highlights the importance of capability development (Del Brío and Junquera, 2003; Johnson and Schaltegger, 2016), calling for the development of training programs providing technical knowledge and raising awareness of the strategic value of CS. In SMEs such as *Alfa*, where formal programs are limited, capability building often occurs through day-to-day problem solving and collaboration across functions. To leverage informal learning while providing structure, managers could establish peer-learning sessions to share sustainability challenges, consolidating the dispersed knowledge that typically develops through experience and collective practice, or partner with industry associations to access SME-tailored training modules.

From a policy perspective, our findings suggest that existing regulatory frameworks, such as the CSRD, can generate tensions for SMEs by applying uniform standards to structurally heterogeneous firms. More flexible and proportionate reporting requirements, such as tiered frameworks with simplified metrics for smaller firms or phased implementation timelines would better reflect SMEs' resource realities. Evidence also highlights limited sustainability capabilities and leadership commitment within SMEs (Aragón-Correa et al., 2008) that targeted public programs could help address through subsidized access to industry-specific sustainability toolkits, access to peer-learning networks, or technical assistance programs that help SMEs translate regulatory requirements into operational practices. Finally, since inter-organizational relationships emerged as key enablers of sustainability advancement (Inigo et al., 2020), policy instruments that foster collaboration among SMEs and with larger firms, for example, through network-based funding, supplier development grants, or sector-specific

sustainability consortia, which could strengthen the systemic conditions for sustainability transitions while addressing the supplier paradoxes we identified.

This study also entails some limitations that suggest directions for future research. First, the empirical validation of the framework relies on a single case of a European SME active in chemical manufacturing. Sectoral and regulatory specificities may shape the intensity and visibility of paradoxes and present unique features that limit the practical transferability of some findings to highly regulated sectors. The sector is characterized by stringent environmental regulations and complex technical requirements that generate paradoxes potentially less prevalent in service-based or less regulated industries. Also, the geographical scope presents contextual boundaries. The European regulatory and institutional environment shapes how sustainability paradoxes emerge and are managed in ways that may differ in other regions.

While the single-case design limits statistical generalization, the findings offer analytical generalization relevant to SMEs sharing similar structural and contextual characteristics. Specifically, the framework and mechanisms identified are applicable to manufacturing SMEs transitioning toward formalized sustainability practices, operating in industries with inherent environmental tensions, and characterized by concentrated ownership and informal decision-making structures. The paradox of *integration vs. fragmentation and change vs. continuity* may resonate with SMEs experiencing similar shifts from implicit, values-based sustainability to explicit structured approaches. Future studies could strengthen the framework through comparative case studies that distinguish context-specific patterns from generalizable dynamics across SME populations, including service-based firms, different geographical contexts, and varying stages of sustainability maturity.

Second, the SME under investigation has been, since 2020, part of a larger industrial group. While CS-related practices and commitments existed beforehand, group membership provided additional drivers (attention to the sustainability issues) and structure (new roles). Evidence suggests that the paradoxes predate this affiliation and reflect SME-specific dynamics. Three observations support this interpretation. First, long-tenured employees (purchasing team, HR) consistently traced sustainability tensions to pre-2020 practices, including supplier relationship norms and informal decision-making patterns. Second, the structural features that generate paradoxes in our analysis remain characteristic of *Alfa's* local operations rather than group-level governance. Third, the CSR Roadmap, while developed post-2020, addresses challenges (capability gaps, leadership engagement, cross-functional coordination) that employees described as longstanding. However, we cannot fully disentangle group influence from

*Alfa's* autonomous dynamics, and findings should be interpreted with this caveat in mind. We recognize that this may influence how these paradoxes are handled. As Huse (1994) observes, small firms embedded in broader governance systems often experience a structural paradox of simultaneous independence and interdependence in their relationships with parent structures. Although we did not investigate these dynamics empirically, acknowledging this condition helps delimit the scope of our findings and suggests a potential avenue for future research. Future research could compare sustainability paradoxes in independent SMEs versus those embedded in larger corporate structures.

Third, our data collection directly captured the perspectives of employees and middle managers, without direct access to top leadership. Our understanding of leadership's role is therefore inferred from middle managers' and employees' perspectives rather than directly captured. This limitation points to the need to incorporate all hierarchical perspectives to have a more comprehensive picture of how sustainability paradoxes are perceived, framed, and managed in the company.

Last, our cross-sectional data collection limits our ability to directly observe how paradox responses evolve over time. Reliance on retrospective accounts of early sustainability efforts (i.e., the 2000s ISO certifications and informal practices) are subject to potential recall bias, post-hoc rationalization, and to the influence of current understanding of sustainability. While we mitigated this through triangulation across multiple informants with different tenures and functional roles, and by anchoring recollections to documented events, temporal distance limits the reliability of such reconstructions. Moreover, paradoxes themselves evolve in terms of salience, manifestations shift, and organizational conditions. Our analysis therefore prioritizes current dynamics, where triangulation is strongest through real-time observation, recent interviews, and documents. Findings thus represent a snapshot of how paradoxes manifested at a specific moment in *Alfa's* sustainability transition. Longitudinal research tracking SMEs through the different phases of sustainability transitions could reveal how detection, sensemaking, and responding processes co-evolve, and whether defensive strategies gradually give way to more integrative approaches as organizational capabilities develop.

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## Appendix A: coding structure

This appendix presents representative examples of the coding process, showing the progression from first-order empirical data (direct quotes from interviews, observations, and documents) through second-order thematic interpretation to aggregate analytical dimensions aligned with the paradox framework.

| First-order representative quotes                                                                                                                                                                                                                                                                                                                                                                  | Second-order thematic categories                                                                            | Analytical dimensions                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| <i>"There is also some resistance from employees and managers towards change and new practices" (Interview with HR Team)</i>                                                                                                                                                                                                                                                                       | Detecting internal barriers to sustainability at the individual level                                       | Paradox of change vs. continuity                  |
| <i>"People who have been here a long time and are used to doing things as they have always done" (Interview with HR)</i>                                                                                                                                                                                                                                                                           | Detecting continuity orientation at the individual level                                                    |                                                   |
| <i>"The board has not fully grasped the additional resources that several departments need [...] We need training. It is not at all easy to integrate all this into daily activities" (Interview with purchasing manager)</i>                                                                                                                                                                      | Detecting resource and capability gaps at the firm level                                                    | Paradox of integration vs. fragmentation          |
| <i>"What's really needed is proper CSR coordination. It's crucial because we each work in our own area, and we don't always formalize things" (Interview with HR Team)</i>                                                                                                                                                                                                                         | Detecting and sensemaking of coordination issues at the firm level/lack of CS integration                   |                                                   |
| <i>"Since I started working here [more than 30 years ago], we've always prioritized local or at least national suppliers. [...] But it did cause difficulties. For example, in supplier selection, when you're demanding from this perspective, and now with social and societal aspects as well, it reduces the number of suppliers that can be selected" (Interview with purchasing manager)</i> | Responding to supplier-related tensions at the inter-organizational level                                   | Paradox of responsible partnership vs. efficiency |
| <i>"Approving a supplier takes longer, and it means not everyone can become a supplier for our company. As a result, this can also limit or impact commercial conditions. Because, when there are packaging or safety requirements in the specifications, it means a cost for the supplier" (Interview with purchasing manager)</i>                                                                | Responding to operational challenges at the firm level related to supplier CSR requirements                 |                                                   |
| <i>"We tell suppliers it takes us long to approve them, but once they are approved, we remain loyal to them" (Interview with purchasing manager)</i>                                                                                                                                                                                                                                               | Responding to tensions between procedural rigor and relational continuity at the inter-organizational level |                                                   |

|                                                                                                                                                                                                                                                                         |                                                                                                                            |                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| <i>"We're in a business where we sell consumables, not high-value-added products. You use the thing and then discard it. This means it's difficult to set high prices on products, even if they are more environmentally friendly" (Interview with purchasing team)</i> | Detecting market-driven constraints at the systemic level                                                                  | Paradox of environmental/ social responsibility vs. market competitiveness |
| <i>"We tried launching more sustainable products, like water-based products [...] But the issue is that the water-based formulation hasn't been as effective. When it rained, the product ran" (Interview with purchasing team)</i>                                     | Responding to performance and market challenges at the systemic level                                                      |                                                                            |
| CSR manager describes feeling "floating on air" and perceives CSRD compliance as his only legitimately recognized role. While tasked with coordinating CS-related initiatives, limited support reinforces a compliance-oriented approach (Field notes and interview)    | Sensemaking of role ambiguity and lack of organizational support at the individual level affecting firm-level coordination | Paradox of formal responsibility vs. real authority                        |
| <i>"We need someone to drive the change and push things forward" (Multiple interview respondents)</i>                                                                                                                                                                   | Detecting leadership void at the firm level                                                                                |                                                                            |
| <i>"In CSR, a demand comes from the board to change something, to achieve some goals; then there should be a phase in which a plan is drawn up to activate the CSR plan. (Interview with sustainability manager)</i>                                                    | Sensemaking of strategic misalignment at the firm level                                                                    | Paradox of strategic intent vs. operational reality                        |
| <i>"We need to inform everyone about our CSR initiatives, explaining what we aim to achieve and how we'll go about it. But it hasn't been done yet. Right now, we are in a kind of ad hoc mode, doing what we can" (Interview with HR Team)</i>                         | Sensemaking of lack of communication at the firm level                                                                     | Paradox of internal vs. external communication asymmetry                   |
| Multidisciplinary team created to drive CS initiatives without providing members with specialized training, and expectations placed on commercial team to integrate sustainability without adequate skills development (Observation and interview data)                 | Detecting learning paradox at the firm level: immediate capability demands without investment in development               | Paradox of capability urgency vs. capability development                   |



## ENTREPRENEURSHIP & NETWORKS IN PERIPHERAL AREAS: A BIBLIOMETRIC ANALYSIS

Francesco Mutignani  
francesco.mutignani@unipv.it  
University of Pavia

Roberta Bocconcelli  
roberta.bocconcelli@uniurb.it  
University of Urbino

Alessandro Pagano  
alessandro.pagano@uniurb.it  
University of Urbino

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### Abstract

**Purpose.** Despite growing scholarly attention to Peripheral Areas (PAs), research on entrepreneurship and networks that sustain them remains scattered across disciplines. This paper offers the first systematic map of this literature, tracing its intellectual foundations, identifying the most influential voices, and proposing avenues for further research.

**Design/methodology/approach.** We conduct a bibliometric analysis of 937 documents drawn from Scopus and Web of Science from 2000 to 2023. Performance analysis examines publication and citation patterns while science mapping, through citation, co-citation, and bibliographic coupling, uncovers the intellectual structure and thematic evolution of the field.

**Findings.** Research on entrepreneurship and networks in PAs has grown, concentrated around two dominant streams: contextualised/rural entrepreneurship and social capital. Key outlets and authors are identified. Thematic mapping uncovers social capital, regional/rural development as motor themes, along with microfinance, women's entrepreneurship, migration as emerging niches.

**Practical and social implications.** Findings stress that networks and social capital are central resources enabling resource mobilisation, innovation and place development in PAs. Policy and practice should prioritise network facilitation, place-based support, and social-enterprise promotion to enhance local resilience and inclusive development.

**Originality of the study.** By merging Scopus and WOS and applying a comprehensive bibliometric workflow (2000–2023), this study provides the first consolidated, multidisciplinary map of entrepreneurship–network research in PAs, pinpoints thematic gaps and offers a clear research agenda for future, place-sensitive investigations.

## 1. Introduction

In the last decade, an increasing interest towards Peripheral Areas (PAs) has emerged among researchers (Pugh & Dubois, 2021), practitioners and policymakers, who see in these territories new opportunities for regional and national economic growth (European Commission, 2021). With this umbrella term, we refer to places that experience the structural disadvantages of unequal regional development (Korsgaard et al., 2015a), standing in contrast to larger metropolitan areas where essential services, work, and entrepreneurial opportunities tend to concentrate (Wiggins & Proctor, 2001; Scott, 2006; Barca et al., 2014). While industrial development across the 19th and 20th centuries led to a general impoverishment of these places (Mumford, 1954; Kühn, 2015), today challenges, such as geopolitical tensions and climate crisis, but also opportunities coming from digitalisation and green transition, provide new reasons and tools to bring them back from abandonment.

In these contexts, a key role is played by local entrepreneurial activities (Korsgaard et al., 2015a; Gherhes et al., 2021), which support economic and social development through their network of relationships. Networks are fundamental for entrepreneurship in PAs: they allow firms to mobilise place-based resources, access external ones, and overcome place-related constraints (Johannisson & Nilsson, 1989; Beckmann et al., 2021). The issue has been expanded through the years, from simple inter-firm trading relationships (Richardson, 1972) to more elaborated conceptualisations of relational structures connecting multiple actors (Håkansson & Snehota, 1995; Håkansson & Ford, 2002), and scholars have increasingly recognised that entrepreneurial behaviours, resource access, and opportunity perception are all contingent on the environment in which actors are embedded (Wigren-Kristoferson et al., 2022).

Despite this growing attention, the existing literature on entrepreneurship and networks in PAs remains scattered across disciplines, spanning regional economics, economic geography, organisation studies, and innovation research, with no systematic review bringing these contributions together. Existing reviews have addressed adjacent themes, such as peripheralization (Kühn, 2015), entrepreneurship in PAs (Pato & Teixeira, 2016), and innovation processes in PAs (Eder, 2019; Eder & Trippel, 2019), but dedicated reviews specifically focused on the intersection of entrepreneurship and networks in PAs remain scarce (Leick & Gretzinger, 2020; Beckmann et al., 2021). To fill this gap, we conduct a bibliometric analysis (Donthu et al., 2021; Kraus et al., 2022) of contributions on entrepreneurship and networks in PAs, mapping the state of the art, identifying emerging trends, and highlighting aspects that deserve greater attention in future studies.

In particular, this bibliometric analysis addresses the following two interrelated research questions (RQs):

1. *What is the state of the art of research in entrepreneurship and networks in the context of PAs, in terms of prevailing topics, most prominent authors, outlets, and documents?*
2. *What are the emerging themes and the future streams of studies on the issue under investigation?*

The article is structured as follows. In the next section, the bibliometric methodology approach is outlined with the protocol explanation. Section three describes the obtained results, divided between performance analysis and science mapping. Section four discusses the main results and addresses the two RQs, tracing four main future research avenues. Finally, conclusions are drawn along with the limitations of the study and the future developments.

## **2. Methodology**

Considering the growth of research in small business and entrepreneurship (Kraus et al., 2023) and in the light of our research purposes, a bibliometric analysis seems the proper method to analyse such a large amount of contributions on the issue of entrepreneurship and networks in PAs.

The popularity of bibliometric analysis is due to several factors (Donthu et al. 2021, Kraus et al., 2022), from the disposal of new technological tools to the recognition of its importance in research, as it permits to handle large volumes of scientific data and to produce high research impact. As Rey-Martí et al. (2016) note, with the application of statistical tools to determine qualitative and quantitative changes in a given scientific research topic, this method enables scholars to gain an overview of the research, identifying knowledge gaps and future trends. This work adopts “bibliometrix”, a comprehensive R-tool specifically designed for bibliometric analyses (Aria & Cuccurullo, 2017), as a tool for extracting key information from our dataset.

### **2.1 Data Collection**

Data were collected from Scopus and Web of Science (WoS), two complementary databases widely recommended for bibliometric work in the social sciences (Mongeon & Paul-Hus, 2016; Sánchez et al., 2017). Their joint use broadens analytical coverage but requires dataset harmonisation

prior to merging (Echchakoui, 2020; Caputo & Kargina, 2022). Drawing from previous contributions mentioned in the introductory section, the search query was constructed by linking key themes, or their synonyms and related terms, concerning entrepreneurship, networks, peripherality, and geographical contextualization. These keywords were searched for in the titles, abstracts, and keywords of each document in the databases (Table 1).

Table 1. Research query development

| Research Themes                          | Entrepreneurship                                                      |     | Networks                                                                                                          |     | Peripherality                                                                                                               |     | Territory                                                               |
|------------------------------------------|-----------------------------------------------------------------------|-----|-------------------------------------------------------------------------------------------------------------------|-----|-----------------------------------------------------------------------------------------------------------------------------|-----|-------------------------------------------------------------------------|
| <b>Title,<br/>Abstract,<br/>Keywords</b> | <i>entrepreneur*<br/>business*<br/>firm*<br/>venture*<br/>compan*</i> | AND | <i>network*<br/>ecosystem*<br/>district*<br/>platform*<br/>cluster*<br/>communit*<br/>relation*<br/>interact*</i> | AND | <i>rural*<br/>"sparsely<br/>populated"<br/>remote<br/>marginal<br/>peripher*<br/>inner<br/>"non-core"<br/>"left behind"</i> | AND | <i>place*<br/>area*<br/>region*<br/>territor*<br/>space*<br/>local*</i> |
| <b>Boolean operators</b>                 | OR                                                                    |     | OR                                                                                                                |     | OR                                                                                                                          |     | OR                                                                      |

Source: author's elaboration.

In relation to the time frame definition, we considered Pike et al. (2023) argumentation which indicates 2008 as the starting point from which the topic of PAs began to attract the attention of researchers. However, the authors also highlight significant literary production between the late 1990s and early 2000s. For this reason, we have decided to extend the timeframe of our research from 2000 to 2023, capturing more than 20 years of studies on the issue.

As search boundaries within the two databases, we limited the research area to "Business, Management and Accounting", the document type to "Article", "Review", "Book Chapter", "Book", and "Editorial" and, finally, the language to "English". We decided not to restrict the search to high-ranking outlets in order to have a holistic representation of current research contributions and also to identify minor trends. With these parameters, our search conducted on Scopus and WoS yielded us 716 and 538 results respectively.

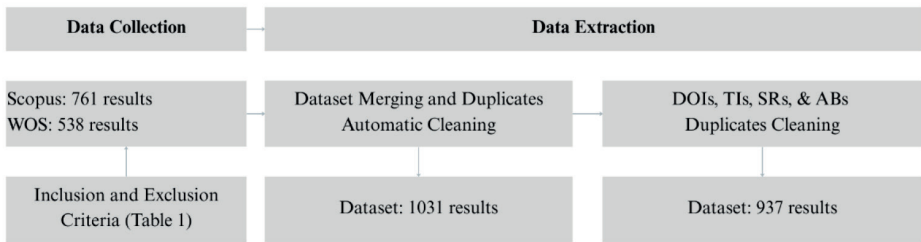
We followed the instructions of Echchakoui (2020) to merge and clean the downloaded datasets in bibtext format by using Rstudio. Since Scopus and WoS datasets have different structure, the first step involved the standardisation of their columns' order and names according to the format outlined by Aria and Cuccurullo (2017). The two datasets were merged into

one and cleaned it from errors and duplicates (Figure 1). Duplicate records were removed automatically in two stages. First, an automated deduplication was performed across all fields. Second, the dataset was reviewed, cross-checking separately titles, DOIs, and abstracts to catch any residual duplicates that the automated process may have missed due to inconsistencies or errors in the metadata.

No additional screening was performed as the search string was deliberately constructed to be highly specific, combining 4 themes' categories, minimising the risk for irrelevant documents.

Our final combined dataset resulted in 937 documents, and we uploaded it into biblioshiny interface for bibliometrix.

Figure 1. Research extraction process



Source: Our elaboration

## 2.2 Data Analysis

Data analysis follows the two-stage structure that constitute the fundamental building blocks of a comprehensive bibliometric analysis, namely *performance analysis* and a *science mapping* (Donthu et al., 2021; Mukherjee et al., 2022), which allow to move from a descriptive overview of scholarly production to a structural understanding of how knowledge has developed and organised itself within a field (Lim & Kumar, 2024). All analyses were conducted using the bibliometrix R-package (Aria & Cuccurullo, 2017), an open-source tool specifically designed to support the full bibliometric workflow, from data loading and cleaning to network construction and visualisation.

Performance analysis is an evaluative technique that assesses the contributions of research constituents to a given field through quantitative metrics (Donthu et al., 2021). Specifically, the metrics employed in this study include *total publications per year*, which indicate annual growth rate, the *mean total citations (TC) per year*, which measure the influence and reach of a set of contributions, and *authors' h-index*, which captures both the productivity and citation impact of authors and outlets simultaneously. These

indicators allow us to identify the most influential authors, journals, and documents in the corpus, and to track how the field has grown over time.

Science mapping shifts the focus from individual contributions to the relationships between research constituents and to the intellectual structure they collectively form (Donthu et al., 2021; Aria & Cuccurullo, 2017). The techniques employed in this study are described below.

*Citation analysis* measures the number of citations for individual articles to identify the most influential ones (Donthu et al., 2021). Our study focuses specifically on local citations (LC) to assess the impact at the dataset level. The same analysis was carried out on the references cited by the articles, in order to find the most influential ones in terms of LC.

*Co-citation analysis* is used to uncover relationships among cited foundational publications, wherein cited publications converging into a cluster represent a common theme (Mukherjee et al., 2022). When two works are repeatedly cited in the same papers, it is reasonable to infer that the scholarly community perceives them as thematically related (Donthu et al., 2021). In this study, the technique is applied to the 50 most cited references in the corpus, and the resulting clusters are interpreted as knowledge communities or intellectual traditions.

*Bibliographic coupling* is the forward-looking counterpart of co-citation analysis, connecting documents within the examined dataset that cite the same references (Hjørland, 2013; Donthu et al., 2021). Two articles are strongly coupled when their bibliographies overlap substantially, suggesting that they draw on the same intellectual foundations and are therefore likely to address related research questions. Unlike co-citation, which tends to surface older, foundational works, bibliographic coupling is better suited to mapping current and recent research fronts, as it focuses on the citing documents rather than the cited ones. In this study, it is used to cluster the top 100 documents by LC score, identifying the main thematic communities present in contemporary research on entrepreneurship and networks in peripheral areas.

Finally, co-word analysis shifts the unit of analysis from documents and references to words. Specifically, it examines which author-assigned keywords tend to appear together across the corpus, treating co-occurrence as a proxy for thematic relatedness (Aria & Cuccurullo, 2017). It is particularly useful for mapping the conceptual landscape of a field and identifying emerging, declining, or niche topics. In this study, the results of co-word analysis are visualised through a thematic map, which positions keyword clusters according to the dimensions of centrality, that is the relevance of the cluster to the overall field, and density, i.e. how strongly the keywords within a cluster are connected to each other, indicating the degree of internal development of that theme.

These two dimensions define four quadrants in the thematic map: Q1)

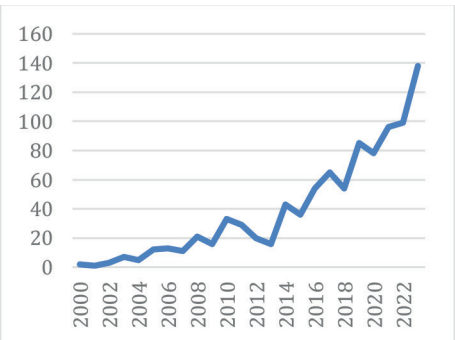
motor themes - high centrality and high density - which are both central and well-developed; Q2) basic themes - high centrality and low density, which are relevant but underexplored; Q3) niche themes - low centrality, high density - which are internally coherent but peripheral; Q4) emerging or declining themes - low centrality and low density - whose trajectory remains unclear.

### 3. Findings

#### 3.1. Performance Analysis

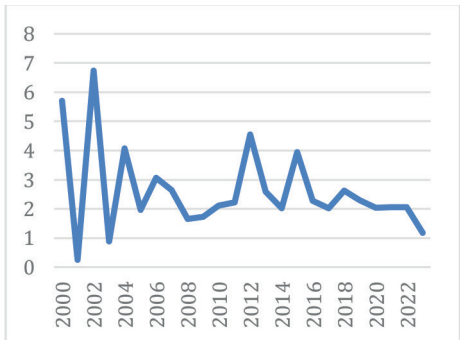
Figure 2 illustrates the annual scientific production that we can see increasing every year at 20.21% rate. It started with very few documents in 2000 to reach 138 results in 2023, with a significant increase after 2013.

Figure 2. Annual production



Source. Our elaboration

Figure 3. Mean Total Citation (TC) per year



Source. Our elaboration

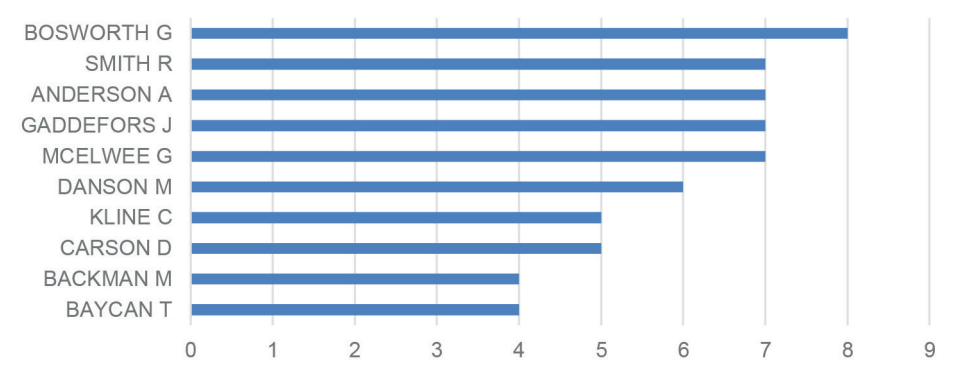
Not surprisingly, we note a decrease in Mean Total Citations (TC) per year trend (Figure 3) due to the expansion of the research on the topic and by the newness of documents which have a mean age of 6,61 years. However, we can clearly notice four peaks of citations in 2000, 2002, 2012, and 2015.

In Figure 4, the 10 most productive authors are ranked according to the number of published documents. Bosworth G. is the most productive author, with 8 publications.

A clearer view is provided by the analysis of Authors' local impact based on h-index. As we can see in Table 2, Anderson, A. and Bosworth, G. appear to be the most relevant authors, but the first one has a higher TC

index and is the first in our list to have published documents on the topic. In terms of TC index, Korsgaard, S. has the highest rate.

Figure 4. Top 10 Authors per production



Source. Our elaboration

Table 2. Top 10 authors per h-index

| Author        | Affiliation                                 | h-index | TC  | Publications | First Publication Year |
|---------------|---------------------------------------------|---------|-----|--------------|------------------------|
| Anderson, A.  | University of Aberdeen                      | 6       | 474 | 7            | 2000                   |
| Bosworth, G.  | Northumbria University                      | 6       | 234 | 8            | 2008                   |
| Gaddefors, J. | Swedish University of Agricultural Sciences | 5       | 369 | 7            | 2015                   |
| Kline, C.     | Appalachian State University                | 5       | 179 | 5            | 2010                   |
| Smith, R.     | University of the West of Scotland          | 5       | 114 | 7            | 2006                   |
| McElwee, G.   | Nottingham Business School                  | 5       | 110 | 7            | 2009                   |
| Korsgaard, S. | University of Southern Denmark              | 4       | 512 | 4            | 2015                   |
| Backman, M.   | Jönköping International Business School     | 4       | 340 | 4            | 2005                   |
| Carson, D.    | Umeå University                             | 4       | 79  | 5            | 2001                   |
| Danson, M.    | Heriot-Watt University                      | 4       | 76  | 6            | 2012                   |

Source. Our Elaboration

Table 3 examines the 10 most important journals for local impact. *Entrepreneurship and Regional Development* is the most relevant outlet from every point of view.

Table 3. Top 10 Journal per h-index

| Outlet                                                        | h-index | TC   | Publications | First Publication Year |
|---------------------------------------------------------------|---------|------|--------------|------------------------|
| Entrepreneurship and Regional Development                     | 20      | 1631 | 35           | 2000                   |
| Technological Forecasting and Social Change                   | 10      | 433  | 13           | 2012                   |
| Journal of Enterprising Communities                           | 9       | 268  | 24           | 2015                   |
| Journal of Small Business and Enterprise Development          | 9       | 311  | 15           | 2005                   |
| Regional Studies                                              | 9       | 374  | 13           | 2006                   |
| Journal of Sustainable Tourism                                | 8       | 601  | 9            | 2007                   |
| International Journal of Entrepreneurial Behaviour & Research | 7       | 331  | 14           | 2016                   |
| International Journal of Entrepreneurship and Innovation      | 7       | 171  | 9            | 2013                   |
| International Journal of Entrepreneurship and Small Business  | 7       | 158  | 17           | 2006                   |
| Local Economy                                                 | 7       | 148  | 17           | 2016                   |

Source. Our Elaboration

However, a more accurate analysis of the local sources is given by Figure 5, where we can see the most locally cited sources. Entrepreneurship and Regional Development is still at the first position, but it is followed by Journal of Business Venturing and Small Business Economics.

Figure 5. Top 10 sources per local citations (LC)



Source. Our Elaboration

### 3.2. Science Mapping

#### 3.2.1. Citation analysis

Table 4 presents the top 10 articles for local impact on Entrepreneurship, Networks and PAs. By observing the local citation index (LC), i.e., how many times the document has been cited by others in the dataset, we can classify articles according to their relevance to the topic we are analysing. From this perspective, although other articles may have a higher number of global citations (GC), their weight is lower for the purposes of the analysis. The ratio between LC and GC provides us with information on the specialisation of that article within the academic community.

*Table 4. Top 10 Articles per Local Citations (LC)*

| Authors                                     | Title                                                                                                  | Year | LC | GC  | LC/GC Ratio (%) |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------|------|----|-----|-----------------|
| Gaddefors, J. & Anderson, A.R.              | Romancing the rural: Reconceptualizing rural entrepreneurship as engagement with context(s)            | 2019 | 13 | 62  | 20.97           |
| Freire-Gibb, L.C. & Nielsen, K.             | Entrepreneurship Within Urban and Rural Areas: Creative People and Social Networks                     | 2014 | 10 | 64  | 15.63           |
| Lordkipanidze, M., Brezet, H. & Backman, M. | The entrepreneurship factor in sustainable tourism development                                         | 2005 | 7  | 213 | 3.29            |
| Mair, J., Martí, I. & Ventresca, M.J.       | Building Inclusive Markets in Rural Bangladesh: How Intermediaries Work Institutional Voids            | 2012 | 6  | 689 | 0.87            |
| Brown, R.                                   | Mission impossible? Entrepreneurial universities and peripheral regional innovation systems            | 2016 | 5  | 90  | 5.56            |
| Burnett, K.A. & Danson, M.                  | Enterprise and entrepreneurship on islands and remote rural environments                               | 2017 | 5  | 27  | 18.52           |
| Paulson, A.L. & Towansend, R.               | Entrepreneurship and financial constraints in Thailand                                                 | 2004 | 4  | 149 | 2.68            |
| Lafuente, E., Vaillant, Y. & Serarols, C.   | Location decisions of knowledge-based entrepreneurs: Why some Catalan KISAs choose to be rural?        | 2010 | 4  | 54  | 7.41            |
| Aarstad, J., Haugland, S.A. & Greve, A.     | Performance Spillover Effects in Entrepreneurial Networks: Assessing a Dyadic Theory of Social Capital | 2010 | 4  | 71  | 5.63            |

| Authors                                       | Title                                                                                                                                             | Year | LC | GC | LC/GC Ratio (%) |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|------|----|----|-----------------|
| Cunha, C., Kastenholz, E. & João Carneiro, M. | Entrepreneurs in rural tourism: Do life-style motivations contribute to management practices that enhance sustainable entrepreneurial ecosystems? | 2020 | 4  | 61 | 6.56            |

*Source. Our elaboration*

These ten most locally cited articles reflect the two main research streams identified throughout this analysis, that is, contextualised entrepreneurship and social capital, while also shedding light on the structural conditions and individual motivations that shape entrepreneurial activity in PAs.

A first strand foregrounds the relational and contextual nature of entrepreneurship in PAs. Gaddefors and Anderson (2019), the most locally cited contribution, challenge static readings of rural context, arguing that entrepreneurs and their territories co-produce one another through ongoing engagement rather than entrepreneurship simply occurring within a given place. This theoretical reframing is consistent with the embeddedness perspective running through the broader literature, and is operationalised empirically by Freire-Gibb and Nielsen (2014), who show that social networks, rather than individual creativity, are the decisive factor for new venture creation in rural areas, where relational ties compensate for sparse formal infrastructure. Burnett and Danson (2017) extend this reasoning to island and remote environments, highlighting how localised social capital functions simultaneously as a constraint and a distinctive resource, one that calls for place-sensitive policies rather than frameworks transposed from urban contexts.

A second strand examines how structural and institutional conditions filter entrepreneurial activity. Mair et al. (2012), Paulson and Townsend (2004), and Brown (2016) collectively suggest that the institutional architecture of PAs is not merely thin or absent but actively shapes who can engage in entrepreneurship, how they do so, and with what resources. Particularly notable is Brown's (2016) critical observation that even formally supportive institutions such as universities can generate policy lock-in, reinforcing their own centrality rather than catalysing broader entrepreneurial ecosystems in peripheral regional innovation systems.

A third strand connects entrepreneurship in PAs to networks, performance spillovers, and sustainable development. Aarstad et al. (2010) demonstrate that network position matters as much as individual endowments, with firms embedded alongside social-capital-rich partners benefiting from performance spillovers, a finding with direct implications for

how entrepreneurial communities in PAs can be deliberately structured. Lordkipanidze et al. (2005) and Cunha et al. (2020), both focused on rural tourism, show that cooperative networking is a key mechanism for overcoming weak entrepreneurial culture and administrative barriers, while Lafuente et al. (2010) nuance this picture by showing that personal motivations, particularly quality-of-life considerations, rather than infrastructure alone, drive the type of entrepreneurship most likely to generate knowledge spillovers in PAs.

Taken together, these contributions converge on a core insight that networks and social capital are not merely resources for entrepreneurs in PAs but constitutive elements of the entrepreneurial process itself, enabling resource mobilisation, legitimation, and place development where formal market and institutional architectures are incomplete.

*Table 5. Top 10 cited references per Local Citations (LC)*

| Author                                       | Year | Title                                                                                                                    | LC |
|----------------------------------------------|------|--------------------------------------------------------------------------------------------------------------------------|----|
| Welter, F.                                   | 2011 | Contextualizing entrepreneurship—conceptual challenges and ways forward                                                  | 40 |
| Korsgaard, S., Müller, S., & Tanvig, H. W.   | 2015 | Rural entrepreneurship or entrepreneurship in the rural—between place and space.                                         | 36 |
| Eisenhardt, K. M.                            | 1989 | Building theories from case study research                                                                               | 35 |
| Jack, S. L., & Anderson, A. R.               | 2002 | The effects of embeddedness on the entrepreneurial process                                                               | 33 |
| Granovetter, M.                              | 1985 | Economic action and social structure: The problem of embeddedness                                                        | 31 |
| Anderson, A. R.                              | 2000 | Paradox in the periphery: an entrepreneurial reconstruction?                                                             | 27 |
| Korsgaard, S., Ferguson, R., & Gaddefors, J. | 2015 | The best of both worlds: how rural entrepreneurs use placial embeddedness and strategic networks to create opportunities | 26 |
| McKeever, E., Jack, S., & Anderson, A.       | 2015 | Embedded entrepreneurship in the creative reconstruction of place                                                        | 26 |
| Peredo, A. M., & Chrisman, J. J.             | 2006 | Toward a theory of community-based enterprise                                                                            | 23 |
| Miles, M. B., Huberman, A. M., & Saldana, J. | 2014 | Qualitative data analysis: A methods sourcebook                                                                          | 22 |

*Source. Our elaboration*

The most locally cited references in Table 5 reveal the theoretical and methodological architecture underlying the empirical contributions examined in Table 4, making the intellectual lineage of the field explicit. The two dominant strands we have previously highlighted are traceable to a

small number of foundational texts that the applied literature repeatedly mobilises.

The contextual strand is anchored above all by Welter (2011), the most locally cited reference in the entire dataset, whose systematic argument for treating context as a multi-dimensional analytical lens, encompassing spatial, institutional, social, and temporal dimensions, provides the conceptual scaffolding on which much of the subsequent empirical work is built. Anderson (2000) anticipates this move from an empirical angle, showing that peripheral location can be reconstructed as an entrepreneurial resource rather than a structural liability. Korsgaard and colleagues extend this logic in two complementary directions: the first work (2015a) distinguishes between place-based and space-based orientations in rural entrepreneurship, mapping the tension between locally embedded actors and more strategically networked entrepreneurs; the second (2015b) argues that the most effective rural entrepreneurs combine both orientations simultaneously. McKeever et al. (2015) complete the picture by showing how deeply embedded entrepreneurs actively reconstruct the places they inhabit.

The embeddedness strand traces back to Granovetter (1985), whose argument that economic action is inextricably embedded in social structures of trust and obligation functions as the invisible connective tissue of the field. Jack and Anderson (2002) operationalise this insight in an explicitly entrepreneurial register, showing how embeddedness shapes both the opportunities entrepreneurs can perceive and the resources they can mobilise. Peredo and Chrisman (2006) extend this reasoning to collective forms of entrepreneurship in resource-poor environments, providing a theoretical counterpart to the intermediary model of Mair et al. (2012) and to the community-oriented practices documented by Burnett and Danson (2017).

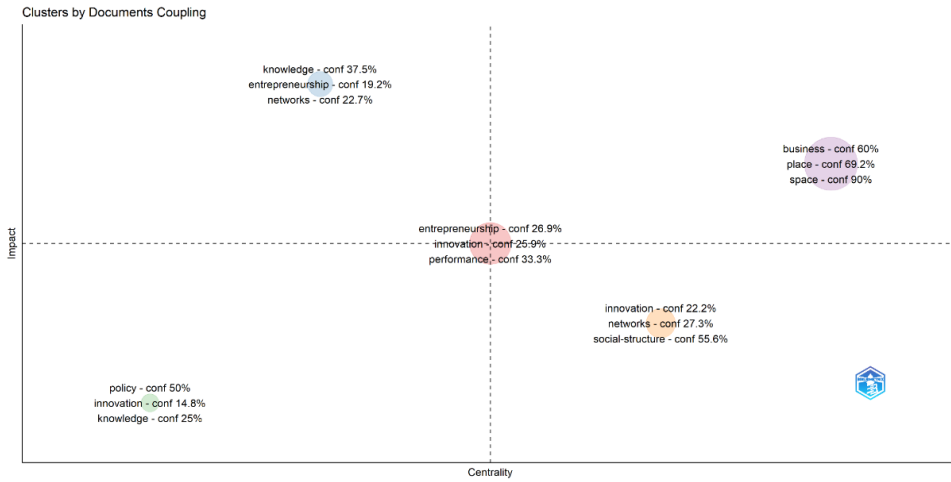
Finally, the presence of Eisenhardt (1989) and Miles et al. (2014) in this ranking, signals that a substantial share of the empirical work in this field relies on qualitative case-study designs.

### *3.2.2 Bibliographic Coupling*

Bibliographic coupling groups documents that share common references, revealing not merely thematic affinities but genuine intellectual communities. Read alongside the previous section's findings, the cluster structure in Figures 6 and 7 becomes analytically informative in ways that the visual alone does not immediately convey. Specifically, Figure 6 shows the top 100 documents for LC score clustered around common topics identified by Keywords Plus criteria, which are standardized terms extracted automatically from the titles of the cited references. The most relevant are represented by larger points and bold references. Figure 7 helps us in iden-



Figure 7. Clusters impact and centrality



Source. Bibliometrix

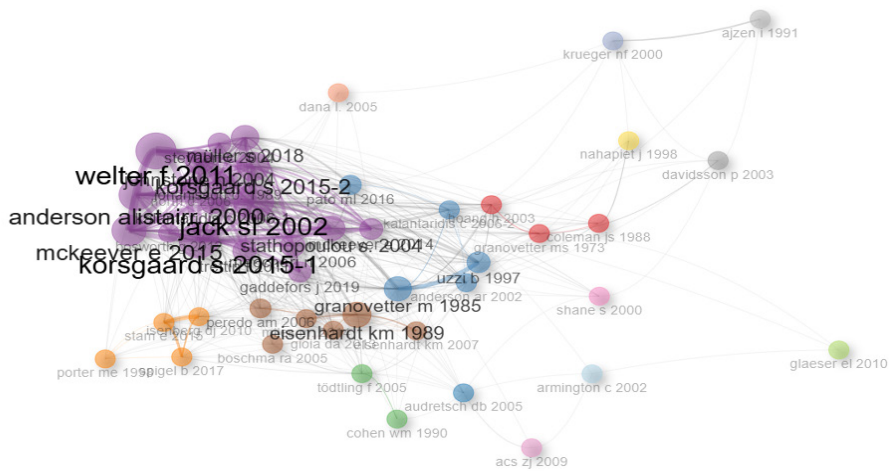
### 3.2.3 Co-citation analysis

While bibliographic coupling groups documents that share common references (Donthu et al., 2021), co-citation analysis inverts the perspective by identifying which foundational texts are systematically read together by the scholarly community (Hjørland, 2013). The two techniques are therefore complementary, and their findings here are mutually reinforcing.

The emergence of a single dominant co-citation cluster, centred on Welter (2011), Jack and Anderson (2002), and Korsgaard et al. (2015a), is analytically significant for two reasons. First, it confirms that the two streams identified throughout this analysis are not parallel but overlapping traditions. In other words, scholars working on either contextualised entrepreneurship or social embeddedness consistently frame their contributions against the same theoretical background.

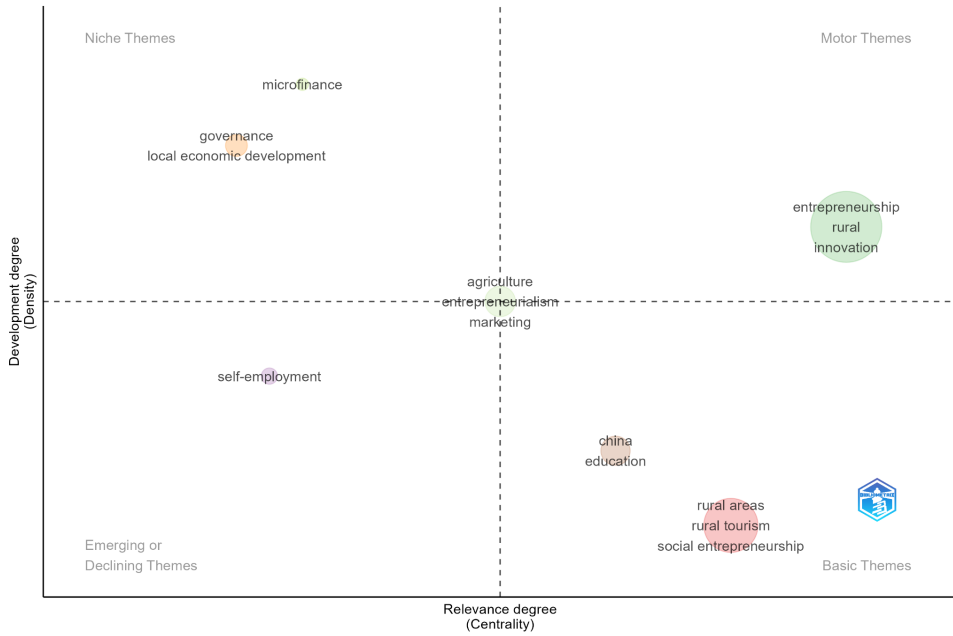
Second, the compactness of this cluster suggests that the field's theoretical foundations, while robust, are relatively narrow. The relative isolation of Granovetter (1985) and Peredo and Chrisman (2006) from the core, despite their high local citation counts, indicates that the sociology of networks and the community-enterprise tradition are widely cited individually but have not been fully integrated into the dominant framework, reinforcing the observation made in the bibliographic coupling analysis about inter-cluster bridges remaining underdeveloped.

Figure 8. Top 50 references co-citation analysis



Source. Bibliometrix

Figure 9. Co-word analysis thematic map



Source. Bibliometrix

### 3.2.4 Co-word analysis

The co-word analysis thematic map in Figure 9 extends this picture into the temporal dimension, tracing not only where research currently stands but also the directions in which it is moving. The motor themes in Q1, entrepreneurship, rural, innovation, social capital, regional development, confirm that the field's productive core is precisely the intersection of the two dominant streams. Their development level, close to the average, suggests that this core, while established, has not yet reached theoretical saturation. Family firms and community emerge as secondary motor themes within the same cluster, pointing to a growing interest in the collective and intergenerational dimensions of entrepreneurship in PAs that the literature has begun to explore but not yet systematically theorised.

The basic themes in Q2, social entrepreneurship, social innovation, creativity, and lifestyle entrepreneurship, are perhaps the most analytically interesting. Their high relevance but lower development indicates that these topics are firmly established as research concerns without having generated the same cumulative theoretical progress as the motor themes.

The emerging cluster in Q3, organised around self-employment and immigrant entrepreneurship, and the niche cluster in Q4, centred on microfinance, women's entrepreneurship, and financial inclusion, deserve particular attention. Their low centrality does not reflect marginal empirical importance but rather a genuine theoretical disconnect from the mainstream literature, as these communities build on different foundational references that have not yet been brought into dialogue with the place-embeddedness framework.

## 4. Discussion

This paper presented a bibliometric analysis on business networks and entrepreneurship in PAs, identifying the evolution of the field and tracing future research avenues.

Performance analysis confirms the growing interest on the issue, highlighting the most prominent authors and outlets, belonging to a variety of research areas beyond the fields of Entrepreneurship and Regional Development.

Science mapping revealed that the main documents are focused around the two interconnected topics of entrepreneurship in PAs (Bosworth, 2012; Korsgaard et al., 2015a; Gaddefors & Anderson, 2019) and social capital/embeddedness (Bourdieu, 1986; Granovetter, 1985; Malecki, 2012). Entrepreneurship in PAs is characterised by a strong degree of territorial embeddedness, reflected in rural localisation, rural customers, and rural products

(Bosworth, 2012; Korsgaard et al., 2015a), and by the centrality of relationships as the primary development factor. As Korsgaard et al. (2015a) argue, rural entrepreneurship leads to an enhancement of the quality of place and of localised resources, a process that social capital literature confirms empirically (Moyes et al., 2015).

These two streams are linked by the concept of social entrepreneurship, understood as entrepreneurial effort aimed at creating social value (Peredo & McLean, 2006). Social entrepreneurship is strongly present in our results and is proposed as a key leverage for place development, operating as a mediation activity between actors from different levels, voluntary, public, and mainstream business (Steiner & Teasdale, 2019), and generating positive externalities for the territory.

Besides these main research streams, science mapping analysis revealed further subjects that can be developed. Building on the gaps identified through science mapping, we propose four directions for future research.

First, the co-citation network shows that foundational contributions from the sociology of networks (Granovetter, 1985) and community-based enterprise theory (Peredo & Chrisman, 2006) are widely cited individually but rarely mobilised together with the dominant contextualised entrepreneurship framework. Whilst recognising the established nature of these issues, future research could analyse them in connection with the prevailing strand of contextualised entrepreneurship literature, with a particular focus on PAs. Nevertheless, this could be an opportunity to expand research beyond the social relationships' dynamics, placing emphasis also on contractual relations in such contexts.

Second, the literature is heavily concentrated in Northern and Western Europe, with PAs in the Global South, Eastern Europe, and Latin America largely absent from the empirical record. This raises a theoretically consequential question concerning social capital and contextualised entrepreneurship mechanisms in different geographical contexts.

Third, as it emerges from the thematic map's Q3 and Q4 clusters, topics such as migrant entrepreneurship, women's entrepreneurship, and microfinance, that draw on entirely different theoretical traditions, are still under-integrated without yet having been brought into dialogue with the mainstream literature. In the contemporary global scenario, characterised by turbulence and diversity, studies that address these issues in the context of PAs have the potential to generate significant interest.

Finally, in the light of the predominance of cross-sectional designs in the corpus prevents any systematic understanding of how entrepreneurial networks evolve over time. Future research should investigate how entrepreneurial networks in PAs adapt and restructure in response to disruptive external shocks such as digitalisation, climate transition, or pandemic-related and geopolitical disruptions.

## 5. Conclusions

The present bibliometric analysis offers a wide representation of recent studies and future trends of research over the interdisciplinary issue of entrepreneurship in PAs. On the one hand, the performance analysis revealed the increasing interest on PAs-related research, led by entrepreneurship and regional development studies. On the other hand, the content analysis highlighted relevant topics of rural entrepreneurship and social entrepreneurship which often employ the concept of social capital as key resource for business activities.

Therefore, it appears that relationships and networks are key resources for business activities located in PAs, opening to new research opportunities studies on the topic beside Entrepreneurship literature.

This study is not without limitations, as the bibliometric analysis method involves per se some issues (Donthu et al., 2021). Firstly, the choice of keywords and inclusion criteria, even when identified as holistically as possible, may not capture all conceptually relevant studies that do not employ the specific terminology adopted.

Secondly, bibliometric analysis operates at the level of aggregate structural patterns rather than the depth of individual textual arguments (Donthu et al., 2021; Mukherjee et al., 2022). Accordingly, the findings should be interpreted as a map of the field's intellectual landscape rather than a substitute for an in-depth systematic or meta-analytic review. Future research may complement this study by engaging more qualitatively with the thematic clusters identified here.

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## THE SUSTAINABLE LANDFILL: AN INTEGRATED SERVICE FOR THE ENVIRONMENT AND ITS POSSIBLE IMPACT ON THE SME'S SECTOR

Rosalba Rombaldoni  
rosalba.rombaldoni@uniurb.it  
University of Urbino

Paolo Polidori  
paolo.polidori@uniurb.it  
University of Urbino

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### Abstract

**Purpose.** This paper aims to contribute to the debate on waste management with the intention of considering the waste cycle as a network of environmental services, which are vital and necessary to the industry. At the same time, it wants to emphasize the concept of the sustainable landfill, that finds a new role whenever it is collocated at the end of the cycle.

**Design/methodology/approach.** A simple model shows that the lifespan of a landfill, in the absence of economic constraints, depends on the actions put in place upstream of the final storage phase, which will have to be all the more incisive the greater the community's aversion to the creation of landfills. The various phases of the waste cycle are detailed, together with an economic exploration of the economic dimension of the waste sector, also outlining organization and ownership structures.

**Findings.** The sustainable landfill, a necessary building block that cleanly closes the material cycle, imposes the constraint that produces backward effects throughout the supply chain, even to the point of changing the structure of the entire network. Within a circular economy framework, the potential for SMEs, in terms of new market space, turnover and economic profits is enormous.

**Practical and Social implications.** The waste sector, extremely relevant for its economic dimension, is very parcelled out, characterized by the presence of a large number of SMEs and exhibits very interesting margins of profitability whenever a sustainable landfill is taken into consideration.

**Originality of the study.** It intends to fill a gap in the literature, emphasizing the concept of sustainable landscape and presenting the waste cycle as a network of services for the environment, that is a specific management model (Integrated Waste Management As A Service or IWaMAAS)

## 1. Introduction

Waste management is one of the most controversial aspects, in relation to human activity, because of the impact generated socially and environmentally. Globally, only 19 percent of waste becomes recovered material through recycling and composting, while 11 percent is treated by incineration. The growth forecast, made for 2050, is 3.4 billion tons, considering movements in urban areas (Kaza et al., 2018). Separate waste collection and disposal-related services make a substantial contribution to reducing environmental pollution (Castillo-Giménez et al., 2019), but the containment of negative impacts, on society and the environment, depends on a multiplicity of factors (Cervantes et al., 2018), such as the involvement of individuals, institutions, and companies that offer various waste management services (Agovino et al., 2016; Soltani et al., 2015). The responsibility for waste management is in the hands, at least for some stages of the cycle, of local authorities that generally have limited resources, with negative effects in the capacity for planning, procurement, operational monitoring, and so on. The absence of cooperation among municipalities contributes to a fragmented picture at different geographic levels, both local and global.

The concept of circular economy (Korhonen et al., 2018) dovetails perfectly with waste management (Kirchherr et al., 2017), especially in Europe (Bogner, 2005). On the one hand, the transition to the circular economy must take place at multiple levels (micro, meso, and macro) (Cerquetti et al., 2021); on the other hand, achieving the goals requires the involvement of a plurality of actors ranging from institutions to businesses, from consumers to governments, as agents of a single network (Merli et al., 2018). Also business models are affected by this concept, with strong impacts also on small and medium enterprises (SMEs) (Trequattrini et al., 2021). A systematic literature review (Ahmadov et al., 2025) focuses on the different factors (macro, meso, and micro) and mechanisms influencing the transition process, contributing to develop a conceptual model about the dynamics of the circular transition process within SMEs.

However, the realization of the circular economy through prevention, reuse, and recycling is far from the goal of “zero waste,” and faces a somewhat generalized unpreparedness to manage the waste stream that recycling generates. Wise waste management cannot ignore a balanced use of different treatment and disposal methods (Cossu, 2009). The landfill, at this point, makes it possible to complete the disposal service, close the material cycle and control the spread of contaminants. It can no longer be considered “a dustbin,” nor be abandoned to obsolete and inadequate quality standards.

Within this framework, the “sustainable” landfill stands as a necessary building block to cleanly close the material cycle. It is an approach that

has not been much analyzed in the literature, hence the paper is giving a contribution in filling the gap in this direction. Some authors address the opportunity of reducing environmental parameters to acceptable risk level in order to prevent damage to humans and the environment (Osazee, 2021), whereas some others advise the necessity of planning in advance operations and monitoring, closure and post-closure care (Townsend et al., 2015). The choice of a sustainable site of location is made on parameters which are identified and categorized into three groups including environmental, economic, and social criteria (Rahimi et al., 2020). Once the landfill has been closed, there are significant international experiences about the various types of landfill use destination<sup>1</sup>.

To fully play the role of sink, it must be designed and implemented in accordance with the principles of environmental sustainability, that is, with all technical measures that can ensure the stability of waste and immobilization of pollutants after the closure of the landfill. The time considered is that of one generation (30 years), within which to achieve environmental balance (Cossu et al., 2020). However, it is important to underline that the financial guarantee to be observed in Italy (30 years) does not seem to be the right instrument to obtain the final quality of the landfill. If technical interventions are not made (regardless of low or high recycling rates), at the end of the financial guarantee, the result will be a contaminated land rather than a depleted landfill site.

SMEs are fully involved in the ecological transition and as it will be shown in the paper, the economic interests related to this sector have now assumed very important dimensions. The decision to build sustainable landfills as the final element of the integrated waste management cycle undoubtedly has effects that reverberate backward throughout the supply chain and impact the mainly medium-small businesses that are part of it. In this paper, an attempt will be made to give substance to this claim. To understand the impact of sustainable landfill on the ownership regimes of management companies, reference will be made to the notion of control. We will speak of private ownership when the entity or entities that control the company operating any waste management facility are private, while we will speak of a public company when control is in the hands of public capital. However, the debate about privatization in public service provision is still open: expected results in terms of higher efficiency and investments have not been achieved, so supporting a growing re-municipalization trend (Petersen et al., 2018). In particular, in the waste sector, contextual factors and the role of policymakers that influence governance models, need further investigation (Gradus et al., 2019; Romano et al., 2023).

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<sup>1</sup> See Cossu (2020). Many examples come from Europe (Germany, France, Malta, Great Britain) but also from China, Usa, Japan, Israel and South Africa.

The reference to the ownership regime is relevant in the context of the waste chain because it reintroduces a classic reflection on the different time horizons of public and private interests. When one moves away from a company's break-even point to pursue the interest of future generations by minimizing the negative externalities associated with the final storage phase, it inevitably affects its ownership regime. Indeed, the interests of public or private investors are clearly different. A sustainable landfill has, by its nature, particularly long-time horizons that are perhaps ill-suited to private ownership. High initial investment costs, often compounded by a lengthy administrative and socio-political process to locate a site, can only discourage a private investor.

But while sustainable landfills seem to reduce the space for the private sector, the choice to promote them can trigger very interesting prospects throughout the upstream supply chain. In fact, as already pointed out, these kinds of facilities need a special waste management chain, in all stages of collection, recycling and treatment, which offer great entrepreneurial opportunities. Here the space for private and investee companies is enormous (Preite et al., 2024; Del Bo et al., 2025).

The integrated waste management service also plays a strategic role for the entire SME system, located in a given territorial basin, for two main reasons. The first is that businesses need to manage the amount of waste, especially special waste, they produce in a cost-effective manner. Both by reducing its quantity, maximizing recycling opportunities, and reducing the costs associated with the inevitable final storage. The second reason is that SMEs can become from a business and industry perspective active participants in the waste management chain. So, the decision to build sustainable landfills, seemingly penalizing as they are subject to more stringent environmental constraints and devoted to the defence of future generations, presents an extraordinary form of incentive to build a real industrial waste supply chain with significant investment and employment opportunities.

This paper aims to contribute to the debate on waste management and its possible impact on the net of SMEs with the intention of considering the waste cycle as an integrated service using the logical scheme proper to network analysis. Its optimization involves the identification of critical nodes and bottlenecks that prevent the system from achieving balances in line with circularity and sustainability, a matter to which also SMEs are called to carefully report (Roberto et al., 2024). At the same time, it wants to emphasize the concept of the sustainable landfill, that has been deeply investigated by Cossu et al. (2020), but that finds a new role whenever it is collocated at the end of the cycle: the entire upstream system changes and adapts to achieve high quality in final storage. Section two details the various phases of the waste cycle and proposes a classification of waste,

introducing a simple model in which the lifetime of a landfill, in a closed administrative unit, in the absence of economic constraints, depends on the actions put in place upstream of the final storage phase, which will have to be all the more incisive the greater the community's aversion to the creation of landfills. The model deliberately does not present an empirical application, due to the lack of Italian data on the specific subject of sustainable landfills, but rather emphasises the relationships between the relevant variables in determining the break-even point.

The third section explores the economic dimension of the waste sectors, outlining also organization and ownership structures. Characteristics, limitations and aims of the sustainable landfill are explained in section four. Finally, the waste cycle is presented as a network of services for the environment, assuming a specific management model (Integrated Waste Management As A Service or IWaMAAS). In the end, remarks and references close the paper.

## **2. The waste cycle and the role of landfills for the chain of small and medium-sized enterprises**

Waste management is the set of policies, procedures or methodologies aimed at managing the entire waste process, from its generation to its final destination thus involving the phase of collection, transportation, treatment (recovery or disposal) until the reuse/recycling of waste materials, usually produced by human activity, in an attempt to reduce their effects on human health and impact on the environment. The proper management of hazardous and non-hazardous waste, whether of urban or special origin, is the basis of the principles that the European Union has set forth in specific Regulations and Directives<sup>2</sup>.

Based on the principle of the hierarchy of waste treatment, the European Commission has established that the proper management of Waste must adhere to a precise hierarchy of actions.

According to this principle, prevention should be implemented by encouraging the reduction of waste generation and hazardousness and facilitating its reuse, recycling and other recovery operations. At the bottom of the hierarchical ladder is landfilling, conceived as a residual option to be zeroed out over time.

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<sup>2</sup> Each Member State, including Italy, has implemented the principles enshrined by the European Union with specific legislation: single text of Legislative Decree 152/2006 as amended and supplemented. See Clini (2024) "La gestione dei rifiuti urbani", in Eugenio Picozza and Annalisa Di Giovanni, *La disciplina dei servizi pubblici locali di rilevanza economica*, Giappichelli, 2024.

Waste can be distinguished firstly into non-hazardous and hazardous waste. Then they can also be classified into two other main macrocategories: municipal waste and special waste. The distinction relates to their origin and how they are managed<sup>3</sup>. Each category of waste creates a network that in fact forms a system of interdependent networks composed of operators of various natures; these include companies both that are part of the network and that must interface with it for production reasons.

As for the origin of municipal waste, this is produced by commercial and public household activities in urban areas. Paper, plastic, glass (recyclables), organic waste such as food scraps, non-recyclable waste, bulky waste, etc. also fall into this category. Municipal waste is usually collected, treated and disposed of by public waste collection services, which often sort it according to its type in order to facilitate recycling. Special waste, on the other hand, comes from industrial, artisan, agricultural, hospital and other specific production activities. These wastes do not fall into the municipal waste categories and require special management<sup>4</sup>. While municipal wastes are often destined for recycling facilities or landfills, special wastes may require specific facilities for treatment and disposal, depending on their hazardous or non-hazardous nature.

A not insignificant distinction between the two categories of waste also concerns their economic management at the time they are sent to landfills, in fact the price of delivery in the case of municipal waste is often regulated while in the case of special industrial waste it is subject to market mechanisms and therefore this price is significantly affected by the differences between demand for storage and availability of suitable space or landfills willing to accept them.

The waste business cycle is the process that describes all stages of waste management, with the goal of minimizing environmental impact and maximizing resource recovery.

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3 Inert wastes are solid wastes that by their nature do not undergo any physical, chemical or biological transformation, that is, they do not dissolve, burn, degrade naturally and are not subject to physical or chemical reactions.

4 Examples of special wastes are industrial wastes, medical wastes (such as hospital wastes), processing wastes, hazardous wastes (such as solvents, paints, used oils), and materials contaminated with toxic or hazardous substances with specialized facilities and procedures for treatment and disposal, such as incinerators or licensed landfills. They are regulated by special waste legislation. Testo Unico Ambientale (TUA), DLgs. 152/2006 and subsequent amendments.

It is a complex system (in a mathematical sense)<sup>5</sup>. In line with circular economy policies, the waste economic cycle aims to close the life “circuit” of materials by reducing waste, reusing resources and, when possible, recycling materials for other uses. The waste economic cycle is divided into several stages, which include production, collection, transportation, treatment, recycling, energy recovery and, finally, disposal. Each stage involves economic and management activities that can involve both the public and private sectors.

In this paper we will deal in a privileged way with waste disposal in a particular type of landfill, the sustainable landfill, and then make a reflection on the impact that this landfill can have on the network of SMEs. The landfill is sustainable only if all (industrial) necessary pre-treatment and in-situ treatment of the waste is carried out in order to achieve optimal target values, to be verified in the post management phase. The most relevant treatments to environmental sustainability are pretreatment prior to landfilling and in situ treatment<sup>6</sup>.

The aim is to contribute to the debate on waste management and its possible impact on the SME network with the intention of considering the waste cycle as an integrated service using the logical framework of network analysis. Providing for a sustainable landfill at the end of the cycle affects the entire upstream system generating a backward effect throughout the supply chain, changing the structure of the entire network. Its optimisation involves identifying critical nodes and bottlenecks that prevent the system from achieving a balance in line with circularity and sustainability, an issue that directly involves SMEs as both waste generators and users of secondary products created within the waste cycle presented as a network of services for the environment, adopting a specific management model.

The concept of the Integrated Waste Management As A Service understood as a network of firms with an environmental service function will be used (Seadon, 2006).

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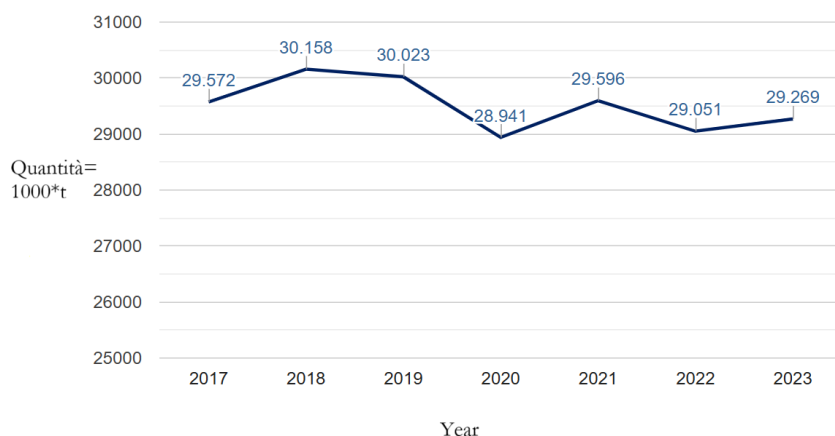
<sup>5</sup> Although there is no unanimous formal definition of it, it can be said that a complex system has certain basic characteristics: it is composed of a considerable number of interacting subsystems; it exhibits emergent characteristics, that is, ordered behaviors resulting from interactions among subsystems when the subsystems themselves or their connections exceed a certain number; it is highly structured; it exhibits feedback mechanisms (whereby an output response also becomes an input stimulus); and it is characterized by nonlinear dynamics that are sensitive to initial conditions (chaos). Thus, a complex system is characterized by a large number of variables, and observable behaviors depend to a large extent on how subsystems organize and interact with each other. [https://www.treccani.it/enciclopedia/sistema-complesso\\_%28Enciclopedia-della-Matematica%29/](https://www.treccani.it/enciclopedia/sistema-complesso_%28Enciclopedia-della-Matematica%29/).

<sup>6</sup> Among the pretreatments prior to landfilling we have mechanical biological, thermal and leaching treatment. Among those in situ we find leachate reticulation, forced aeration, natural convective aeration and leaching (Cossu et al., 2020).

### 3. The economic dimension of the waste sector and the role of SMEs

The objective of this section is to frame the sector that deals with waste management, in all its phases, to highlight its relevance from an economic point of view, and the opportunities for companies in terms of profitability. Nonetheless, the strategic role it takes on, as a provider of a whole range of environmental services, organized in networks, used by the entire industrial sector, should be highlighted. An initial survey of municipal waste production shows that at the national level, from 2017 to 2023, the trend is slightly downward, with values that seem to settle around 29 million tons (Fig. 1).

Fig 1. National municipal waste generation trend, years 2017-2023.



Source: <https://www.catasto-rifiuti.isprambiente.it/index.php?pg=ru>

At the per capita level in 2022 each Italian citizen produced 494 kilograms, a decrease of 1.6% compared to 2021<sup>7</sup>.

According to the 2024 Green Book edited by Fondazione Utilitatis and Utilitalia, Federazione Utilities, the municipal waste sector shows high dispersion, both horizontally and vertically: there is a very large number of operators that coexist with specialized operators in the upstream or downstream stages of the supply chain and a few large operators that close the management cycle. The sample considered<sup>8</sup> includes companies that deal exclusively with municipal solid waste management (thus single-utility, about 80 %), but also operators active in other sectors, such as energy, wa-

<sup>7</sup> These are always Ispra's data.

<sup>8</sup> The sample considered within the Green Book 2024 (Fondazione Utilitatis and Utilitalia, Federazione Utilities), consists of 552 companies.

ter and transportation (multi-utility, about 20%). The turnover generated in 2022 turns out to be 13 billion euros, corresponding to about 0.7% of GDP. The level of employment stands at 86000, accounting for 1.47% of those employed in the industrial sector.

The 2023 Althesys report shows that the waste management sector is strongly driven by technological innovation. Small and medium-sized companies remain, but the number of operators and the ability to generate value is growing over time<sup>9</sup>.

Confirming the picture outlined by the Green Book mentioned above, the Althesys report shows a picture favorable to the entry of new players into the market, also from other sectors. While in 2013 only operators from the waste sector were noted, in 2023 in addition to these there are also technological, financial, energy companies and utilities from other sectors. In the municipal waste sector, a large contribution comes from multi-utilities, which make 52.6 % of investments. Large groups consolidate and expand their position by acquiring other companies and expanding their activities<sup>10</sup>. The spatial distribution of managers, employees and turnover shows a higher concentration of companies and workers employed in the South (34% and 33 % respectively), while the highest percentage share in terms of turnover belongs to the Northwest, with 34%. More details are illustrated in Table 1.

Table 1. Sector estimates

|                                                      |           |                                   |                                                                                     |           |
|------------------------------------------------------|-----------|-----------------------------------|-------------------------------------------------------------------------------------|-----------|
| Turnover Environment sector<br>(mln/€)<br>13.056.711 |           | Impact on Italy's<br>GDP<br>0,73% | Coverage of the population<br>(of the considered sample of<br>216 companies)<br>62% |           |
| Employees<br>86.430                                  |           | Employees Italy<br>0,34%          | Employees industry<br>1,47%                                                         |           |
| Territorial Distribution                             |           |                                   |                                                                                     |           |
| Nord-Ovest                                           |           | Nord-Est                          | Centro                                                                              | Sud       |
| Companies                                            | 151       | 107                               | 107                                                                                 | 187       |
| Turnover                                             | 4.395.478 | 3.729.432                         | 2.227.775                                                                           | 2.704.024 |
| Employees                                            | 26.577    | 17.943                            | 13.264                                                                              | 28.645    |

Source: GreenBook, 2024.

9 The report also suggests that there is also an emerging gradual convergence in terms of objectives and results between the municipal and special waste sectors, and also some evolution of extended producer responsibility systems, leading to strategic alliances based on research and innovation. This makes it possible to optimize the recovery processes of complex materials, (such as some metals of great strategic value) and the production of energy sources (e.g., biomethane).

10 Data come from Althesys Report, 2023.

Very relevant information on the economic balance of management comes from the analysis of the income statement. Single-utility companies record, in 2022, 10.8 billion euros in total revenues with employment of 72000 people. The EBIT and EBITDA<sup>11</sup> indicators are positive and indicate that companies manage to adequately meet operating, financial, extraordinary and tax costs, with an aggregate profit of 612 million euros. Small companies are the most numerous in the sample (accounting for 51%), followed by medium-sized companies (24% of the total) and large, medium-large and top companies, which jointly occupy 26%. And it is the latter category that performs best with EBIT of 26 million, value added of 106 million versus a sample average of 1.8 million and 11 million respectively. The overall picture thus shows that indicators improve as firm size increases.

Current legislation, in order to maximize service efficiency and achieve economies of scale and scope, dictates certain obligations at the national level that lie in the identification of an administrative ambit, called ATO, within which networked local public services of general economic interest must be organized, and the establishment, for each ATO, of a governing body, the so-called EGATO<sup>12</sup>. In Italy, there appear to be 76, with some regions not yet having complied with the obligation to identify the ambit government<sup>13</sup>.

When considering the distribution of population and the municipalities by mode of entrustment, in-house management affects 30% of municipalities and 40% of the population: it is clear that this type of management affects relatively large municipalities. In contrast, in-house management on a population basis shows half the value (1%) of that of municipalities (2%), so it can be inferred that this mode involves predominantly small municipalities<sup>14</sup>.

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11 EBIT (Earnings Before Interest and Taxes) represents operating income, taking into account depreciation and amortization, but not interest and taxes. EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization), on the other hand, considers operating income before interest, taxes, depreciation and amortization.

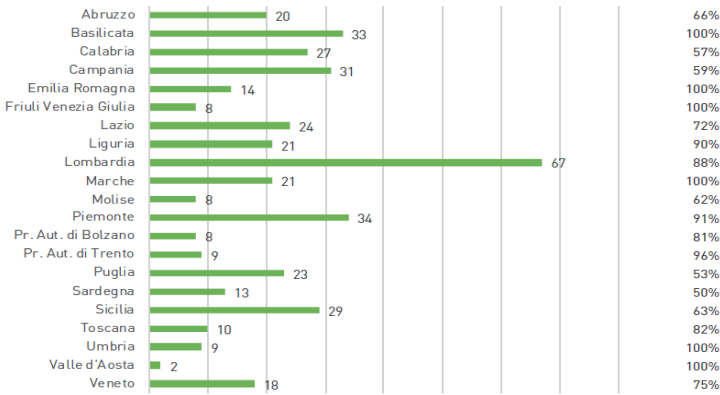
12 ATO stands for Ambito territoriale ottimale (Optimal territorial ambit), a geographic area defined by the region that is considered optimal for the management of a given local public service. EGATO stands for Ente di Governo dell'Ambito Territoriale Ottimale (Governing body of the Optimal territorial ambit) and represents the entity that organizes and manages the service in that ATO, ensuring that municipalities within the area participate and cooperate.

13 Figures reported by the 2019 Monitor-SPL National Report "Organizational and management structures of municipal waste service."

14 As part of the analysis of service entrustment, relating to the activities of collection, sweeping, transport, treatment and disposal of municipal waste, with a population coverage of 76% and 60% of municipalities, the 2019 Monitor-SPL National Report indicates that 803 active managements were identified, within which we find the entrustments arranged according to the regulations in force, the managements subject to direct entrustment, and the cases of service managed directly in economy by local authorities. At the national level, competitive bidding generally prevails (58%), followed then by in-house entrustments, to joint ventures, and management in economy.

It is extremely relevant to analyse the characteristics of corporate governance and the economic and financial performance of the sector<sup>15</sup>. Figure 2 shows the number of companies by region and the coverage of the population served. In terms of legal form, at the national level, corporations, S.R.L. and S.P.A. are predominant with shares of 41% and 30%, respectively, followed by single-member S.R.L. and single-member S.P.A., both with a value of 9%. This is followed by S.C.A.R.L.P.A. with 4% and a residual share that includes various types of companies<sup>16</sup>.

Fig. 2. Number of firms by region and coverage of population served.



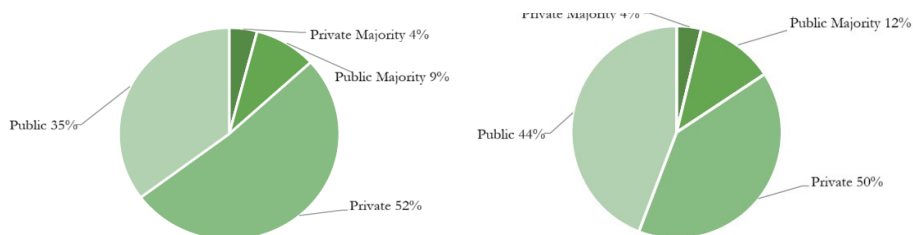
Source: 2019 Monitor-SPL National Report "Organizational and management structures of municipal waste service."

Ownership structures are assessed from the perspective of direct and indirect shareholdings (Figures 3A and 3B). The analysis shows a prevalence of private firms (52%), followed by public firms (35%), and then public-majority firms and private-majority firms. When we turn to second-tier ownership structures, we see a decrease in private enterprises (40%), with an increase in public enterprises instead (accounting for 44% of the total).

15 The sample taken for analysis in the Monitor-SPL national report consists of 326 companies whose balance sheet data are available in the Aida - BureauVanDijk database.

16 Such types of companies include: S.C.A.R.L., simplified S.R.L., consortium limited liability company, consortium cooperative companies, consortium limited liability companies.

Figures 3A and 3B. Ownership structures, direct shareholdings and indirect shareholdings.



Source: Monitor-SPL National Report "Organizational and management structures of municipal waste service," 2019

The nature of the entities holding public shareholdings shows the absolute predominance of municipal administrations (97%). The remainder is divided, in descending order, between mountain communities/unions, unions of municipalities, consortia, provinces, municipal pharmacies, metropolitan cities, and regions.

The dominant class in the direct shareholding of private companies is individual or family type shareholding, with a 63% share, followed by entrepreneurial type shareholding (32%) and mixed type shareholding (14%), which includes companies held by individuals or families and corporations<sup>17</sup>.

Generally, an enterprise defined as public, or majority public (always in indirect ownership structures) is considered to be in public control, and similarly, an enterprise defined as private or majority private is defined as being in private control. In Italy, most managers are in public control (56%) regardless of first-tier ownership structures. In addition, little shareholding (between 2 and 10 shareholders) seems to predominate, with an interesting presence of individual shareholding as well, both in publicly and privately controlled companies<sup>18</sup>.

Considering both aspects of contracts and ownership structures, it can be observed that in-house contracts and public ownership are predomi-

17 The analysis conducted on a geographic basis also shows some interesting aspects: in the Northwest, individual or family-type shareholding weighs about the same as entrepreneurial and mixed-type shareholding, and a similar situation is found for the Northeast. In the centre, on the other hand, individual or family-type shareholding clearly dominates (with about 82%), and similarly occurs in the south and islands, albeit at a lower value (65%).

18 It is important to point out that within governance there are also dynamics of corporate control, direct and indirect types. While in the first case it refers to the ownership of more than 50 % of the units or shares with which voting rights are associated, in the second case the individual has the majority of votes to appoint the board of directors and control body, so the parent company is in a position to direct the subsidiary's activities according to precise economic planning lines.

nantly found in larger companies located more frequently in the centre-north, while contracts awarded through tenders to private companies, which are more widespread in the south, are more fragmented and often concern individual segments of the service chain.

Some empirical examples regarding ownership structures are particularly interesting. Among these is the Contarina case<sup>19</sup>: this is a wholly publicly owned company currently responsible for waste management in 49 municipalities in the province of Treviso<sup>20</sup>. Today's Bacino Priula Board of Directors was formed through the merger of the two consortia, Priula and TV3, into a single legal entity. The strong institutional preference for proceeding with separate waste collection has enabled Contarina to improve its economic, environmental, and social performance, becoming a benchmark in Italy and worldwide for sustainable waste management, through a circular approach that respects the waste hierarchy: minimize, reuse, and recycle. The success of the business model—in which ownership structure and governance have played a decisive role—is clearly demonstrated by the excellent economic, environmental, and social results reported in the latest financial statements, with significant growth in revenue and investments<sup>21</sup>.

Further interesting empirical evidence is provided by Cinquegrana et al. (2016), who analyze the performance of public and private companies in the water and sanitation sectors (as recorded in Istat's ASIA database) over the three-year period from 2008 to 2010<sup>22</sup>. The results show that public com-

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19 In 2025, it received the prestigious Green Leaf Award from the European Commission as a model of the circular economy, with low rates of landfill disposal (4.2%) and incineration (8.7%) and a high recycling rate (86.8%). Detailed information about the Contarina case is given in the book edited by Romano (2024) relating to the effective management and good governance of local public service companies, with distinctive features and critical success factors of wholly publicly owned companies.

20 Initially, in 1989, the company had mixed public-private ownership, albeit with a public majority. The private sector had been brought in to finance the plant investment, with the investment's amortization funded through user fees. The Priula intermunicipal consortium significantly expanded the number of participating municipalities over time, with a strong and shared preference for separate waste collection, a policy not supported by the private partner's management. This led to remunicipalization, with the Priula consortium purchasing the private partner's shares: the conviction of mayors and administrators was rooted in the need for a company capable of prioritizing environmental and economic considerations in its decisions, with a clear understanding of the region's needs to minimize the reliance on landfills and incinerators. This choice prevailed over the private sector's objective, which was instead focused on maximizing profit margins and the distribution of dividends.

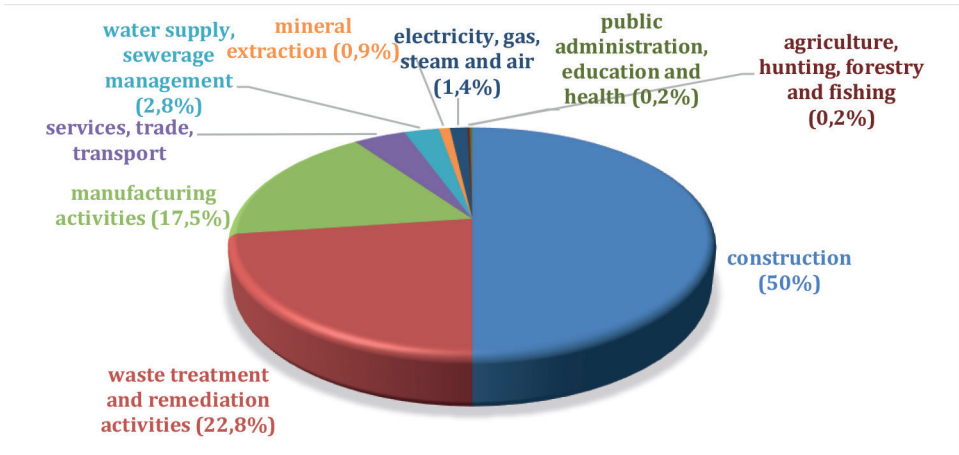
21 Please refer to Romano's book (2024), "Good Management and Good Governance of Local Public Service Companies", specifically Chapter 5, which analyzes the Contarina case. The data show an increase in revenue from 79 million to 97 million euros between 2017 and 2023, an EBITDA margin rising from 15.2% to 18.5%, and investments increasing by approximately 30%, from 15 million in 2017 to 21 million in 2023.

22 Specifically, the study is based on estimating a cost frontier and measuring the distance between

panies are slightly less efficient than private ones and that the differences are most pronounced in the case of large companies, while mixed public-private companies perform substantially similarly to those that are wholly publicly owned. The analysis also focuses on various economic and financial performance indicators<sup>23</sup>: overall, public companies are less profitable than private companies. However, labor productivity in public companies is not lower than that of private companies, and value added per worker is often higher in public companies than in private companies. The authors attribute the higher profitability of private companies to greater control over labor costs.

The special waste sector has a significantly higher output than municipal waste with a value in 2022 of 161 million tons<sup>24</sup>. The largest contribution comes from the building and construction sector, which with a production of about 80.8 million tons reaches half of the total production (Fig. 4). The production of special non-hazardous waste follows exactly the same breakdown, making up as much as 94% of total production.

Figure 4. Breakdown in % of total special waste production, by economic activity, year 2022



Source: ISPRA

en each firm's cost function and the frontier. The analysis uses firm size, the technological intensity of production (measured by the labour cost share) and regional location (North, South and Islands) as control variables.

23 The considered indicators are the following: 6 for productivity, 3 for profitability, 10 for cost structure, 3 relating to liquidity indicators, and 4 for growth.

24 The reference data are again ISPRA (Report 2024). This value also includes the amount of special waste from the treatment of municipal waste.

The distribution of such waste across the country reveals a strong concentration in northern Italy, compared with a more developed industrial fabric (92.7 million tons or 57.4%), followed by the centre (28.1 million tons, 17.4 % of the total) and then southern Italy (with 40.6 million tons or 25.2 %).

The parcelization of service that exists for municipal waste is also found for special waste. The considered companies<sup>25</sup> generate a production value of 4.7 billion euros. Large operators absorb 72% of the value of the supply chain, but in all stages (collection, treatment, recovery and disposal) small and medium-sized operators are active, accounting for 83% of the total. Investments reach 218 billion euros and are a sign of a rapidly evolving sector.

It is interesting to note that the heterogeneity of economic and management structures is accompanied by a strong differentiation in plant engineering as well, detectable both at the sectoral and geographic levels. Specifically, waste-to-energy plants are prevalent in northern Italian regions, as are plants for organic waste. For this last type of waste, an estimate of the needs for 2035 shows a surplus for northern regions and a more or less marked deficit for southern regions depending on the scenario considered of high or low waste production<sup>26</sup>.

#### **4. Landfills are necessary: a simplified model**

According to Legislative Decree No. 36 of January 13, 2003, which implements European Directive 99/31/EC, it is possible to distinguish landfills into 3 categories: for inert waste; for non-hazardous waste; and for hazardous waste. These facilities must meet certain technical and construction requirements and comply with specific standards because different wastes have different effects on the environment.

In Italy, according to the most recent data, there are 261 total landfills in operation<sup>27</sup>. Of these, 118 are landfills for inert waste, 132 for non-hazardous waste and 11 for hazardous waste. Municipal waste landfills fall mainly into the non-hazardous waste category. Special waste, both hazardous and non-hazardous, can be delivered to specific or mixed landfills, depending on permits and the type of treatment required. These facilities are distributed throughout the country, with a greater concentration in the North, which hosts about 45 percent of the total facilities.

The acronym NIMBY (Not In My Backyard) is well known and has un-

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<sup>25</sup> Althesys report of 2023 takes into consideration 59 companies.

<sup>26</sup> Ibidem.

<sup>27</sup> The source is ISPRA, Rapporto Rifiuti Speciali, Edizione 2024, dati di sintesi.

doubtedly been at the centre of debate whenever a community has found itself deciding whether or not to approve the siting on its territory of a facility intended to treat waste, be it a biodigester, incinerator, or landfill<sup>28</sup>. Everyone produces waste and the amount of waste produced is often positively correlated with the level of consumption.

There is a need to return to thinking about the waste management cycle by trying to obtain a model that allows for the pursuit of two distinct objectives: that of efficient technical management of waste along with that of adequate economic efficiency by highlighting all the constraints, of a technical, regulatory and economic-financial nature, that are part of the problem. In this perspective, the issue of landfill creation and management within the organization of the entire waste cycle remains central as well as the construction of an integrated waste management model that takes into account the physical, administrative, social and economic specificities of the territories.

Assume the existence of a closed democratic administrative reality  $A$ , where closed means located in a territory that has no trade with the outside world at least as far as waste management is concerned. This administration has within it consumers ( $C$ ), generating enterprises of different nature ( $I_p$ ), trade and service sectors ( $S_c$ ) each of which produces as a result of its activity a certain waste stream distinguished into municipal waste ( $R_u$ ) and special waste ( $R_s$ ) which, as mentioned above, must be managed internally in  $A$ . The  $R_u$  produced will be mainly a function of the activities of  $C$  and  $S_c$  while  $R_s$  will be a function of  $S_c$  and  $I_p$ . For now, the classic distinction between hazardous and non-hazardous waste is left out.  $C$ ,  $I_p$ ,  $S_c$ ,  $R_u$ , and  $R_s$  can be considered carriers, that is, they can be composed of elements or agents with different characteristics. Therefore:

$$R_u = f(C, S_c) \text{ and } R_s = g(S_c, I_p)$$

The waste will have to be stored, in the simplest scenario, within a dedicated site i.e. a landfill ( $D$ ). Since the landfill is a place not desired by the administrative reality in question, or rather not wanted by the community living there, the process of identifying the location in which to locate the landfill is tortuous and the level of social cost will be proportional to the population density of  $A$  or rather to some relationship between the numerosity of the community living in  $A$  and the availability of physical space in  $A$  suitable for hosting a landfill.

If the siting of the landfill is a costly process in terms of social consensus,

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<sup>28</sup> For the definition and origin of the acronym Nimby, see <https://www.britannica.com/topic/NIMBY>.

the creation and management of the landfill become a critical step. Indeed, since the landfill is nothing more than a container that can accommodate waste, a relevant issue is to decide what the physical life of the landfill should be, i.e., its saturation time. Obviously, the mode of delivery is related to economic, environmental and social costs that are a major part of the problem under analysis. At this first stage, the public or private mode of landfill management is left out. The problem thus formulated unequivocally defines, given the capacity of the landfill ( $C_D$ ) and the flow of the various wastes produced in  $A$ , the time by which the landfill will reach saturation, and a new storage site will therefore need to be identified.

Given  $C_D$  and the waste stream  $F(R_u; R_s)$ , the physical lifetime of the landfill ( $Tvf$ ) in the absence of intervention is determined:

Sub  $C_D$  and  $F(R_u; R_s)$ ,  $Tvf$  is determined

Once the  $Tvf$  interval is exhausted, a new landfill must be available that can accommodate the waste stream produced within  $A$ . Since implanting and operating a landfill also has financial costs ( $Cost$ ) the problem also takes on an economic dimension. These costs must be borne by the community inhabiting  $A$  either through a general taxation ( $T$ ) or through a form of pricing  $t$  that affects  $R_u$  and  $R_s$  delivered to the landfill. So, it must at least be:

$$Cost = t_{Ru} + t_{Rs} + T \text{ with } t \text{ and } T \geq 0$$

Note that any social costs (environmental, health, etc.) associated with the presence of  $D$  are not taken into account for the time being. Note also that we do not go into the question of whether  $D$  is public or private in nature: in fact, in a completely private context, the coverage of  $Cost$  could be left to market rules as is partly the case today for  $R_s$ .

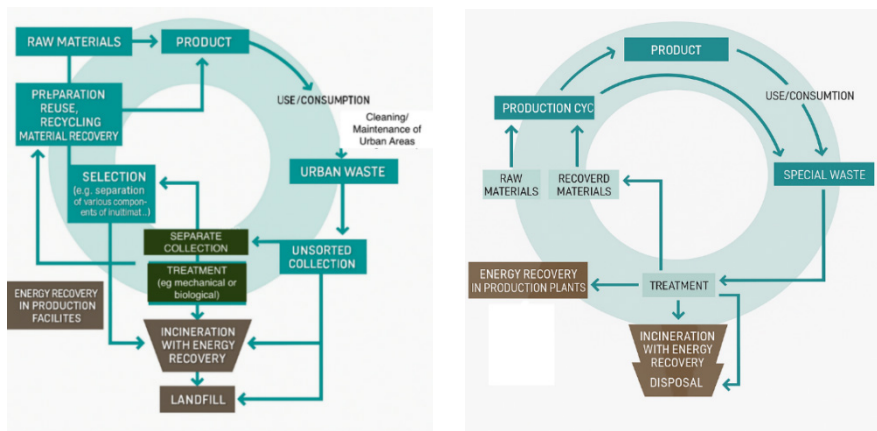
To lengthen the  $Tvf$  interval, the only option is to put in place interventions between the production and storage phases. These may be reduction in the production of  $R_u$  and  $R_s$  streams, treatment, recycling and reuse as seen above. Only if the final flow is reduced to zero will it be possible to dispense with landfilling otherwise it will remain necessary. The diagrams in Figs. 5 and 6 show a classic representation of the possible interventions that can be put in place to try to lengthen the  $Tvf$  value<sup>29</sup>. It should be pointed out at the outset that the municipal waste cycle in the figure does not break down, at the stage referred to as "sorting," the components of

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29 The source of the two figures is authoritative: it is, in fact, the Ispra Database on Municipal and Special Waste; <https://www.catasto-rifiuti.isprambiente.it/index.php?pg=&width=1352&height=878>.

wet, plastic, paper and glass. These types of materials are subject to very different industrial treatment processes. The location and management of some of these facilities present problems comparable to those of a landfill, increasing the degree of complexity of the system. Consider, for example, biodigesters used to treat the wet part of municipal waste<sup>30</sup>. Figures 5 and 6 essentially illustrate the entire supply chain of small and medium-sized enterprises involved in the waste management cycle. This includes companies directly engaged in the treatment and processing of raw waste, as well as those that generate it (the  $I_p$ 's in the simplified model), which need to store the residues from their production activities in some way.

Figs. 5 and Fig. 6. The cycle of municipal (left) and special (right) waste reduction and treatment



Source: Ispra

Some observations can be made in keeping with the proposed simplified model:

- (a) the activity of using and consuming goods always generates both municipal waste and special waste;
- (b) business activity (production cycle) generates special waste;
- (c) the design of environmentally friendly products can reduce the

30 The treatment of municipal waste can also generate special waste. Municipal waste, once collected, is often subjected to sorting, treatment and disposal processes that can produce waste or residues classified as special waste. These may include: (a) sorting waste, in fact during the sorting stage of municipal waste, materials such as metals, non-recyclable plastics or other components may be separated and classified as special waste; (b) ash and slag because if municipal waste is incinerated, the slag resulting from the combustion process becomes special waste, often hazardous due to the presence of toxic substances; (c) sewage sludge from the wastewater treatment processes of waste disposal plants; (d) chemical wastes; and (e) wastes from treatment plants related to maintenance operations or simple operation (such as contaminated filters, waste oil or contaminated materials).

amount of waste sent to landfills in accordance with the principles of the circular economy, as it simplifies the sorting and treatment stages;

(d) waste treatment allows on the one hand to recover materials but on the other hand inevitably produces special waste because a treatment process is very unlikely to have 100 percent efficiency, and the level of efficiency takes different degrees depending on whether we are talking about plastics, paper, or glass;

(e) waste treatment that ends in energy recovery stages in production plants (e.g., Solid Secondary Fuel, CSS, used to generate energy in cement plants) or incineration for the sole purpose of producing energy also has a final stage that requires the disposal and storage of special waste, specifically ash<sup>31</sup>;

(f) the landfill remains the indispensable final step in any intermediate process created for the purpose of reducing the amount of residue produced in the simplified model in order to lengthen its physical life, i.e., the variable  $T_{vj}$ .

All production activities generate special waste including treatment actions resulting from separate waste collection. This is often not made clear in the most common presentations of the waste cycle since in the information given to the public the focus is placed on municipal waste and the techniques that enable its reduction. The landfilling phase of which disposal is also a part is represented, even in visual terms, as residual although always present and indispensable.

According to this simplified model that sees a closed administrative unit in the absence of economic constraints, waste cycle management is transformed into a technical problem that can be summarized as follows.

### *Proposition 1*

*The lifetime of a landfill is a function of the actions that a closed administrative unit takes upstream of the final storage phase. These actions will be more incisive the greater the community's aversion to the creation of landfills and the less space available suitable for the placement of a landfill.*

This is clearly a simplified model, which could be enriched by loosening

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31 CSS stands for Secondary Solid Fuel, which is the solid fuel produced from waste that meets the classification and speciation characteristics identified in the technical standards UNI CEN/TS 15359 as amended and supplemented. CSS finds application in various industrial sectors, including cement factories, incinerators, and thermal power plants. The acronym RDF stands for Refuse Derived Fuel while CSS stands for Secondary Solid Fuel. While CSS is specifically produced for use as a fuel in industrial plants with specific energy needs, RDF can have a wider range of applications, including the production of electricity and heat (<https://www.valli-ambiente.it/news/classificazione-dei-rifiuti-una-semplificazione-guida-alluso>). Valli Ambiente).

some constraints. The first is that administrative unit  $A$  is not closed but open to exchange with the outside world, specifically with other administrative units that may be domestic or foreign. The second lies in the fact that the management of the waste cycle has economic constraints, that is, there is the issue of its cost-effectiveness, which reflects the choice of possible ownership models within the cycle. In this paper we will follow this last.

## 5. The relationship between the physical and economic life of a landfill site

The economic life of a landfill refers to the period during which the facility is able to operate in a financially sustainable manner within technical and regulatory constraints. This concept includes several aspects:

(a) the assessment of investment and operating costs: plant and operating expenses for waste treatment, environmental monitoring, personnel, maintenance and safety;

(b) revenues from waste delivery (fees paid by municipalities or companies) and, in some cases, from energy production (e.g., through biogas capture) plus any subsidies;

(c) environmental regulations, such as, for example, those for compliance with waste, emissions, and remediation regulations, which directly affect the duration of the landfill's operations as they affect both costs and revenues;

(d) the post-management phase. Indeed, even after closure, a landfill has costs associated with environmental monitoring and maintenance to avoid negative impacts on soil, air, and groundwater. This period can last for decades.

The simplified model introduced in Section 4 established that landfill ( $D$ ) is a necessary element of the waste cycle, acting as a "container" whose physical life ( $T_{vf}$ ) is determined by its defined capacity ( $CD$ ) and the incoming waste stream  $F(R_u; R_s)$ . To extend the  $T_{vf}$  interval, the only option is to implement effective actions upstream of the final storage phase, such as production reduction, treatment, recycling and reuse. The model shows that, in a context without explicit initial economic constraints,  $T_{vf}$  depends on the effectiveness of these actions and the extent to which the administrative community is averse to the creation of new landfills. However, to analyse the real need for landfills, the model must be integrated with the financial dimension, as the construction and operation of the landfill generate financial costs ( $Cost$ ). The economic life of a landfill refers specifically to the period during which the facility can operate in a financially sustainable manner, taking into account investment and operating costs, revenues from landfill fees ( $t$ ) and any subsidies ( $T$ ). The break-even point ( $BEP$ ) is

the key metric for assessing economic life.

The relationship between physical life and economic life is not always direct: financial sustainability depends not only on fixed costs ( $FC$ ) and variable costs ( $VC$ ), but also on the necessary inclusion of external costs ( $EC$ ), whether environmental or social, in order to obtain a comprehensive economic analysis. The ownership structure and economic objectives of the operator (profit maximisation for private individuals versus potential  $Tvf$  maximisation for public bodies) become decisive here. A private operator, for example, could reach break-even point before physical saturation, and then maximise profits, removing the incentive to extend the  $Tvf$  because this would mean postponing profit flow; he could also have an incentive to externalise environmental costs to anticipate the break-even. Therefore, optimal waste cycle management, with the landfill as the binding end node, must balance physical life (technical capacity and social imperative of waste reduction) with economic life (financial sustainability and internalisation of costs, influenced by the ownership regime), as the ownership structure can reduce physical life if the objective is profit maximisation, allowing the externalisation of social and environmental costs.

The  $BEP$  of any investment is obtained from the application of a formula, which in its simplest version can be stated as follows:

$$BEP = CF / (PV - CVU)$$

where  $CF$  are the fixed costs,  $PV$  the selling price of the good or service, and  $CVU$  the variable cost per unit, i.e., the variable cost input to a single unit of product. The analysis for calculating  $BPE$  is effective only if one is aware of the firm's fixed costs and variable costs. The value in parentheses,  $(PV - CVU)$ , indicates the contribution margin, i.e., how much the fixed costs affect the final selling price, while the sum of fixed and variable costs represents total costs:  $CT = CF + CV$  previously referred to, in the case of the landfill, as  $Cost$ . The selling price is actually the waste delivery fee  $t$  (which can be different for municipal or special waste:  $t_{Ru}$  and  $t_{Rs}$ ). Simple application of the formula tells us how many units are produced, in the case of the landfill, how many tons of waste, leading to the break-even point of the investment made. Then profits will begin to be made.

As it has been guessed from the presentation of the simplified model, tariffs can also be such that cost coverage can be through external financial support. That is, given the formula  $Cost = t_{Ru} + t_{Rs} + T$ , if  $T > 0$  then it means that the public entity breaks even on the plant i.e. provides financial coverage, since it was assumed that  $T$  are amounts from general taxation. If  $T = 0$  then the landfill is breaking even while if  $Cost < t_{Ru} + t_{Rs}$ , a profit is being generated, and its destination may be different in the case of public, private

or mixed ownership of the plant.

It is important to note that if there are external costs ( $C_{est}$ ) associated with the operation of the landfill in order to have a comprehensive economic analysis these will have to be considered as a component of  $Cost$ :

$$Cost = CF + CV + C_{est}$$

The nature of external costs can be either environmental or social. The break-even point of the landfill will therefore have to be the following:

$$BEP = (CF + C_{est}) / (PV - CVU).$$

Without the evaluation of external costs any consideration of whether to lengthen  $T_{vf}$  or to build landfills with very low environmental impact (the sustainable landfills discussed in the next section), is of little interest since the decision to build a landfill takes on the same characteristics as any financial investment. It is the environmental component and the need to use precautionary approaches that make the issue of sustainable landfill construction and management peculiar.

As mentioned before, if the landfill were private, the break-even point could occur before the landfill is fully saturated. In this case, profits could be generated. Indeed, this is the condition for having an investment by a private party, which will obviously have an incentive to minimize the  $Cost$  variable by acting as much as possible on its  $CF$ ,  $CV$  and  $C_{est}$  components. This can lead both to greater efficiency and to an attempt to disregard any external costs, that is, to externalize the environmental damage that the landfill may produce.

Whether the landfill would be publicly or mixed ownership and the ownership has profit distribution as its goal is relevant. In the case of public ownership, one might expect a greater focus on minimizing external costs but this is not a given. It also appears, as one of the most relevant issues, both the amount of fees that are paid for waste delivery and the economic regime, market and nonmarket, to which they are subjected. It should be recalled that special waste falls under the free market so that the transfer prices respond to the dynamics of supply and demand for storage while the transfer fees for municipal waste are regulated<sup>32</sup>.

Paradoxically, in a situation where in administrative area  $A$  the demand for special waste storage was greater than the supply of storage, a private special waste landfill could define its  $T_{vf}$  variable solely by maximizing

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32 References on how the municipal waste tariff regulation system works can be found in ARERA's consultation document, Definition of the waste tariff method for the second regulatory period (MTR-2), July 2, 2021.

its profits. Once the permit to build the facility is obtained, the social component of *Cest* is nullified as is the incentive to stretch *T<sub>vf</sub>*. In light of the considerations so far, the previous proposition can be supplemented as follows.

*Proposition 2*

*The lifetime of a landfill is a function of the actions that a closed administrative unit takes upstream of the final storage phase. These actions will be more incisive the greater the community's aversion to landfill creation and the less space available suitable for the placement of a landfill. Ownership structure reduces the physical lifespan of a landfill to the extent that ownership can afford to externalize environmental and social costs and operates with the intent of maximizing its profits.*

If we were in the presence of a public operator running the plant with the aim of maximizing *T<sub>vf</sub>* then all actions would be aimed at extending the life of the landfill. The actions would be quite different from a profit-maximizing perspective. The landfill, as the final collector of the residue that cannot be otherwise managed except through storage, is the stringent constraint from which to start in an attempt to describe all upstream actions aimed at reducing the waste delivered to it. So, the waste cycle, in fact, depends on the capacity and characteristics of landfills and the regulatory constraints that govern them.

The picture sees its degree of complexity increase if one seeks to achieve the goal of reducing the waste stream to be stored through intermediate facilities such as biodigesters, incinerators, separation and treatment plants, and recycling facilities, which, created with the aim of reducing storage needs, replicate in whole or in part the problems that have been highlighted for landfills. That is, they will have their own well-defined physical capacity, their own need for cost-effectiveness and their own BEP, their management depends on the ownership regime, they may generate external costs that must be minimized and internalized in the production process, and they are subject to a problem of acceptability by the communities that must host them. In a way they are born to reduce the economic-social-environmental problems of landfills but end up replicating them although with different characteristics.

Hence the need to conceive of the waste cycle as an integrated system that ultimately provides a social and environmental service, as in the case of integrated mobility systems. What is the best management model for the entire integrated system depends on the set of factors previously described. Can it be left to spontaneous organization? Can optimal administrative areas be defined? How much of the process needs to be regulated? The landfill appears as the final collector of the entire process, which de-

pend, in a backward optimization perspective, on the choices made about its technical and economic characteristics. The “sustainable landfill” represents the most modern and ecological vision that a final waste storage system should have in an economy that actually wants to call itself circular.

## **6. The waste cycle as a network of enterprises and services for the environment: the IWaMAAS network**

Network Analysis (NA) is an interdisciplinary methodological approach that studies the relationships between entities (called nodes) within a network. These entities can be individuals, organizations, computers, genes, or any other unit that can be connected to others. The connections between nodes are called links or arcs, and the overall structure of the network is represented as a graph, composed of nodes and links<sup>33</sup>.

NA can also be applied to the waste cycle to analyze and optimize material flows, relationships among the numerous enterprises involved, and the overall structure of the waste management system. This approach can help identify inefficiencies in the system, improve its sustainability and also its environmental sustainability, and support strategic decisions. It can be used for modelling the waste management system understood as a network. Nodes represent the actors or stages in the waste cycle, such as waste producers (e.g., households, businesses); collection centres (e.g., ecological islands, drop-off points); treatment facilities (e.g., incinerators, biodigesters, recycling plants, landfills); and markets for recycled materials. Links, on the other hand, represent the flows of waste or materials between nodes (e.g., transportation of waste from a residential area to a recycling plant). A network can show how waste is collected, transported, processed, and

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<sup>33</sup> NA uses a number of key concepts. Nodes (Vertices) are the basic units of the network, representing actors or entities. Links (Arcs) are the connections between nodes, which can be direct or indirect, weighted or unweighted. Degrees, on the other hand, are the number of connections a node has. A node with many links is often considered “central” within the network under analysis. Thus, Centrality is defined as a measure that identifies the importance of a node in the network (e.g., degree, betweenness, closeness). References to recent scientific literature are: Barabási (2016). *Network Science*. Cambridge University Press. This book provides a comprehensive overview of network science, with practical and theoretical examples. Newman (2018). *Networks*. Oxford University Press. A text covering both the theoretical foundations and practical applications of network analysis. Borgatti et al. (2009). *Network analysis in the social sciences*. An article exploring the use of network analysis in the social sciences. Lusher et al. (2013). *Exponential Random Graph Models for Social Networks: Theory, Methods, and Applications*. Cambridge University Press. An advanced text that focuses on statistical models for the analysis of social networks. Cinelli et al. (2021). The echo chamber effect on social media. A recent article using network analysis to study the echo chamber effect on social media. Bardoscia et al. (2021). The physics of financial networks. A review of applications of network analysis in the context of financial networks.

returned to the production cycle<sup>34</sup>.

NA can be used to track and quantify waste flows through the system (material flow analysis). This would help identify bottlenecks (e.g., overloaded plants), optimize transport routes to reduce costs and environmental impact, and also assess the efficiency of recycling and material recovery. Through network models, alternative scenarios can be simulated, such as the introduction of new treatment plants or increased separate collection. Then NA can reveal which actors are most central in the waste management system, and for example, identify the most critical treatment plants or major waste generators (Centrality) or group (in Community) actors with similar functions (e.g., municipalities sharing a treatment plant). If a recycling plant were highly central, its closure could have a significant impact on the entire system. Through network analysis, one can try to optimize logistics or costs. In fact, by applying optimization algorithms to networks, it is possible to reduce waste transport distances, minimize operating costs, and improve overall system efficiency (e.g., minimum route algorithms can be used to plan waste collection routes).

From the above, we can see how NA can be combined with tools for life cycle assessment of various facilities (Life Cycle Analysis or LCA) to quantify the environmental impact of waste streams, identify the stages of the cycle with the greatest impact (e.g., CO<sub>2</sub> emissions from transport), and propose more sustainable solutions (e.g., increasing recycling or reducing landfilling). It allows studying the resilience of the collection and storage system with respect to potential facility failures, sudden increases in waste generation (e.g., during special events or emergencies), regulatory changes. NA can support the transition to a circular economy by both mapping recycled and reusable material flows and identifying opportunities to close material loops (e.g., linking waste producers with recycled material users)<sup>35</sup>.

Considering integrated waste cycle management as a network that can perform an environmental service function offers a reading perspective underlying which there are a number of issues that deserve to be explored (Integrated Waste Management As A Service). First and foremost, it is a service that should be aimed at reducing the impact of human activities on the environment and therefore managed with its sustainability in mind given that its purpose should be to reduce landfilling and also the impact that landfills will have on future generations (the importance of the sustainable landfill concept returns). However, it cannot be ruled out that the

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34 For an application see Cerqueti et al. (2021). Municipal waste management. A complex network approach with an application to Italy.

35 For some examples see: Liao et al. (2023); Chertow (2000); Brunner and Rechberger (2016); Ghisellini et al. (2016).

service can be provided with other objectives such as profit maximization.

The scientifically and technically relevant issue is that it is not just one network but a series of overlapping industrial networks that can be analyzed, and even managed, each in isolation or as a structure of connected and interdependent networks. For example, the waste collection cycle can be viewed as a network of nodes and links that include waste generation points, sorting points, treatment points, recovery facilities for processing, reuse or recycling, and disposal nodes for non-recoverable residues that may be incinerators or landfills. In this example, the network can be broken down into sub-networks because plastic, glass, paper, aluminium do not necessarily always follow the same routes but may be part of different structures. Each of these networks produces, at some stage, special waste destined to enter as input into a dedicated network (the special waste network, for example) composed of its nodes and links. The same reasoning can be made for municipal waste. This is another network with its nodes and links such as households, municipalities, sorting and pretreatment centres, biodigesters, and landfills.

This networked system, which we might call “multi-layered,” sees the presence of actors managed under private, public, or mixed ownership with economic objectives that may differ depending on the objective functions of the property. Given the fragmented nature of the sector, characterised by a large number of SMEs (Small and Medium-sized Enterprises), network analysis (NA) plays a crucial role in integration, providing the analytical lens needed to effectively map and coordinate the huge number of operators. SMEs, being active in all stages of the chain, particularly in special waste (representing 83% of operators), are themselves the vital nodes of these industrial networks. Improving integration through NA means not only optimising the flow of materials but also identifying how individual SMEs can maximise the business opportunities and profitability offered by the transition to a circular economy, acting as providers of environmental services. The system could be optimized according to its physical, economic, or hybrid sustainability.

The complexity of the system is apparent but, as mentioned above, if the aim were to conceive of the entire waste cycle as a service for environmental sustainability, it should be studied as a single system trying to identify the best ownership, economic and spatial management according to its environmental sustainability. This would be the first best.

### *Proposition 3*

*The integrated waste cycle is a system of integrated and overlapping networks with the landfill as its final storage node.*

*Proposition 4*

*If the landfill is a sustainable landfill its technical-economic characteristics serve as a constraint in the construction of the entire waste cycle management network.*

## **7. Final Considerations**

This paper has explored the waste management cycle taking into account the concepts of sustainability, economic efficiency, and systemic integration, proposing a novel conceptual and analytical framework to understand the role of the sustainable landfill within a broader industrial network of environmental services. The major idea developed throughout the work is that landfilling, often considered the least desirable solution in the waste hierarchy, must be rethought, not eliminated, as a crucial infrastructural and functional component of a circular economy. In this context, the sustainable landfill is not merely an endpoint, but a decisive node that influences upstream processes, reshaping the operational and strategic dynamics of the entire waste cycle. The choice to build sustainable landfills can have relevant impacts on the entire supply chain of small and medium-sized enterprises that are part of the waste management chain and offer profitable opportunities for those that want to enter in this sector.

The simplified model proposed in the paper tries to link the physical lifetime of a landfill ( $T_{vf}$ ) to the collective capacity of a community or administrative unit to implement upstream interventions—such as waste reduction, pre-treatment, and reuse. Whenever the model is integrated within an economic perspective, it further reveals how ownership regimes (public, private, or mixed) significantly affect both the physical and economic longevity of landfills. More specifically, it shows that when ownership structures allow for the externalization of environmental and social costs, the incentives to maximize the operational life and environmental performance of landfills are weakened.

Moreover, the analysis presented highlights the growing economic weight of the waste management sector, characterized by increasing investments and a trend toward technological and organizational innovation. In this fragmented yet evolving landscape, SMEs play a pivotal role, not only as waste producers but as active participants and service providers within the circular economy paradigm. The involvement of businesses in waste cycle management, with a view to creating a sustainable landfill site, could have significant implications in terms of incentives to develop technological innovation projects for waste reduction, implement alternative production processes that use waste that cannot be disposed of, and invest in industrial design to improve recycling opportunities and thus minimise waste.

The introduction of network analysis as a methodological tool has allowed us to reinterpret the waste cycle as a complex, multilayered system of interconnected nodes and flows, what we have termed the IWaMAAS model. Through this model it is possible to acknowledge the complexity of managing differentiated waste streams (municipal, special, hazardous) but also to emphasise the need for strategic coordination across actors, sectors, and territories. It identifies central nodes, critical bottlenecks, and structural inefficiencies, so providing a robust foundation for decision-making processes, with the aim of maximizing system resilience and minimizing environmental impact.

In this vision, the sustainable landfill becomes both a constraint and a driver of innovation: a constraint, in the sense that it imposes rigorous environmental standards and long-time horizons; a driver, because it stimulates the development of upstream infrastructure, services, and governance models aligned with sustainability goals. Its implementation - technically sophisticated, socially negotiated, and economically evaluated - should be considered not as an unfortunate necessity but as a civic infrastructure of public interest, on par with transportation networks or energy grids.

In our vision sustainable landfills, far from being a residual or obsolete solution, are essential in constructing an effective and environmentally sound waste management system. Their integration into a broader circular economy strategy must be carefully planned, regulated, and supported by public policies that should be based on transparency, long-term investment, and active participation from all stakeholders. SMEs are strongly called upon to take part in this process.

Ultimately, the debate on the sustainability of the waste cycle and the integration of the IWaMAAS model provide the basis for clearly distinguishing the functions of the sector and the related optimal ownership structures. The management of the waste cycle as an integrated and interconnected service, of which SMEs are a fundamental part, reveals that the ownership regime has a significant impact on both the physical life (*Tvf*) and the environmental performance of final disposal facilities. With regard to the final node, sustainable landfill, public ownership is strongly recommended. This preference stems from the very nature of the facility, which requires particularly long-time horizons and aims to minimise negative externalities and defend the interests of future generations. These objectives are ill-suited to private interests, which, operating to maximise profit, have an incentive to reduce *Tvf* if they can afford to externalise environmental and social costs (*Cest*).

The high initial cost and the tortuous administrative and socio-political process involved in locating a site, although discouraging for private investors, are costs that a public body is better placed to manage with a view to maximising sustainability. On the contrary, for the upstream stages of the

supply chain (treatment, recycling, recovery and reuse), there is enormous scope for private ownership and affiliated companies. These activities are those that require the most innovation and efficiency and offer great business and profit opportunities for SMEs, which are active in all stages of the chain, particularly in special waste. The decision to build sustainable landfills, although it seems to limit the space for private operators in the management of the final node, actually acts as an extraordinary incentive to build a real upstream industrial chain managed by private operators, focused on reducing the flow of waste entering the landfill. In conclusion, the sustainability of the entire system requires binding, long-term public management of the final stage (the sustainable landfill), which acts as both a constraint and a driver, and dynamic, market-oriented private management of all intermediate reduction and recovery services, where efficiency and value generation are maximised.

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| Legend of Symbols and Acronyms |                                                                         |                                                                                                        |
|--------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Symbol/<br>Acronym             | Definition (English)                                                    | Source Context                                                                                         |
| A                              | Closed administrative reality/<br>unit                                  | Simplified model setting                                                                               |
| IWaMAAS                        | Integrated Waste Management<br>As A Service                             | Management model based on network<br>analysis                                                          |
| NA                             | Network Analysis                                                        | Interdisciplinary methodological<br>approach                                                           |
| LCA                            | Life Cycle Analysis (or Life<br>Cycle Assessment)                       | Tool used to quantify environmental<br>impact                                                          |
| D                              | Landfill (Dedicated storage site)                                       | Final collection site for waste                                                                        |
| C                              | Consumers                                                               | Source of waste stream $R_u$                                                                           |
| $I_p$                          | Generating enterprises of<br>different nature (Industry/<br>Production) | Source of waste stream $R_s$                                                                           |
| $S_c$                          | Trade Sector                                                            | Source of waste stream $R_u$ and $R_s$                                                                 |
| $R_u$                          | Municipal waste                                                         | Waste stream                                                                                           |
| $R_s$                          | Special waste                                                           | Waste stream                                                                                           |
| $C_D$                          | Capacity of the landfill                                                | Physical limit of the landfill container                                                               |
| $F(R_u; R_s)$                  | Waste stream (Flow of Municipal<br>and Special waste)                   | Total incoming waste volume                                                                            |
| $T_{vf}$                       | Physical lifetime of the landfill                                       | Saturation time of the landfill                                                                        |
| Cost                           | Financial costs of implanting<br>and operating a landfill               | Total costs, $CT = C_F + C_V$                                                                          |
| $t$                            | Form of pricing / fee                                                   | Fee affecting $R_u$ and $R_s$ delivered to the<br>landfill                                             |
| T                              | General taxation (or financial<br>support)                              | Amounts from general taxation used for<br>cost coverage                                                |
| $t_{Ru}, t_{Rs}$               | Transfer fees for Municipal and<br>Special waste                        | Specific delivery prices (derived from $t$ )                                                           |
| $C_{est}$                      | External costs (Environmental or<br>Social)                             | Costs associated with landfill operation<br>that<br>must be internalized for comprehensive<br>analysis |

|              |                                                     |                                                                  |
|--------------|-----------------------------------------------------|------------------------------------------------------------------|
| $C_F$        | Fixed costs                                         | Costs independent of the quantity produced                       |
| $C_V$        | Variable costs                                      | Costs that vary with the volume of activity                      |
| $C_{vu}$     | Variable cost per unit                              | Variable cost input to a single unit of product                  |
| $P_v$        | Selling price of the good or service                | Equivalent to the waste delivery fee $t$ in the landfill context |
| <b>ATO</b>   | Administrative Ambit (Ambito Territoriale Ottimale) | Administrative area defined for organizing public services       |
| <b>EGATO</b> | Governing body of the ATO                           | Body responsible for the governance of the administrative ambit  |



## THE ROLE OF BUSINESS INCUBATORS IN DRIVING ECO-INNOVATION BY START-UPS: A DESCRIPTIVE-SURVEY STUDY

Antonio Sonetto  
antonio.sonetto@unical.it  
University of Calabria

Silvia Tommaso  
silvia.tommaso@unical.it  
University of Calabria

Antonio Ricciardi  
antonio.ricciardi@unical.it  
University of Calabria

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### Abstract

**Purpose.** This study investigates the role of business incubators (BIs) in fostering the development of eco-innovations by incubated start-ups. By examining how BIs integrate sustainability into their incubation practices and facilitate open innovation (OI) processes, it explores the overlooked intersection between incubation, OI, and eco-innovation.

**Design/methodology/approach.** The research employs a descriptive survey design based on a sample of Italian BIs. Data were collected through structured questionnaires administered in 2024.

**Findings.** The results reveal that BIs are increasingly fostering a sustainability-oriented culture and supporting eco-innovation, although such practices remain at an early stage of development. By acting as OI intermediaries, BIs facilitate knowledge and technology transfer across innovation ecosystems, contributing to more robust and sustainable networks. Nonetheless, incubated start-ups do not yet fully exploit networking services, suggesting either a lack of consolidated strategies and expertise or that the diffusion of OI in Italy is still in progress.

**Practical and social implications.** The findings suggest that BI managers should strengthen sustainability-oriented policies and enhance OI support to make incubation processes increasingly competitive. Start-up managers should leverage BIs' networks to overcome resource constraints, particularly in developing eco-innovations. Policymakers are encouraged to provide incentives, training, and dedicated funding to reinforce BIs' role in fostering sustainable innovation ecosystems.

**Originality of the study.** This study contributes to the emerging debate on the interplay between OI and eco-innovation by conceptualizing BIs as sustainability-oriented OI intermediaries. It advances understanding of how incubation practices shape sustainable innovation ecosystems and provides empirical evidence from the Italian context, where the diffusion of the OI paradigm remains limited.

## 1. Introduction

In an era marked by escalating environmental challenges, the pursuit of sustainable development has become a global priority. Central to this effort is the concept of eco-innovation, encompassing new products, processes, and services that mitigate environmental impacts and enhance resource efficiency (Kemp & Pearson, 2007). The imperative for eco-innovation is reinforced by tightening regulatory pressures, evolving consumer preferences, and the competitive advantages it affords pioneering firms (Parrilli et al., 2023; Putu Aditya et al., 2025; Sun et al., 2023; Zairbani & Jaya Prakash, 2025; Zighan et al., 2024). Within this context, start-ups, characterized by agility, creativity, and risk tolerance, play a pivotal role in developing and deploying eco-innovative solutions (Hojnik & Ruzzier, 2016; Nuthalapati et al., 2020). However, despite these intrinsic advantages, start-ups often face significant barriers in transforming innovative ideas into viable market offerings, primarily due to constraints in financial resources, specialized expertise, and established networks (Spender et al., 2017). These limitations underscore the need for robust external support mechanisms.

Against this backdrop, business incubators (BIs) play a fundamental role. They assist early-stage ventures through tailored support services, including shared infrastructure, strategic mentoring, business monitoring, and advisory programs, thereby creating a structured environment conducive to innovation and growth (Aernoudt, 2004; Hackett & Dilts, 2004). In recent years, their contribution to sustainable transitions and the promotion of eco-innovation has attracted growing scholarly attention (Gliedt et al., 2018). BIs provide a wide range of services, spanning strategic guidance, technical consulting, resource mobilization, and market entry support, that are essential for overcoming the structural barriers faced by eco-innovative start-ups (Kanda et al., 2018).

The literature on BIs remains relatively recent and evolving, with several gaps still evident (Sohail et al., 2023). In particular, the role of BIs in the development of eco-innovations has received limited empirical attention (e.g., Carvalho et al., 2018; Sultana & Turkina, 2023), as has the broader study of sustainable innovation within start-ups (e.g., Sahili & Barrales-Molina, 2024). Accordingly, this research seeks to address the following question:

*RQ<sub>1</sub>: How do business incubators facilitate the development of eco-innovation by start-ups?*

Moreover, BIs are increasingly recognized as innovation intermediaries (Conroy et al., 2023) facilitating the adoption of open innovation (OI) practices by incubated firms through targeted networking services (Hansen et al., 2000; Scillitoe & Chakrabarti, 2010; Soetanto & Jack, 2013). The OI paradigm emphasizes the strategic use of both inbound and outbound

knowledge flows to accelerate innovation and expand commercialization opportunities (Chesbrough, 2003). For start-ups, engaging in OI practices is crucial to offset internal resource limitations by leveraging external knowledge, expertise, and partnerships (Bereczki, 2019; Pastore et al., 2020; Spender et al., 2017). This aspect is particularly relevant for eco-innovation, given its complexity, high risk, and elevated development costs (e.g., Jaffe et al., 2005; Mukherjee et al., 2024; Rennings, 2000). BIs thus connect start-ups with external actors, such as established firms, universities, and research centers (external innovation networks), and foster collaborations among incubated firms themselves (internal innovation networks) (Bøllingtoft & Ulhøi, 2005; Soetanto & Jack, 2013).

Despite increasing attention, research on BIs as OI intermediaries remains limited (Leitão et al., 2022; Theodoraki et al., 2022). These organizations often adopt OI principles in an informal and unstructured manner (Cirule & Uvarova, 2022), highlighting the need for further investigation into how BIs can effectively facilitate OI adoption among start-ups (Leitão et al., 2022). Furthermore, the relationship between OI and eco-innovation is still underexplored, as the two constructs have largely evolved as distinct research domains (Lippolis et al., 2023; Urbinati et al., 2023). In addition, limited research has examined OI collaborations between start-ups and other organizational actors, such as SMEs (Mercandetti et al., 2017) or large firms (Barile et al., 2024). Existing OI studies predominantly focus on large, high-tech firms (Albats et al., 2020; Dubouloz et al., 2021; Presenza, 2015; Sabando-Vera et al., 2022). Based on these research gaps, the following question is proposed:

*RQ<sub>1</sub>: How do business incubators foster the adoption of open innovation processes by start-ups?*

To address these research questions, a descriptive-survey study was conducted on a sample of Italian BIs.

This paper contributes to the growing literature at the intersection of OI and eco-innovation by highlighting the role of BIs as sustainability-oriented OI intermediaries. It further enriches current understanding of how incubation mechanisms influence the development of sustainable innovation ecosystems, offering empirical insights from Italy, where OI practices are still not widely established.

The article is structured as follows. After this introduction, a section outlines the theoretical background underpinning the study. The third section illustrates the applied methodology and describes

the reference sample. The fourth section presents the main findings, which are then discussed in the fifth section. Finally, the article concludes by highlighting the key implications and outlining the main limitations of the research.

## 2. Theoretical Background

### 2.1 BIs

BIs are typically described as organizations that provide shared workspace, business support services, and networking opportunities to early-stage ventures (Bergek & Norrman, 2008). More specifically, the incubation process has been described as an interactive developmental mechanism aimed at encouraging entrepreneurial initiative and supporting start-ups in the creation of innovative products, while also providing a range of complementary services such as managerial support, access to finance, legal advice, operational expertise, and market access (Aernoudt, 2004). BIs have progressively evolved over time in response to changing economic and technological contexts. The literature commonly identifies three main waves in the historical development of incubation programs (Mian et al., 2016). The first wave (until the 1980s) focused on job creation and economic restructuring, offering affordable space and basic shared services to start-ups. The second wave (1980s-1990s) expanded BI offerings to include value-added services such as mentoring, skills development, and networking, while the first Internet-based virtual incubation models also began to emerge. The third wave (since the 2000s) is characterized by mixed-use science parks and the rise of accelerators linked to the digital economy, such as Y Combinator<sup>1</sup>, which provide cohort-based, time-limited programs with a strong emphasis on mentoring and preparing public pitches to attract investors. Therefore, according to Abduh et al. (2007), the services offered by BIs can be grouped into three main categories: (i) Facility-related services; (ii) Counselling and business support services; (iii) Access to networks. Among the various typologies proposed in the literature, Grimaldi and Grandi (2005) classify BIs into four main categories: (i) Business Innovation Centers (BICs): created in 1984 by a European Commission initiative, BICs mainly provide foundational support such as workspace, information on funding opportunities, administrative assistance, and visibility; (ii) University Business Incubators (UBIs): affiliated with universities, UBIs foster the creation, integration, and dissemination of new scientific and technological knowledge. Services often include academic consultancy, access to libraries and laboratories, R&D resources, and technology transfer

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<sup>1</sup> Y Combinator is one of the world's most prominent start-up accelerators located in San Francisco, California.

programs (Mian, 1996); (iii) Independent Private Incubators (IPIs): established by private investors or investor groups, IPIs often acquire equity stakes in start-ups to accelerate their growth. They are commonly referred to as accelerators, focusing on ventures that have already started operations and require additional capital or know-how; (iv) Corporate Private Incubators (CPIs): set up by large corporations to support the development of new business projects emerging from internal initiatives (e.g., intrapreneurship) that cannot be pursued within the parent organization.

Ownership and origin patterns vary by type: BICs and UBIs are generally non-profit, established by public institutions to promote local economic growth, while IPIs and CPIs are private and profit-oriented. Furthermore, UBIs and CPIs often host projects originating within their parent organizations, whereas BICs and IPIs primarily support external ventures.

## *2.2 The Role of BIs in Start-up Eco-Innovation*

Eco-innovations are characterized by their ability to reduce environmental risks, pollution, and other negative impacts associated with resource use, when compared to conventional alternatives (Kemp & Pearson, 2007). Eco-innovation is a highly complex concept, and, at present, there exists no universally accepted definition in the literature (Zairbani & Jaya Prakash, 2025). The development of eco-innovations is particularly well-suited to start-ups, as these emerging ventures operate in dynamic and highly competitive environments (Pichlak & Szromek, 2022). Start-ups' inherent organizational flexibility allows them to implement environmentally innovative practices more readily, due to flatter hierarchies and less rigid structures (Nuthalapati et al., 2020). Moreover, start-ups are fundamentally oriented toward innovation, emphasizing problem-solving and a willingness to take risks (Hojnik & Ruzzier, 2016), which naturally supports the pursuit of eco-innovative solutions. Therefore, eco-innovation can provide start-ups with a distinctive competitive edge, setting them apart from established competitors (Guleria & Kaur, 2022). However, start-ups often encounter substantial challenges in developing and commercializing innovations due to their small size and limited resources, knowledge, and capabilities (Spender et al., 2017). This becomes even more evident in the context of eco-innovation development, given its complexity, risk, and high development costs (e.g., Jaffe et al., 2005; Mukherjee et al., 2024; Rennings, 2000). Therefore, start-ups aiming to develop eco-innovations face unique barriers, including high initial capital costs, uncertain cash flows, and challenges in securing funding from traditional investors (Mukherjee et al., 2024).

Given these substantial challenges, innovation intermediaries such as BIs (Conroy et al., 2023) play a crucial role in supporting eco-innovation development by start-ups (Mukherjee et al., 2024). Innovation intermediaries are widely discussed in the innovation management literature and, more recently, have increasingly attracted attention in the sustainability transitions literature as well (Gliedt et al., 2018). According to Kanda et al. (2018), these organizations support the development of eco-innovations by start-ups through a wide range of practices, including: (i) forecasting and roadmapping, by helping firms identify promising eco-innovations and define strategic directions; (ii) information gathering and dissemination, through the collection and sharing of technical and market knowledge via seminars and digital tools; (iii) prototyping and piloting, by providing testbeds to validate environmental benefits and reduce risks; (iv) technical consulting, offering expertise on energy and material efficiency; (v) resource mobilization, by facilitating access to financial, human, and knowledge resources; (vi) commercialization, supporting market entry for eco-innovations; (vii) branding and legitimation, enhancing reputation and social acceptance; and (viii) networking and partnerships, fostering collaboration among firms, universities, and research centers to overcome innovation barriers. This latter point is crucial, given the innovation barriers that typically characterize start-ups. Therefore, start-ups should adopt OI practices to overcome these constraints by engaging with external entities and organizations (Bogers, 2011; Primario et al., 2024; Spender et al., 2017).

### *2.3 BIs as OI Intermediaries*

The OI paradigm emphasizes firms' intentional use of both inbound and outbound knowledge and technology flows to accelerate internal innovation processes and broaden opportunities for external commercialization of innovations (Chesbrough et al., 2006; Chesbrough, 2003). The literature identifies several variants of OI (e.g., Chesbrough & Bogers, 2014; Chesbrough, 2003; Gassmann & Enkel, 2004): (i) Outside-in (or inbound) OI, where firms acquire knowledge from external sources; (ii) Inside-out (or outbound) OI, where firms transfer knowledge externally; and (iii) Coupled OI, which combines the two previous processes and allows for the development of strategic R&D networks.

BIs play a pivotal role in fostering OI among their incubated start-ups by offering targeted networking services (e.g., Hansen et al., 2000; Scillitoe & Chakrabarti, 2010; Soetanto & Jack, 2013). Such services encourage inter-firm collaboration, facilitate knowledge sharing, and support the establishment of technological and market partnerships (Hansen et al., 2000).

Through these mechanisms, BIs enable start-ups to connect with external actors, such as SMEs, large firms, and universities (external innovation networks), while simultaneously enhancing knowledge exchange among incubated firms themselves (internal innovation networks) (Bergek & Norman, 2008; Bøllingtoft & Ulhøi, 2005; Cirule & Uvarova, 2022; Soetanto & Jack, 2013). In this context, BIs act as enablers of OI practices, supporting start-ups in externalizing their innovation processes and engaging with external knowledge sources (Chesbrough & Brunswicker, 2014; Cirule, 2022; Hansen et al., 2000; Soetanto & Jack, 2013; Van De Vrande et al., 2009). Specifically, networking activities are particularly important because they support start-ups in acquiring external resources and knowledge to develop their innovations (inbound OI), as well as in transferring or commercializing their technology to external partners and markets (outbound OI). Moreover, BIs help start-ups overcome several barriers that can hinder the adoption of OI practices (Cirule & Uvarova, 2022), such as limited knowledge and time constraints (Weingarden & Raes, 2022). Networking opportunities offered by BIs have therefore become a key factor influencing start-ups' decisions to join a particular incubation program (Ruping & von Zedtwitz, 2001). Finally, given that OI has been identified as a key mechanism for addressing emerging technological trends and international policy agendas, such as the Sustainable Development Goals (SDGs) for the 2015-2030 period (Bogers et al., 2018), BIs, acting as OI intermediaries, may represent a critical organizational mechanism for fostering eco-innovation and contributing to broader sustainability transitions.

### **3. Methodology**

This study adopts a survey research method, which is widely employed to collect data while ensuring a defined level of statistical accuracy (Rea & Parker, 1992; Rossi et al., 2013). Specifically, we adopted a descriptive-survey design, as its primary purpose is to assess the extent of a phenomenon and to capture its distribution within a given population, particularly in contexts where existing knowledge on the topic is still limited (Dubin, 1978; Malhotra & Grover, 1998; Wacker, 1998).

#### *3.1 Data Sample*

The research was conducted in Italy, a country where the culture of OI is still relatively underdeveloped (European Commission, 2024). In this context, the role of BIs can be strategic in fostering the diffusion of this paradigm. Specifically, the investigation was carried out on a sample of

BIs, consisting of all certified BIs officially recognized by the Ministry of Enterprises and Made in Italy and listed in the Italian Business Register<sup>2</sup> (Registro delle Imprese) as of March 4, 2024. This choice allowed us to test our research questions on those BIs that, due to their higher quality standards and services, are presumably more inclined to promote innovation. Indeed, Article 25, paragraph 5, of Italian Decree-Law No. 179 of October 18, 2012, converted with amendments by Law No. 221 of December 17, 2012, specifies that a certified BI of innovative start-ups must meet a series of specific requirements outlined in the same article: (i) possess facilities, including physical spaces, suitable for hosting innovative start-ups, such as areas dedicated to testing, experimentation, or research; (ii) have equipment appropriate to the activities of start-ups, including ultra-broadband Internet access, meeting rooms, and machinery for tests, trials, or prototypes; (iii) be managed or directed by individuals with recognized expertise in business and innovation and maintain a permanent technical and managerial consulting structure; (iv) maintain regular collaborations with universities, research centers, public institutions, and financial partners engaged in activities and projects related to innovative start-ups; (v) demonstrate adequate and proven experience in supporting innovative start-ups. Following the approach and methodology applied by Cavallo et al. (2020) and Sansone et al. (2020), a number of non-certified BIs was also included to provide a more comprehensive overview of the incubation ecosystem and to capture relevant practices occurring beyond certified incubation programmes. These BIs were identified using secondary sources available online. In particular, lists compiled by PNI-Cube<sup>3</sup>, Italia Startup Association<sup>4</sup>, and Startup Geeks<sup>5</sup> were considered. Subsequently, a purposive sampling strategy was adopted to retain only non-certified BIs that were most actively engaged in the paradigms of OI and eco-innovation. To this end, an analysis of secondary sources was conducted, including institutional documents of the BIs (specifically, their regulations and, where available, activity reports), websites, and press coverage. The analysis focused on the presence of dedicated sections or information on OI and sustainability, retaining only those BIs that met the following three strict inclusion criteria:

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2 The list of certified Italian BIs is available at the following link: <https://startup.registroimprese.it/isin/static/startup/index.html?slideJump=33>.

3 PNICube, the Italian association that brings together BIs and business plan competitions, provides an updated list of Italian BIs at: <https://www.pnicube.it/associati>

4 Italia Startup, a non-profit association that supports and represents the Italian start-up ecosystem, provides a list of Italian BIs at: <https://innovup.net/soci/>

5 Startup Geeks is an Italian BI and pre-accelerator supporting start-ups through online programs, mentorship, and a dedicated community, and provides a list of BIs at: <https://www.startupgeeks.it/incubatori-acceleratori-startup-in-italia/#post-content-elementor>

(1) tenant selection strategy (sustainable focus): explicit prioritization of start-ups whose projects address sustainable challenges or develop sustainable technologies.

(2) service provision (OI orientation): formal provision of networking and collaboration activities aimed at fostering knowledge exchange and joint initiatives among incubated start-ups as well as between these start-ups and external actors (e.g., corporations, research institutions, and other ecosystem stakeholders), thereby supporting OI processes.

(3) institutional mission (sustainability commitment): explicit references within the BI's mission, vision, official regulations, or public reports that emphasize a strategic commitment to environmental and social sustainability.

For both certified and non-certified BIs, no distinction was made between public or private nature; all types were considered in order to provide an extensive and detailed analysis of the phenomenon. Therefore, all 63 certified BIs were included, and 37 non-certified BIs were selected based on the aforementioned purposive criteria.

### *3.2 Data Collection*

An invitation to participate in the survey was sent to 100 BIs. The survey was administered to individuals holding key strategic or operational roles within the BIs, specifically CEOs, Operations Directors, or Innovation Managers. These roles were selected because they possess comprehensive knowledge of the BI's strategic orientation toward sustainability, the specific incubation services provided, and the management of OI networks. 9 questionnaires could not be delivered due to incorrect contact information. Consequently, 91 questionnaires were successfully administered to the target respondents. At the end of the process, a total of 23 valid responses were received, corresponding to a response rate of 25.27%. Of the 23 respondents, only 20 disclosed their identity and thus provided information directly linked to the identification of the BI (e.g., geographical location). The majority of organizations that agreed to participate in the study are located in Southern Italy (39.13%), while 17.39% are based in Central Italy and 30.43% in Northern Italy. For the remaining 13.04%, no information is available due to the anonymity of BIs. Furthermore, the majority of the organizations that took part in the survey are private BIs (52.17%). Public BIs account for 26.09% of the respondents, while public-private BIs represent 8.70%. In this case as well, information is unavailable on the remaining 13.04%.

The study was conducted through the administration of a questionnaire for BIs, designed using the "Google Forms" platform. All participants were

given the opportunity to remain anonymous, ensuring that any sensitive information could be withheld from inclusion in the paper. The survey consisted of 12 closed-ended questions. Where appropriate, the option “*Other*” was provided, allowing respondents to freely supply an alternative answer if none of the proposed categories applied. Some of the questions allowed respondents to select one or more response options, others were dichotomous (Yes/No), and still others were designed to measure specific phenomena using a four or five-point Likert scale. The survey opened with a brief description of the study and its underlying rationale, as well as a set of practical instructions for completing the questionnaire. Some questions were adapted based on two previous studies conducted by Auricchio et al. (2014) and by Cirule & Uvarova (2022). The first section of the questionnaire included questions aimed at gathering information on the ability of BIs to foster the development of eco-innovations among their incubated start-ups. The second section focused on collecting data regarding the capacity of BIs to act as OI intermediaries. Data collection took place between March and September 2024. Before the actual administration of the questionnaire, a pilot test was conducted with four colleagues from the same department, in order to evaluate and refine the survey design and question wording, as well as to identify potential sources of bias (Dillman, 2013; Forza, 2002). Table 1 provides an overview of the variables included in the questionnaire, along with their respective modalities. For each modality, the table reports the main descriptive statistics, distinguishing between certified and non-certified BIs<sup>6</sup>.

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<sup>6</sup> As noted in Section 3.2, three of the 23 BIs did not disclose their identity, preventing their classification as either certified or non-certified.

Tab.1. Questionnaire variables and descriptive statistics

| Variables                                                | Modalities                                  | Statistics |                   |                            |                                |
|----------------------------------------------------------|---------------------------------------------|------------|-------------------|----------------------------|--------------------------------|
| Selection criterion<br>(Five-point Likert <sup>7</sup> ) |                                             |            | All BIs<br>(n=23) | Certified<br>BIs<br>(n=10) | Non-certified<br>BIs<br>(n=10) |
|                                                          | <i>Characteristics of the Business Idea</i> |            |                   |                            |                                |
|                                                          | Potential of the business idea              | Mean       | 4.26              | 4.40                       | 4.20                           |
|                                                          |                                             | SD         | (0.86)            | (0.84)                     | (0.92)                         |
|                                                          |                                             | MIN        | 2                 | 3                          | 2                              |
|                                                          |                                             | MAX        | 5                 | 5                          | 5                              |
|                                                          |                                             | Median     | 4                 | 5                          | 4                              |
|                                                          | Quality of the business idea                | Mean       | 4.13              | 4.40                       | 3.80                           |
|                                                          |                                             | SD         | (0.92)            | (0.70)                     | (1.14)                         |
|                                                          |                                             | MIN        | 2                 | 3                          | 2                              |
|                                                          |                                             | MAX        | 5                 | 5                          | 5                              |
|                                                          |                                             | Median     | 4                 | 4,5                        | 4                              |
|                                                          | Characteristics of the entrepreneurial team | Mean       | 4.52              | 4.60                       | 4.40                           |
|                                                          |                                             | SD         | (0.85)            | (0.70)                     | (1.07)                         |
|                                                          |                                             | MIN        | 2                 | 3                          | 2                              |
|                                                          |                                             | MAX        | 5                 | 5                          | 5                              |
|                                                          |                                             | Median     | 5                 | 5                          | 5                              |

7 A five-point Likert scale was used in line with Auricchio et al. (2014) to capture nuanced differences in the importance of selection criteria for incubated start-ups.

|  |                                                                    |        |        |        |        |
|--|--------------------------------------------------------------------|--------|--------|--------|--------|
|  | Technological content of the business idea                         | Mean   | 3.39   | 3.30   | 3.40   |
|  |                                                                    | SD     | (0.78) | (0.95) | (0.70) |
|  |                                                                    | MIN    | 2      | 2      | 2      |
|  |                                                                    | MAX    | 5      | 5      | 4      |
|  |                                                                    | Median | 3      | 3      | 3.5    |
|  | Environmental sustainability orientation                           | Mean   | 3.74   | 4.10   | 3.60   |
|  |                                                                    | SD     | (0.86) | (0.88) | (0.84) |
|  |                                                                    | MIN    | 2      | 3      | 2      |
|  |                                                                    | MAX    | 5      | 5      | 5      |
|  |                                                                    | Median | 4      | 4      | 4      |
|  | Social sustainability orientation                                  | Mean   | 3.74   | 3.90   | 3.90   |
|  |                                                                    | SD     | (0.81) | (0.88) | (0.57) |
|  |                                                                    | MIN    | 2      | 3      | 3      |
|  |                                                                    | MAX    | 5      | 5      | 5      |
|  |                                                                    | Median | 4      | 4      | 4      |
|  | <i>Financial Resources Available and Project Development Stage</i> |        |        |        |        |
|  | Project development stage                                          | Mean   | 2.70   | 2.50   | 3.00   |
|  |                                                                    | SD     | (1.15) | (1.27) | (1.15) |
|  |                                                                    | MIN    | 1      | 1      | 1      |
|  |                                                                    | MAX    | 5      | 5      | 5      |
|  |                                                                    | Median | 3      | 2      | 3      |
|  | Availability of debt financing                                     | Mean   | 2.43   | 2.70   | 2.20   |
|  |                                                                    | SD     | (0.79) | (0.82) | (0.79) |
|  |                                                                    | MIN    | 1      | 2      | 1      |
|  |                                                                    | MAX    | 4      | 5      | 3      |
|  |                                                                    | Median | 2      | 2,5    | 2      |
|  | Availability of equity financing                                   | Mean   | 2.65   | 2.80   | 2.50   |
|  |                                                                    | SD     | (0.93) | (0.79) | (1.18) |
|  |                                                                    | MIN    | 1      | 2      | 1      |
|  |                                                                    | MAX    | 4      | 4      | 4      |
|  |                                                                    | Median | 3      | 3      | 3      |
|  | <i>Factors in Common with the BI</i>                               |        |        |        |        |
|  | Link between the start-up and a BI's partner organization          | Mean   | 2.78   | 2.80   | 2.90   |
|  |                                                                    | SD     | (1.17) | (1.14) | (1.37) |
|  |                                                                    | MIN    | 1      | 1      | 1      |
|  |                                                                    | MAX    | 5      | 4      | 5      |
|  |                                                                    | Median | 3      | 3      | 2.5    |

|                                                                                                                           |                                                                                                |                              |        |         |         |
|---------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------|--------|---------|---------|
|                                                                                                                           | Consistency with the business area in which the BI operates                                    | Mean                         | 3.22   | 3.40    | 3.10    |
|                                                                                                                           |                                                                                                | SD                           | (1.35) | (1.17)  | (1.66)  |
|                                                                                                                           |                                                                                                | MIN                          | 1      | 2       | 1       |
|                                                                                                                           |                                                                                                | MAX                          | 5      | 5       | 5       |
|                                                                                                                           |                                                                                                | Median                       | 4      | 3,5     | 4       |
| <b>Commitment in Promoting Sustainability Culture among Incubated Start-ups</b><br><i>(Four-point Likert<sup>8</sup>)</i> |                                                                                                | Mean                         | 3.21   | 3.40    | 3.20    |
|                                                                                                                           |                                                                                                | SD                           | (0.52) | (0.52)  | (0.42)  |
|                                                                                                                           |                                                                                                | MIN                          | 2      | 3       | 3       |
|                                                                                                                           |                                                                                                | MAX                          | 4      | 4       | 4       |
|                                                                                                                           |                                                                                                | Median                       | 3      | 3       | 3       |
| <b>Services Promoting Sustainability among Incubated Start-ups</b>                                                        | Policy requiring incubated start-ups to adopt sustainability criteria                          | (% of BIs providing service) | 26.09% | 40.00%  | 20.00%  |
|                                                                                                                           | Financial support for incubated start-ups making significant sustainability investments        |                              | 39.13% | 50.00%  | 30.00%  |
|                                                                                                                           | Structured integration of sustainability criteria in the selection phase                       |                              | 69.57% | 90.00%  | 70.00%  |
|                                                                                                                           | Technical support for incubated start-ups developing sustainable products or services          |                              | 95.65% | 100.00% | 100.00% |
|                                                                                                                           | Consulting and training on implementing strategic sustainability policies                      |                              | 65.22% | 80.00%  | 60.00%  |
|                                                                                                                           | Organization of events or workshops on sustainable entrepreneurship and eco-friendly practices |                              | 73.91% | 90.00%  | 80.00%  |
|                                                                                                                           | Collaboration with external actors to promote sustainability                                   |                              | 91.30% | 100.00% | 80.00%  |
|                                                                                                                           | Periodic monitoring of environmental and social impact of incubated start-ups                  |                              | 43.48% | 50.00%  | 50.00%  |

8 A four-point Likert scale was used, providing a clearer forced-choice assessment without a neutral midpoint, which is suitable for evaluating perceptions or opinions (Chyung et al., 2017).

|                                                                                                                             |                                 |                                |        |         |         |
|-----------------------------------------------------------------------------------------------------------------------------|---------------------------------|--------------------------------|--------|---------|---------|
| Eco-innovation strategic perspective                                                                                        | Revisionist view                | (% of BIs agreeing)            | 91.30% | 100.00% | 100.00% |
|                                                                                                                             | Adaptation view                 |                                | 8.70%  | 0.00%   | 0.00%   |
|                                                                                                                             | Traditionalist view             |                                | 0.00%  | 0.00%   | 0.00%   |
| Propensity to adopt practices fostering OI among start-ups                                                                  | Always                          | (% of BIs)                     | 78.26% | 90.00%  | 80.00%  |
|                                                                                                                             | Rarely                          |                                | 21.74% | 10.00%  | 20.00%  |
|                                                                                                                             | Never                           |                                | 0.00%  | 0.00%   | 0.00%   |
| Actions supporting OI                                                                                                       | Technical /Financial Support    | (intensity level) <sup>9</sup> | 50.73% | 63.33%  | 53.33%  |
|                                                                                                                             | Training and Mentoring Programs |                                | 72.05% | 81.43%  | 68.57%  |
|                                                                                                                             | Networking                      |                                | 64.78% | 64.00%  | 68.00%  |
| Future investment plans of BIs in OI                                                                                        | Yes, to a significant extent    | (% of BIs)                     | 60.87% | 80.00%  | 50.00%  |
|                                                                                                                             | Yes, to a minor extent          |                                | 26.09% | 20.00%  | 40.00%  |
|                                                                                                                             | No plans                        |                                | 13.04% | 0.00%   | 10.00%  |
| BI's opinion on the level of utilization of networking services by incubated start-ups<br>(Four-point Likert <sup>7</sup> ) |                                 | Mean                           | 3.09   | 3.10    | 3.20    |
|                                                                                                                             |                                 | SD                             | (0.42) | (0.32)  | (0.42)  |
|                                                                                                                             |                                 | MIN                            | 2      | 3       | 3       |
|                                                                                                                             |                                 | MAX                            | 4      | 4       | 4       |
|                                                                                                                             |                                 | Median                         | 3      | 3       | 3       |

Source: Authors' elaboration

<sup>9</sup> Intensity level = number of selected options out of the total options available for each category

## 4. Findings

### 4.1 BIs' engagement in eco-sustainability practices

The analysis of selection criteria reveals that BIs adopt a multidimensional approach in evaluating start-ups, balancing traditional business-oriented parameters with emerging sustainability-related aspects. Specifically, 69.57% reported effectively structured integration of sustainability criteria into the analysis and selection of start-ups. Adoption was higher among certified BIs (90%) than among non-certified BIs (70%). Table 2 presents the importance attributed by BIs to the main selection criteria shown in Table 1. The final evaluation was assigned based on the mean scores reported in Table 1 (calculated using a five-point Likert scale) as follows: from 1 to 2 (low level), from 2 to 3 (medium-low level), 3 (medium level), from 3 to 4 (medium-high level), and from 4 to 5 (high level).

Tab.2. Start-up selection criteria adopted by BIs

| Selection criterion                                                | Final assessment  |                         |                             |
|--------------------------------------------------------------------|-------------------|-------------------------|-----------------------------|
|                                                                    | All BIs<br>(n=23) | Certified BIs<br>(n=10) | Non-certified BIs<br>(n=10) |
| <i>Characteristics of the Business Idea</i>                        |                   |                         |                             |
| Potential of the business idea                                     | High              | High                    | High                        |
| Quality of the business idea                                       | High              | High                    | Medium/High                 |
| Characteristics of the entrepreneurial team                        | High              | High                    | High                        |
| Technological content of the business idea                         | Medium/High       | Medium/High             | Medium/High                 |
| Environmental sustainability orientation                           | Medium/High       | High                    | Medium/High                 |
| Social sustainability orientation                                  | Medium/High       | Medium/High             | Medium/High                 |
| <i>Financial Resources Available and Project Development Stage</i> |                   |                         |                             |
| Project development stage                                          | Medium/Low        | Medium/Low              | Medium                      |
| Availability of debt financing                                     | Medium/Low        | Medium/Low              | Medium/Low                  |
| Availability of equity financing                                   | Medium/Low        | Medium/Low              | Medium/Low                  |
| <i>Factors in Common with the BI</i>                               |                   |                         |                             |
| Link between the start-up and a BI's partner organization          | Medium/Low        | Medium/Low              | Medium/Low                  |
| Consistency with the business area in which the BI operates        | Medium/High       | Medium/High             | Medium/High                 |

Source: Authors' elaboration

Overall, high importance is attributed to several aspects of the business idea, including its potential, quality, and the characteristics of the entrepreneurial team. Medium-to-high importance is assigned to the technological content of the project, as well as to its level of social and environmental sustainability orientation, with both factors receiving an identical average score. This result suggests that BIs increasingly regard sustainability not as a peripheral feature, but as a criterion comparable to technology in shaping the attractiveness of entrepreneurial projects.

Conversely, medium-to-low importance is instead attributed to other factors, such as the project's stage of development and the availability of financial resources in the form of debt or equity. Similarly, the existence of links with the BI's partner organizations does not strongly influence the selection of start-ups, whereas greater relevance is given to the coherence of the project with the business area in which the BI operates. This indicates that BIs are less concerned with immediate financial readiness or pre-existing relational capital, focusing instead on the long-term coherence of the project with their own strategic domain.

When distinguishing between certified and non-certified BIs, the overall importance levels are largely similar. Exceptions include the quality of the business idea, for which non-certified BIs assign medium-to-high rather than high importance, the project development stage, for which non-certified BIs assign a medium level, compared to a medium-low level for certified BIs, and the level of environmental sustainability orientation, for which certified BIs assign a higher level than non-certified ones. The differences between certified and non-certified BIs reflect their distinct priorities and operational approaches. Certified BIs assign a higher importance level to the quality of the business idea, which could be due to their need to maintain strict performance standards entailed by their certified status. Regarding the project development stage, they assign a lower importance level, which may reflect a greater willingness to support projects at very early stages. Being more structured and better resourced, certified BIs may be less concerned with a project's early-stage maturity and more willing to incubate ideas from their inception. For the same reasons, they may also be better equipped to support eco-innovative start-ups, making environmental sustainability a strategic pillar rather than a mere "*plus*".

Consistent with their selection criteria, BIs report a strong commitment to fostering a sustainability culture among the start-ups they support. Specifically, the majority (69.6%) indicate a moderate level of commitment, while 26.1% declare a high level of commitment. Only a small fraction (4.3%) report being slightly committed, and no BI indicates a lack of com-

mitment. Accordingly, the average level of commitment, calculated on a four-point Likert scale, is 3.21, with a relatively low standard deviation, indicating a consistent and broadly shared dedication to promoting sustainability among supported start-ups. When distinguishing between certified and non-certified BIs, some differences emerge. Among certified BIs, 40% report a high level of commitment and 60% a moderate level, resulting in an average commitment score of 3.40. Among non-certified BIs, 20% report a high level and 80% a moderate level, leading to a slightly lower average commitment score of 3.20. Although the difference is relatively small, certified BIs appear somewhat more inclined to promote a sustainability culture among their incubated start-ups.

Moreover, 26.09% of BIs have formal policies requiring incubated start-ups to adopt specific ecological practices, indicating that this aspect is still in its early stages. In detail, 40% of certified BIs report adopting such policies, compared to only 20% of non-certified BIs, confirming the previously observed trend. Additionally, 43.48% of BIs periodically monitor the environmental impact of their start-ups' activities, suggesting that this practice may expand in the coming years. In this case, certified and non-certified BIs show similar behavior, as 50% in each group report conducting such monitoring activities. Furthermore, 65.22% offer advisory and training services to support the strategic implementation of sustainability policies. In this regard, certified BIs (80%) exceed the percentage of non-certified ones (60%). While only 39.13% provide financial support for sustainability-related investments (50% among certified BIs compared to 30% among non-certified BIs), 95.65% offer technical support, such as access to laboratories, tools, and advanced technologies to develop and refine innovations (100% of both certified and non-certified BIs provide this service). Finally, 73.91% organize events or workshops on eco-sustainable entrepreneurship (90% among certified BIs and 80% among non-certified ones), and 91.30% collaborate with external organizations to foster a culture of sustainability among their incubated start-ups (100% of certified BIs compared to 80% of non-certified BIs). Overall, these results confirm the initial commitment of BIs to promote sustainability, highlighting a trend likely to accelerate in the coming years, with more organizations adopting formal sustainability policies and monitoring practices. In particular, this commitment is evident among both certified and non-certified BIs, although a slightly higher level of engagement emerges among certified BIs.

Finally, nearly all BIs (91.30%) agree with the "*Ecological Modernization*" theory (Jänicke, 2008; Zhu et al., 2012) and, consequently, with the "*revisionist view*" (Hermundsdottir & Aspelund, 2021), which posits that the adoption of eco-innovations should not be arbitrary or merely a reactive measure in response to new environmental regulations. Instead, it should

be strategically planned to maximize firm performance. In contrast, 8.70% of respondents believe that the development of eco-innovations is necessary only to comply with environmental regulations (*“adaptation view”*), and none of the BIs adopt the *“traditionalist view”*, which argues that developing such innovations entails only costs and provides no benefits to firms (Hermundsdottir & Aspelund, 2021). When distinguishing between certified and non-certified BIs, 100% of both groups agree with the *“revisionist view”*. These results underscore the generally positive perception of sustainability-related issues among BIs.

#### 4.2 The role of BIs as OI intermediaries

The data collected indicate a strong commitment by BIs to promoting OI among their incubated start-ups, encouraging them to expand the boundaries of innovation. Specifically, 78.3% of BIs reported consistently adopting practices that foster the adoption of OI processes, while 21.7% reported doing so only rarely, and none declared never adopting such practices. More specifically, 90% of certified BIs reported consistently adopting these practices and only 10% doing so rarely. Among non-certified BIs, the share of those consistently adopting such practices decreases to 80%, while the proportion reporting rare adoption rises to 20%. Moreover, 60.9% reported planning substantial investments in OI, 26.1% indicated more limited plans, and only 13% stated that they had no plans in this regard. More specifically, 80% of certified BIs reported planning substantial investments, while the remaining 20% indicated more limited investment plans. Among non-certified BIs, the share planning substantial investments decreases to 50%, while 40% report more limited investment intentions and 10% state that they do not plan to make such investments in the future.

Specifically, BIs adopt targeted practices to foster the development of both internal and external innovation networks. Table 3 summarizes these practices, classifying them according to the type of activity (Technical/Financial Support; Training and Mentoring Programs; Networking) and the type of innovation network (internal or external).

| Type of activity                               | External Innovation Network                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Internal Innovation Network                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Technical/<br/>Financial<br/>Support</i>    | Access to financial and/or technical resources (e.g., testing laboratories) to facilitate the acquisition of external innovations and/or the development and commercialization of internal innovations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Provision of co-working spaces                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>Training and<br/>Mentoring<br/>Programs</i> | Training and/or mentoring programs aimed at fostering a culture of openness and collaboration with external companies. Training and/or mentoring on technology transfer processes and intellectual property management.<br>Support activities for drafting business plans and pitch decks to present innovations to potential partners and investors.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Training and/or mentoring programs on team building.<br>Training and/or mentoring programs designed to foster a co-working culture among incubated start-ups.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <i>Networking</i>                              | Organization of networking events with universities, research centers, innovative firms, and potential investors.<br>Consultancy services for the evaluation, selection, and integration of external innovations.<br>Offering and dissemination of partnership programs with external companies, universities, and other institutions (e.g., call for start-ups, OI labs).<br>Promotion of incubated start-ups through dedicated communication and marketing channels.<br>Support in scouting activities for potential external partners.<br>Development of an online platform enabling incubated start-ups to articulate innovation-related needs and challenges and to showcase their innovations, while allowing external firms to propose their innovations as potential solutions or to request innovations from the start-ups. | Organization of internal networking events to foster interaction and knowledge sharing among incubated start-ups.<br>Organization of collaborative initiatives (internal co-creation projects or those promoted by partner organizations) among incubated start-ups on technological topics of shared interest, or aimed at joint participation in regional, national, and European funding schemes.<br>Creation of a consortium of start-ups in which all members operate according to the principle of " <i>Peer Innovation</i> ".<br>Development of online platforms or dedicated forums for the exchange of resources and knowledge among incubated start-ups. |

Source: Authors' elaboration

A first set of practices revolves around technical and financial support, enabling start-ups to access resources such as laboratories and specialized facilities that facilitate the development and commercialization of internal innovations, as well as the integration of external ones. The provision of co-working spaces also serves as a key mechanism to nurture collaboration within the BI environment. The intensity with which BIs adopt these practices amounts to 50.73%. 63.33% of certified BIs report engaging in this type of support, while the percentage decreases to 53.33% among non-certified BIs. Second, training and mentoring programs are widely deployed to instill an OI mindset. Externally, these programs focus on technology transfer, intellectual property management, and the development of business plans and pitch decks to attract potential partners and investors. Internally, they target team building and the cultivation of a collaborative culture among start-ups sharing the incubation space. In this case, the intensity level is high, reaching 72.05%. When considering certified BIs, the percentage rises to 81.43%, while it stands at 68.57% for non-certified ones. This suggests a stronger level of engagement in this area among certified BIs. Finally, networking practices emerge as the most diversified and structured set of activities. Externally, BIs connect start-ups with universities, research centers, innovative firms, and investors through events, consultancy services, partnership programs, and communication platforms. They also support scouting activities and develop online platforms where start-ups and external firms can match innovation needs and solutions. Internally, networking initiatives foster interaction, knowledge sharing, and resource exchange among incubated start-ups, facilitated by events and dedicated online forums, collaborative co-creation projects, and the formation of consortia operating under a “*Peer Innovation*” approach. The intensity level with which BIs provide networking services amounts to 64.78%. In this area, certified and non-certified BIs show very similar levels, with a slightly higher percentage among non-certified BIs (68%) compared to certified ones (64%). These insights are particularly relevant, as they directly address the research gap concerning “*how*” BIs support OI among their start-ups. However, only 13.04% of the BIs surveyed reported that their start-ups fully and consistently exploit the networking services provided (10% among certified BIs and 20% among non-certified ones), while 82.61% stated that these services are used “*fairly sufficiently*” (90% for certified and 80% for non-certified BIs). Only 4.35% indicated a low level of utilization, and none reported no utilization. Accordingly, the mean perceived level of utilization, calculated on a four-point Likert scale, is 3.09 overall, 3.10 for certified BIs, and 3.20 for non-certified BIs. This finding aligns with the assumption that a culture of OI is still not deeply embedded within Italian firms.

Overall, a strong commitment by BIs to adopting practices that foster the implementation of OI processes among their incubated start-ups can

be highlighted. Specifically, the results show a higher level of engagement among certified BIs compared to non-certified ones, although both categories are, on average, highly committed in this regard.

## 5. Discussion

Sustainability principles are increasingly central to the strategic priorities of BIs. This shift is evident in the growing importance attributed to sustainability-oriented innovation projects during the start-up selection phase. BIs are also progressively adopting internal policies and practices that foster a sustainability-oriented organizational culture, embedding this approach as a foundational element in the business model development of incubated start-ups. Accordingly, they provide targeted support through consulting and training on sustainability, technical assistance, and the organization of related events. In doing so, BIs encourage start-ups to adopt sustainability proactively as a strategic lever, consistent with evidence that eco-innovation enhances firms' economic and financial performance (e.g., Appiah et al., 2025; Putu Aditya et al., 2025; Zairbani & Jaya Prakash, 2025). At the same time, they promote sustainability as an overarching vision and mindset, embedding it throughout organizational processes via a top-down approach. Therefore, the results of this study confirm the growing role of BIs as organizations supporting the development of eco-innovations by their incubated start-ups (Gliedt et al., 2018; Kanda et al., 2018; Mukherjee et al., 2024). Although these initiatives are still at a developmental stage, their relevance is expected to increase in the coming years, as sustainability is becoming intrinsically linked with the concept of start-ups itself. According to the Social Innovation Monitor (2024), the number of start-ups focused on sustainable innovation continues to grow steadily, suggesting that BIs must increasingly align with evolving market expectations by placing greater emphasis on sustainability.

The findings also highlight the active role of BIs as OI intermediaries (Conroy et al., 2023). Through networking services, BIs facilitate both internal and external innovation networks, enabling small firms to overcome constraints related to limited resources and knowledge (Bergek & Norman, 2008; Bøllingtoft & Ulhøi, 2005; Cirule & Uvarova, 2022; Soetanto & Jack, 2013). These services allow start-ups not only to transfer knowledge and technologies outward, thus supporting established firms in developing eco-innovations (outbound OI), but also to acquire external knowledge and technologies that accelerate and strengthen their internal eco-innovation processes (inbound OI) (Chesbrough et al., 2006; Chesbrough, 2003). Consequently, BIs' intermediation activities generate significant benefits for local innovation ecosystems by promoting collaboration among diverse actors and fostering eco-innovation development.

In this sense, BIs contribute to the emergence of “*sustainable innovation ecosystems*”, defined as dynamic networks of heterogeneous actors (e.g., firms, universities, research institutions, government bodies, and civil society organizations) that collaboratively generate innovations addressing major societal challenges while creating economic, environmental, and social value (Evans et al., 2017; Huy & Phuc, 2024; Stubbs & Cocklin, 2008). The growing scholarly attention to this topic underscores its novelty and increasing relevance in tackling contemporary global issues (Parahoo & Ayyagari, 2022).

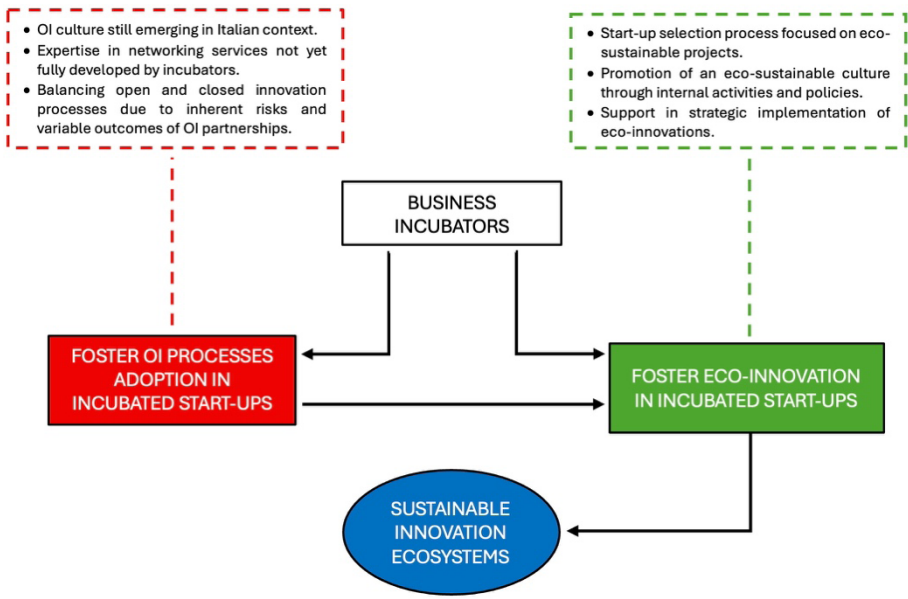
The results further indicate that certified BIs tend to be more committed to promoting a sustainability culture among their incubated start-ups, as well as to adopting practices that foster the implementation of OI processes. This outcome was somewhat expected, as certified BIs are required to comply with legally established quality standards and criteria, which generally translate into greater resources and a stronger organizational structure compared to non-certified BIs. However, it is important to underline that the difference is not particularly pronounced; non-certified BIs also demonstrate a substantial level of commitment to both sustainability and OI practices, confirming that engagement in these areas is widespread across the BI population.

However, incubated start-ups do not yet fully exploit the services offered by BIs, which may reflect a lack of established strategies and expertise or, more broadly, the still-limited diffusion of OI practices in Italy (e.g., European Commission, 2024). Indeed, Italian firms are notably affected by the “*Not-Invented-Here*” syndrome, a major barrier to OI adoption (Politecnico di Milano, 2024). This mindset leads companies to undervalue external ideas and products, perceiving them as inferior to those developed internally. While start-ups generally possess greater organizational flexibility and an inherent orientation toward innovation (Hojnik & Ruzzier, 2016; Nuthalapati et al., 2020), this cognitive barrier prevents them from fully leveraging the external networks provided by BIs. This opens an avenue for future research exploring the factors shaping firms’ perceptions and adoption of OI, particularly among incubated start-ups. Future studies could also provide guidelines and best practices to support BI managers in integrating the OI paradigm more effectively into incubation programs, as well as investigate start-ups’ satisfaction with networking services in the Italian context.

Finally, it is important to note that OI collaborations within innovation ecosystems do not always produce predictable outcomes, as results depend on multiple factors, including partner type, industry sector, relative bargaining power, and broader economic, institutional, cultural, and organizational contexts (e.g., Cricchio & Di Minin, 2025; Sears & Muhammad, 2024; Wallner-Drewitz & Menrad, 2011). Thus, the benefits of OI for eco-

innovation are heterogeneous and context-specific. Moreover, OI processes involve inherent risks, including relational challenges, coordination costs, and significant time and financial investments (Enkel et al., 2009). Excessive openness can increase managerial complexity, create dependence on external knowledge, and heighten the risk of losing control over critical resources such as expertise and intellectual property (Ben Arfi et al., 2018; Enkel et al., 2009; Triguero et al., 2022). Therefore, a balanced approach that combines open and closed innovation activities is essential to maximize the benefits of external collaboration while mitigating strategic and operational risks (Ben Arfi et al., 2018; Enkel et al., 2009). Figure 1 provides a graphical summary of the discussion.

Fig. 1. BIs as Drivers of Environmentally Sustainable OI



Source: Authors' elaboration

## 6. Conclusions

This study explores the role of BIs, also acting as OI intermediaries, in fostering eco-innovation among start-ups. The findings reveal that BIs are increasingly committed to promoting a sustainability-oriented culture within their incubated firms, making environmental engagement and related challenges central to their programs. Nevertheless, such practices remain at an early stage of development and require further time to become fully institutionalized. By functioning as OI intermediaries, BIs facilitate

knowledge and technology transfer between start-ups and other innovation ecosystem actors, thereby contributing to the creation of robust and sustainable ecosystems and accelerating the development of eco-innovations across stakeholders. Finally, considering the distinction between certified and non-certified BIs in the Italian context, both groups show a high level of commitment to environmental sustainability and OI practices, with certified BIs appearing slightly more engaged.

This research offers several implications.

From a theoretical perspective, this study makes multiple contributions to innovation management literature. First, it bridges three research streams that have largely evolved in parallel (business incubation, OI, and eco-innovation), thereby offering a more integrated perspective on how BIs foster open eco-innovation. Second, it addresses a specific theoretical gap concerning the *“how”* of OI intermediation. Rather than simply portraying BIs as facilitators, the study empirically identifies the mechanisms, ranging from internal co-creation networks to external technology transfer practices, through which BIs operationalize OI to help start-ups overcome resource constraints. Third, it contributes to the emerging debate on sustainable innovation ecosystems by showing how BIs orchestrate heterogeneous actors to accelerate eco-oriented innovation processes, thereby enriching ecosystem-level theorization.

From a managerial perspective, BI managers should integrate environmental sustainability criteria into start-up selection processes and provide tailored services that support sustainability. Such practices enhance the attractiveness of incubation programs, as an increasing number of start-ups are developing core businesses focused on environmental solutions (Social Innovation Monitor, 2024). Managers should also reinforce networking services, which are becoming critical components of incubation activities. In turn, start-up managers should actively exploit these networking opportunities to overcome resource and competence constraints through collaboration with external partners. This is particularly relevant for eco-innovation, which can serve as a strategic lever for achieving competitive advantage. Particularly, within the Italian framework, for non-certified BIs, specializing in eco-innovation and OI services can serve as a crucial differentiation strategy to attract high-potential start-ups. Conversely, certified BIs should leverage their institutional recognition and established networks to act as lead orchestrators in larger, sustainability-oriented OI ecosystems.

Policymakers should implement measures that strengthen local and national innovation ecosystems by offering incentives for collaborative eco-innovation practices among start-ups and established firms. They should also support the creation of platforms and networks that facilitate OI processes. Moreover, in the specific context of the Italian innovation ecosystem, policymakers could consider integrating specific sustainability

metrics into the legal requirements for granting or renewing the “*certified*” status, thereby institutionalizing green practices at the ecosystem level. Furthermore, targeted financial incentives and funding schemes should be designed for BIs that actively promote sustainability (especially for non-certified BIs aiming to upgrade their service portfolio towards green transition), thus fostering their development in this domain. Finally, investment in training and awareness programs on sustainability and OI is essential to nurture a more open, responsible, and sustainability-oriented innovation culture.

This study is not without limitations. First, it relies on a specific and bounded sample of Italian BIs; therefore, the findings are deeply tied to this geographical and institutional context and may not directly apply to different international ecosystems. To address this, future research should adopt a comparative approach, expanding the analysis to other European or global contexts. Second, the analysis captures only the perspective of BIs, excluding that of the incubated start-ups. Third, it adopts a descriptive-survey approach. Future research could employ qualitative methods (e.g., in-depth case studies) or quantitative ones (e.g., econometric models) to provide deeper insights into the dynamics examined. Fourth, the data are based on respondents’ self-perceptions; thus, complementary analyses using objective indicators of start-ups’ economic performance and environmental impact would offer a more comprehensive understanding.

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## EXPLORING THE INFLUENCE OF AI ON ENTREPRENEURIAL AUTHENTICITY: A RESEARCH AGENDA

Silvia Ranfagni  
silvia.ranfagni@unifi.it  
University of Florence

Massimo Rosati  
massimo.rosati@unifi.it  
University of Florence

Kristian Gianassi  
kristian.gianassi@unifi.it  
University of Florence

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### Abstract

**Purpose:** the paper aims at understanding which major spheres of the authentic entrepreneur are impacted by AI and develop a research agenda on these.

**Design/methodology/approach:** based on fundamental principles of authentic entrepreneurship and AI's impact on it, a semi-systematic literature review applying inductive thematic analysis on 55 academic works has been developed, giving space for a wide discussion and a research agenda for future studies.

**Findings:** four major spheres with significant implications for authentic entrepreneurs have been identified: crafting the authentic self in the AI-driven age; the social construction of authenticity in AI-mediated contexts; authentic entrepreneurial agency in human-AI co-creation; relational climate and shared intent in AI-mediated entrepreneurship.

**Practical and social implications:** authentic entrepreneurs need to provide an answer to the transition opened up in these domains in order to preserve their authenticity.

**Originality of the study:** the article enriches the scant resources found in the specific intersection under inquiry. Disclosing new domains that need investigation, it offers some interesting insights for practitioners on which aspects to take into account in AI adoption, for researchers where to direct their focus.

## 1. Introduction

Authenticity has long been a central theme in scholarly debate, interpreted through a variety of lenses—from objective/iconic views tied to products and brands (Grayson & Martinec, 2004; Beverland, 2006; Ranfagni, 2018), to relational/indexical perspectives rooted in context and recognition (Burrese et al., 2022). Beyond consumer objects, a rich stream of research has also focused on the authentic individual, particularly in leadership and entrepreneurship (Avolio & Gardner, 2005; Walumbwa et al., 2008; Trilling, 2009; Gardner et al., 2005). In the latter, authenticity is conceptualized not as a fixed trait, but as a dynamic process of self-construction and moral alignment—one that integrates personal conscience, vision, and values into everyday action (Ranfagni et al., 2018; Duffy & Dik, 2013). More specifically, authentic entrepreneurs are capable to ground their actions in a deep coherence between personal values, ethical purpose and business practice (Avolio & Gardner, 2005; Luthans & Avolio, 2003; Gardner et al., 2021). Hence, the self-authentication process, which they enact, reflects an inner tension between remaining faithful to one's evolving self and negotiating the demands of markets and society (Alvesson & Einola, 2019). In other terms, it implies a tradeoff between respecting one's personal identity and profoundly held values (Wagenschwanz, 2021) or privileging one's social identity and fitting with one's environment and the relations constituting it (Schmader & Sedikides, 2018). Consequently, authenticity in entrepreneurship is not a given state, but a becoming—an existential project that integrates personal conscience and social embeddedness.

At the same time, we are witnessing an unprecedented technological shift driven by Artificial Intelligence (AI) (Menon, 2024; Ciacci et al., 2024). Far from being a neutral tool, AI acts as a symbolic and relational mediator capable of influencing how individuals reflect, communicate, and relate to others. In particular, recent advancements in symbolic AI—such as language models, recommender systems, and affective computing—intervene in the very domains where authenticity takes shape: self-perception, narrative construction, and social recognition (Sharon, 2013; Floridi, 2023). AI is thus not only transforming business operations, but also reconfiguring the conditions of being for entrepreneurs, with potential consequences for identity, agency, and meaning making (Tonks, 2021; De Pisapia, 2024).

Studying the interplay between authenticity and AI in the entrepreneurial domain is therefore urgent and timely. On one hand, authenticity remains a key aspiration for entrepreneurs seeking meaningful and ethically grounded ventures. On the other hand, the pervasive presence of AI calls into question the extent to which these aspirations can be realized, mediated, or even simulated by machines. Understanding how AI is adopted,

appropriated as Kudina (2021) would say – meant as a way of interpreting and attributing meaning to technologies –, is of paramount importance, since it influences the authenticity of entrepreneurs. If it is, in fact, true that AI impacts both personal and social dimensions of the self (Tonks, 2021; De Pisapia, 2024; Alexopoulos, 2024; Kouros & Papa, 2024; Kirk et al., 2025), the way this set of technologies is appropriated may reverberate on the way authenticity is interpreted by entrepreneurs translating in the way business is conducted (O’Neil et al., 2022). Hence, this convergence invites us to a deeper exploration of how authenticity and artificial intelligence are increasingly intertwined in the entrepreneurial landscape. Rather than treating them as separate or opposing domains, we consider how they interact, influence one another, and open new conceptual and practical tensions (Boddington, 2023). Accordingly, this study is guided by the following research question: How does Artificial Intelligence influence the processes of entrepreneurial authenticity, and what are the implications for identity construction and authentic agency in contemporary entrepreneurship?

Exploration of such a domain has been possible by approaching academic works and perspectives that are multidisciplinary. This has been done to reflect on the processes linking the triad AI-authenticity-entrepreneurship, which open up to transitions in society and make a call for the development of a research agenda useful for setting future specific research questions.

In order to do this, the first paragraphs of this paper (2.1 and 2.2) have tried to summarize the major contributions that have given birth to what implies authentic entrepreneurship. Then, the article moves towards observing the role of AI in entrepreneurship as a mediating factor to experience reality (3.1) and its impacts on the deepest self of individuals (3.2). At this point, attention has been directed to a semi-systematic literature review adopting an inductive thematic analysis carefully designed on the selected 55 articles composing the final sample (4) (Jones et al., 2011; Snyder, 2019; Wong et al., 2013; Braun & Clarke, 2006; Naeem et al., 2023). Upon these bases, a discussion has been stoked around the main entrepreneurial spheres that are hit by AI and that disclose relevant considerations and hypotheses for the authentic paradigm. The four thematic tracks detected – 1- crafting the authentic self in the AI-driven age; 2- the social construction of authenticity in AI-mediated contexts; 3- authentic entrepreneurial agency in human-AI co-creation; 4- relational climate and shared intent in AI-mediated entrepreneurship – enrich literature concerning the nexus AI-entrepreneurship-authenticity with a new prospective cut, that, to our knowledge, has not been addressed in the academic debate yet. Simultaneously, findings open up to a series of reflections that withhold significant managerial implications, among which: the risk to grow visionless compa-

nies; the need to understand how to optimally match enterprises and AI; the necessity to understand what is this promising flexible structure about which authors talk (capable of successfully embracing AI); and the call for developing proper educational protocols for balancing human-AI capabilities (5). In conclusion, a set of interconnected research questions has been proposed in order to fully embrace the changes brought forward by AIs for authentic entrepreneurs and stimulate further critical thinking (6).

## **2. Entrepreneurial Authenticity**

### *2.1 Authenticity as a self-authentication process*

Although in the past multiple schools of thought had emerged around the concept of entrepreneurship and their respective position on the field (Cunningham & Lischeron, 1991), today the entrepreneur is recognized as a precise object of research. Such a personality can be analyzed for its multiplicity of aspects. As Gartner (1990) evidences, the debate about the nature of entrepreneurship concentrates around some cardinal themes, from its unique personality to the distinctive role of innovation, but what unites all these perspectives is the recognition that entrepreneurship is an important matter that may generate significant spillovers for society (van Praag & Versloot, 2007; Gartner, 1990). Among the streams of thought there are some that privilege the identity of entrepreneurs (Wagenschwanz, 2021) and within these it is possible to recognize the stream of authentic entrepreneurship.

The meaning of authentic entrepreneurship is something still significantly debated. Although there's a general consensus around some conceptualizations that are considered to be forming the core construct of authenticity (Walumbwa et al., 2008; Avolio & Gardner, 2005; Luthans & Avolio, 2003; Avolio, Wernsing & Gardner, 2018; Walumbwa et al., 2011; Avolio et al., 2004), authentic entrepreneurship remains a controversial theme of debate. (Gardner & McCauley, 2022; Ford & Harding, 2011; Alvesson & Einola, 2019; Gardner et al., 2021; Alvesson & Einola, 2024; Helmuth et al., 2024). To optimally understand what it implies it is necessary to go beyond the idea claimed by "The Great Person School of Entrepreneurship" (Cunningham & Lischeron, 1991) and embrace a view that recognizes different shades of grey between black and white, respecting the identity struggle that happens at multiple levels (Wagenschwanz, 2021). In fact, philosophers and psychologists teach us that authenticity develops through a process and narrative of self-authentication—a bi-dimensional journey that creates a dialogue between self-development and self-discovery (Arnould

& Price, 2003; Ranfagni, 2018). This self-narrative is built through authenticating acts that promote an integrated perspective on the individual. This does not mean that people are unitary beings; rather, authenticity holistically fuses the different facets of identity into a coherent representation (Arnould & Price, 2003; Shaw, 2010; Vannini & Franzese, 2008). A self-authentication process can originate from an entrepreneur's vocation or calling. The whole process is typical to entrepreneurs who are not really driven by economic profit and success, rather are pushed by a personal stimulus of self-fulfilment or external forces linked to a sense of destiny and duty (Duffy & Dik, 2013). Arguably, it is not possible to be born authentic. Authenticity is a process and not a state (Ranfagni et al., 2018; Helmuth et al., 2024; Shaw, 2010). This can push towards one's true self even individuals that have not yet clearly identified it. The dynamic never comes to an end and has to be reinforced day by day, action by action, and value by value. However, it is undeniable that authenticity remains a deeply personal subject, that is anchored to the beliefs and values embraced and, simultaneously, built by entrepreneurs in their identity (Wagenschwanz 2021). That's the reason why entrepreneurs who found themselves pursuing a self-authenticating process may be literally animated by an (existential) project. Adopting Heidegger's words, "ent-werfen", they implement acts of projecting themselves toward possibilities, being always in the mode of becoming, not fixed (Golomb, 1995; Kaufmann, 2016). They put in motion a process of self-knowledge aimed at understanding who they are or what they are becoming and, therefore, at keeping track of how their true self evolves (Walumbwa et al., 2008; Akrivou et al., 2011). Remaining loyal to their true self, without renegading thoughts, beliefs, ideas and values over the course of time (Trilling, 2009), inspires entrepreneurs who seek authenticity in doing business. Authors highlight how authentic beings experience personal growth establishing a *feeling of control*, hence demonstrating personal autonomy and freedom from external and given conditions in determining their actions (Shaw, 2023; Golomb, 1995; Kaufmann, 2016; Li et al., 2023; Vannini & Franzese, 2008). Similarly, they are emotionally *connected* as being "Dasein in der Welt" (Golomb, 1995; Michie & Gooty, 2005; Vannini & Franzese, 2008; Kelly et al., 2022): they try to give meaning to their self by immersing themselves in the environment and inhabiting it (Shaw, 2023; Freeman & Auster, 2011; Vannini & Franzese, 2008; Jackson, 2005). As effects, they embed the environment in their beliefs and actions, understanding how they evolve and how their aspirations can be attained. While doing this, time assumes a fully interior value: in an authentic being, past with its memories and its immersive processes "lives" of its present time. It is part of the present moment and generates a temporal continuity that drives potential future choices (Ranfagni et al., 2021; Jackson, 2005). The relationships that he develops in time with others are circular: he gives

to others in order to receive in terms of self-definition. As Atwijuka and Caldwell (2017) point out, these entrepreneurs follow the ethic of ‘take care of.’ Expressed in relationships based on a reciprocal sense of responsibility, it can be seen as moral reasoning that derives from the desire to maintain mutual relationships with those affected by one’s actions. This ethic can be found in the connections between people, and also in connections between people and goods, the care of which generates effects that are conducive to cultivating an individual growth (Atwijuka & Caldwell, 2017; Derry, 2005).

## *2.2 Authentic-self and its social recognition: impacts and paradoxes*

“Das Ein” is ethically connected, evolving socially and temporally over time. As Freeman and Auster (2011) argue, “authenticity becomes the project of finding this unique expression of our humanity that takes account of both individual (and intra-psychic) and community (inter-subjective) aspirations” (p. 21). The entrepreneurial self, emotionally and socially connected, requires external perception and acknowledgment. In fact, social recognition is essential for the entrepreneur’s authenticity to materialize (Ranfagni et al., 2018; Ranfagni, 2018; Burresi et al., 2022). As Edwards (2010) emphasizes, the entrepreneurial self cannot be fully realized without the validation of others. Recognition, in this sense, is not merely about superficial approval but involves a deep, relational validation that confirms the entrepreneur’s authenticity within the social context (Edwards, 2010; Erickson, 1995). This recognition validates the entrepreneurs’ alignment with their internal values and activates a participatory process that transforms the entrepreneurs’ internal authenticity into a socially acknowledged reality (Freeman & Auster, 2011; Derry, 2005; McPherson, 2013). Contextual fit is a pillar of authenticity, and its absence may have significant negative repercussions on the self of individuals (Schmader & Sedikides, 2018).

The effects of individual-context alignment can positively impact the relationships between entrepreneurs and their community. The formers act as role models whose actions—rooted in moral courage—are emulated by followers (Hannah et al., 2011; Sekerka & Bagozzi, 2007; Walker & Hennig, 2004). This process strengthens organizational ties and fosters shared purpose (Avolio et al., 2004; Freeman & Auster, 2015; Auster & Freeman, 2013). In organizations led by authentic entrepreneurs, followers show higher engagement, commitment, and loyalty due to the alignment between the leader’s words and actions, reinforcing trust (Avolio & Gardner, 2005; Luthans & Avolio, 2003). Additionally, recognized authenticity en-

hances the emotional climate within the organization, generating positive psychological states like trust, hope, and self-efficacy (Green et al., 2003; Huy, 1999; Lenton et al., 2013; Luthans & Avolio, 2003; Luthans, 2002; Walumbwa et al., 2011; Asghar et al., 2022; Yozi & Mbokota, 2024). Followers report higher job satisfaction, emotional well-being, and empowerment (Spreitzer, 1995), with authentic leaders fostering psychological safety that promotes open communication and collaboration (Walumbwa et al., 2008; Luthans & Avolio, 2003; Zhu et al., 2009). Lastly, creativity thrives where authenticity is nurtured (Xu et al., 2017). When employees trust that their leaders value their contributions, they feel empowered to share ideas, take risks, and innovate—positively impacting employee creativity and innovative behaviour (Rego et al., 2014). Motivating leadership further strengthens these effects (Gardner et al., 2011). The recognition of the authentic self, although socially and emotionally connected, is not automatic. Since authenticity in entrepreneurship is a dynamic, context-dependent process shaped by social interactions and external validation (Gardner et al., 2005; Liu et al., 2017), it can lead to the recognition of an inauthentic self as authentic. Entrepreneurs may craft narratives that align with societal expectations, leading their actions to be perceived as authentic even if they are strategically constructed (Rose & Wood, 2005; Hartmann & Ostberg, 2013). This creates a situation where the appearance of authenticity may overshadow its genuine manifestation, complicating how authenticity is recognized (paradox of situation) (Rose & Wood, 2005; Burresi et al., 2022). Furthermore, entrepreneurs are often viewed as more authentic when their image aligns closely with the values and identity of their followers. The relatability of the entrepreneur to their audience enhances their perceived authenticity (paradox of identification). It follows that authenticity can sometimes be more about aligning with external expectations than remaining true to one's inner self (Rose & Wood, 2005; Ranfagni & Guercini, 2014). Entrepreneurs may thus feel pressure to adopt identities that resonate with their audience, even if these identities differ from their own. Finally, entrepreneurs are seen as more authentic when their actions seem natural and effortless, yet this perception often results from intentional construction. The behavior that appears spontaneous is frequently planned and performed, creating a tension between the genuine self and the crafted public persona. It ensures that authenticity can be manufactured for strategic purposes, which undermines its true nature (paradox of production) (Rose & Wood, 2005; Ranfagni & Guercini, 2014).

Authenticity is vulnerable. Its realization depends on recognition, and recognition is shaped by social expectations, audience align-

ment, and performative dynamics (Rose & Wood, 2005; Gardner et al., 2021). In this fragile balance, the self can be misunderstood, strategically performed, or even fragmented—challenging the very notion of a coherent true self. It is interesting to explore how, in an era increasingly influenced by artificial intelligence—disembodied, abstract, and predictive—the emotionally and socially grounded self confronts itself with the new tensions that may influence how to preserve a human-centered, relational understanding of what it means to be and to become.

### **3. Beyond Automation: the role of AI as a Techno-Symbolic Mediator of Authenticity**

The relentless acceleration of Artificial Intelligence (AI) technologies has made any singular or stable definition increasingly elusive. As a result, scholars often define AI in broad functional terms — as a system capable of creating meaningful connections (from *inter*, “between,” and *legere*, “to choose”) that simulate or surpass human cognitive capacities (Rani, 2020; Chen et al., 2022; Jiang et al., 2022). Yet such functionalist views obscure deeper ontological tensions regarding the very concept of “intelligence” (Tuo et al., 2021; Emmert-Streib et al., 2020). Philosophical and psychological perspectives highlight contrasting interpretations: essentialist frameworks often present AI as a threat to human authenticity (Sharon, 2013), while transhumanist narratives see it as a means to expand self-expression and human potential (Sharon, 2013). A third position, *methodological posthumanism*, offers a more nuanced view by emphasizing that the impact of AI depends on how individuals and societies interpret, engage with, and appropriate these technologies (Verbeek, 2005; Sharon, 2013).

In the context of entrepreneurship, technology has historically been recognized as a fundamental element for innovation (Kuratko, 2023; Kahn, 2018). The latter is a central piece of the puzzle of entrepreneurial processes (Gartner, 1990) and is often the cornerstone upon which businessmen develop companies (Nijssen, 2021). It's not a chance that Klein (1977) defines the entrepreneur as “*a broker between what is economically desirable and technologically possible*” (p. 187). Within such a framework, industry 4.0 seems to be the new big question mark for entrepreneurs, especially AI, considered by some authors as the new commodity of the 21st century (Di Fraia, 2020). AI technologies span a wide spectrum — from narrowly specialized systems (e.g., task-specific automation) to generative and adaptive

forms capable of language, image, and decision support. All of them find adoption across different sectors (Kim et al., 2022; Woschank et al., 2020; Poalelungi et al., 2023; Dakalbab et al., 2024; Zhang et al., 2021; Gligorea et al., 2023; Rasheed et al., 2021; Huang & Rust, 2021) and their implementation is considered to be sharpening decision-making, operations optimization, innovation, competitiveness, and even creativity (Pfau & Rimpp, 2021; Weng et al., 2024; Kordon, 2020; Reim et al., 2020; Giuggioli & Pellegrini, 2023).

We therefore distinguish between three functional types of AI: (1) operational AI (e.g., robotic automation) (Russell & Norvig, 2020), (2) logical or rule-based AI (e.g., neural-symbolic systems) (Besold et al., 2017), and (3) linguistic or symbolic AI, such as foundation models (Bommasani et al., 2021). These latter AI systems intervene in the symbolic, reflective, and social dimensions of entrepreneurial activity and may influence identity construction, narrative shaping, and interpersonal perception. More specifically, these systems do not merely automate decisions; they restructure how entrepreneurs reflect, communicate, and are perceived, thereby impacting the coherence and credibility of their self. In this sense, symbolic and relational AI, such as transformer-based large language model (LLM), recommender systems, sentiment analyzers, and affective computing tools, act as mediators in the entrepreneur's negotiation with themselves. More specifically, they trigger techno-symbolic self-negotiation that is a reflective and socially-situated engagement between human intentionality and machine mediation. It follows that they can act as both a lens and an amplifier for how authentic entrepreneurs perceive and inhabit a technological environment fuelled by AI applications.

Human and artificial intelligence constitute two fundamentally distinct forms of intelligence. While both share *techne* (practical knowledge) and *episteme* (analytical understanding), only humans possess *phronesis* (practical wisdom), *nous* (intellect), and *sophia* (reflective insight) — qualities that are indispensable for context-sensitive and interpretive engagement with tools (Mancuso, 2024). Moreover, this higher-order “beyond-intelligence”, or “thought”, embeds the evolutionary history of individuals, their affective dimensions, tacit knowledge, and metaphorical reasoning (Shojaee et al., 2025). Authenticity becomes a lens through which to understand how entrepreneurs combine emotion, history, and passion with depersonalizing cognitive tools. These tools can reshape the sense of self, fostering technological dependency, superficial learning, and blur boundaries between real and virtual realms — opening up risks

of anxiety, depersonalization, and derealization (Tonks, 2021; Aardema et al., 2006), as well as reducing the uniqueness of one's own experiences and compromising the individuality of the self (Alexopoulos, 2024). They may lead to a dissociation and misalignment between the subjective "I" and the composed "Me" (James, 1950) – that is, between the material self, encompassing the body, possessions, and technologies; the spiritual self, as the site of subjectivity and reflexivity; and the social self, comprising one's perceived and attributed identities in relational contexts (Tonks, 2021; De Pisapia, 2024). More specifically, on a social level, they find themselves navigating a hybrid space composed of human intentions and algorithmic structures (Latour, 1999). Technological prostheses (Sharon, 2013) restructure modes of thinking and acting. They give rise to specific forms of human–technology relations, which, according to Ihde's (1990) taxonomy, can be grouped into four types. First, embodiment relations, where AI systems become transparent extensions of the subject – for example, decision-support algorithms that feel "invisible" yet subtly guide choices. Second, hermeneutic relations, in which AI produces interpretable representations of reality, such as analytics dashboards that require human interpretation. Third, alterity relations, where AI appears as an autonomous "other", exemplified by collaborative robots. And finally, background relations, where AI operates invisibly in the background and becomes noticeable only when something fails – as with continuous monitoring systems. The new social network, defined by Brandtzaeg et al. (2025) as AI-individualism, may open space for individuals' psychosocial moratorium (Kouros & Papa, 2024), but may also reduce interhuman relations deeply necessary to discover one's authenticity (Brandtzaeg et al., 2024; Brandtzaeg et al., 2025; Kirk et al., 2025). This implies a change in the entrepreneurial context with potential mismatch between the latter and entrepreneurs' social identity at self-concept fit level, goal fit level, and social fit level (Schmader & Sedikides, 2018), impacting their authenticity. Authentic entrepreneurs thus face a dual movement: on one hand, AI can enable reflective isolation and introspection conducive to authenticity; on the other, it may erode interpersonal dialogue — a cornerstone of authentic development (Akrivou et al., 2011; Chen & Lin, 2024). The entrepreneurial challenge lies in consciously navigating these tensions, balancing introspection, relational engagement, and critical technology use to sustain genuine processes of self-realization and innovation (Sundar, 2020; Sharon, 2013; de Jong, 2020). The entrepreneurial authenticity building process (O'Neil et al., 2022) definitely is at stake here.

## 4. Methodology

To comprehensively explore the intersection of artificial intelligence (AI), authenticity, and entrepreneurship as an emerging research domain, and to synthesize the existing literature on the potential impact of AI on authentic entrepreneurial processes, we conducted a qualitative semi-systematic literature review following established methodological frameworks (Tranfield et al., 2003). The ultimate goal was to develop a research agenda to stimulate future investigations (Snyder, 2019). Semi-systematic, or narrative, literature review is a recognized qualitative methodological framework that was selected for its effectiveness in consolidating fragmented evidence in multidisciplinary topics (Snyder, 2019; Kraus et al., 2023; Wong et al., 2013) and in supporting the formulation of research agendas. Semi-systematic reviews occupy a middle ground between traditional, highly subjective narrative reviews, and systematic highly objective reviews. This methodology helps maintain a high degree of objectivity while preserving the flexibility needed to capture valuable insights guided by the researchers' intuition (Kraus et al., 2023; Zunder, 2021). This methodological choice is also consistent with the objectives of the present research: mapping existing themes on the topic of reference, proposing a different interpretative angle on emerging processes, and stimulating reflections for future studies. These aims align with the purposes of narrative literature reviews as observed by Baumeister and Leary (1997). To ensure analytical depth and conceptual relevance, the review was complemented by an inductive thematic analysis, based on the six-step protocol of Naeem et al. (2023) and grounded in Braun and Clarke's (2006) foundational work. This dual strategy enabled the identification of latent themes, emerging trends, and conceptual gaps. The overall process was structured into three main stages: (1) review design, (2) review execution, and (3) review analysis (Snyder, 2019; Tranfield et al., 2003).

### *4.1 Review Design – Objectives, Scope, and Search Strategy*

The review began with a validation of the research question's relevance and originality, supported by the historical significance of the topic and the lack of integrative studies addressing the AI–authenticity–entrepreneurship nexus (Snyder, 2019; Tranfield et al., 2003). The multidisciplinary nature of this intersection further justified a structured and replicable methodological approach. A systematic search protocol was then defined to ensure high-quality source se-

lection while balancing breadth and specificity. In line with Jones et al. (2011), the first stage consisted in the initial definition of a broad search criterion, with the aim of progressively narrowing our focus to the core domains of the review, namely “examining the interplay between the three contexts of entrepreneurship, authenticity, and artificial intelligence and, especially, which implications does AI hold on the authenticity of entrepreneurs.” Search terms were derived from the literature at the intersection of these three domains (Jones et al., 2011). Translated into Boolean operators (AND, OR), this meant searching for articles using queries such as: (‘artificial intelligence’ OR ‘machine learning’) AND (‘entrepreneurship’) AND (‘authenticity’ OR ‘authentic’). Additional combinations were applied in an effort to cover the different nuances and shades through which the themes may emerge in such a blurred and cross-disciplinary area of investigation. The search was conducted between October 2024 and February 2025 across Scopus, Web of Science, and EBSCO, and covered publications between 2016 and 2025. The initial year (2016) was chosen for its symbolic value: the moment when the wider public first realised that deep learning could outperform the human brain, following AlphaGo’s victory over Lee Sedol. Articles were included if they: (1) were peer-reviewed; (2) were written in English; (3) conceptually addressed at least two of the three core domains (AI, authenticity, entrepreneurship); and (4) provided theoretical, empirical, or conceptual insights rather than purely technical discussions. Exclusion criteria involved non-peer-reviewed sources, conference abstracts without full text, and works focused solely on technical AI development without conceptual relevance.

These criteria were adopted from the outset to ensure conceptual importance, given the vast and interdisciplinary nature of the keywords involved (Snyder, 2019). At the same time, considering the innovative and early-stage nature of the context under analysis and the plausible lack of highly cited contributions, we chose to go beyond only highly impactful journals (Jones et al., 2011; Tranfield et al., 2003) in order to broaden the number of articles that could be scrutinized. This process yielded an initial corpus of 79 documents, which served as the basis for further selection and analysis.

#### *4.2 Conducting the Review – Screening, Selection, and Inter-Coder Validation*

A second round of screening was conducted to refine the initial corpus and ensure conceptual alignment. First, the presence of duplicates was checked manually and, when present, duplicates were removed. Next, the three authors independently screened the abstracts to exclude articles lacking substantive connection to the research focus. Subsequently, full-text reviews were carried out to assess theoretical depth and relevance (Jones et al., 2011). Studies addressing solely technical aspects of AI were excluded unless they contributed to understanding authenticity in entrepreneurial contexts (Tranfield et al., 2003). In addition to this reductive process, backward and forward snowballing was applied to identify additional sources. The screening and selection procedures were independently carried out by multiple researchers. Disagreements were discussed and resolved through consensus meetings. All decisions were documented in a shared Excel protocol to ensure transparency and replicability. The final sample comprised 55 peer-reviewed articles, which form the empirical and conceptual base for the thematic analysis and are presented in Appendix C.

#### *4.3 Thematic Analysis and Conceptual Synthesis*

The selected corpus was subjected to an inductive thematic analysis, following best practices for qualitative synthesis (Braun & Clarke, 2006; Naeem et al., 2023; Krippendorff, 2004; Seuring & Gold, 2012). Each article was treated as a unit of analysis (Jones et al., 2011). The process began with open coding, independently performed by the researchers to identify emergent categories. This step was reinforced by the generation of brief descriptions of the main arguments and the most interesting insights associated with each source (Ward et al., 2009; Jones et al., 2011). The open coding process was considered complete when the sources no longer provided additional, substantially new insights and perspectives on the influence AI may have on the authenticity of entrepreneurs (Kolbe & Burnett, 1991; Jones et al., 2011). Subsequently, axial coding was applied, through which related codes were grouped into higher-order themes. In line with Braun and Clarke (2006), themes were deemed valid when they captured something meaningful about the data in relation to the research question and reflected a patterned conceptual response. These themes were not extracted from their context; rather, they were identified

in close connection with their original milieu and meaning (Jones et al., 2011). To ensure intersubjective reliability, a collaborative triangulation protocol was applied (Kolbe & Burnett, 1991): discrepancies in coding were discussed and reconciled through consensus. This phase also involved a systematic examination of the theoretical frameworks, research designs, and empirical contributions across the corpus. Rather than merely identifying surface-level topics, the goal was to extract deeper thematic patterns and theoretical lenses—such as entrepreneurial identity, AI ethics, sociotechnical imaginaries, and authenticity as symbolic capital—that recur across studies. The initial phase of theme framing resulted in 15 themes, each accompanied by a presentation of its conceptual substance. These codes were then analysed again in a second aggregating stage, carefully scrutinized to identify areas of connection between them that would hold theoretical relevance and build a coherent representation of the dynamics under inquiry. This phase was repeated iteratively until arriving at super-classes, each representing a different domain with connected founding principles (Jones et al., 2011). Although discrete and mutually exclusive at an analytical level, the four major clusters obtained are highly interconnected due to the nature of the phenomenon under observation. The resulting conceptual structure informs both the discussion and the forward-looking research agenda presented in the final section (Snyder, 2019). In Appendix A a table summarizes some of the main references that have been analyzed in order to define the thematic areas.

## **5. Results, Discussion, and Implications**

AI's ubiquity (Menon, 2024) impacts on the entrepreneurial sphere starting from the very root of its nature, hence the individual dimension. Concurrently scholars have also evidenced a series of influences that extend from the individual to the organizational level, impacting on businesses. The analysis of the chosen sample of 55 papers confirms this trend evidencing the emergence of four major thematic tracks that present relevant implications for authentic entrepreneurs in an AI-based transition, that emerged from our literature review. These are more specifically: 1- crafting the authentic self in the AI-driven age; 2- the social construction of authenticity in AI-mediated contexts; 3- authentic entrepreneurial agency in human-AI co-creation; 4- relational climate and shared intent in AI-mediated entrepreneurship. All of them present significant implications for

the entrepreneurial profile, especially for its authenticity. Figure 1 provides a visual synthesis of these four thematic tracks and their conceptual relationships.

### *5.1 Crafting the Authentic Self in the AI-driven age*

#### *a. Thematic discussion*

As artificial intelligence (AI) reshapes the spatial, temporal, and relational structures of social life (Tonks, 2021; De Pisapia, 2024), entrepreneurs face the challenge of maintaining a coherent and credible sense of self in increasingly disaggregated environments. The construction of entrepreneurial identity—already fluid and performative—is further complicated by digital infrastructures that both expose and mediate the self (Floridi, 2023; Menon, 2024). This thematic cluster explores how AI-driven systems interact with, threaten, and potentially support the enactment of authentic entrepreneurial identities. Entrepreneurs today must negotiate multiple layers of self-presentation, balancing visibility and intimacy in a landscape marked by algorithmic logics. As noted by Mei and Genet (2024), managing “frontstage” and “backstage” personas becomes crucial for cultivating trust and credibility. Yet sociological perspectives warn that hyperconnected environments increase the risk of identity fragmentation, blurring the distinction between authentic expression and performative adaptation (Pedersen & Ritter, 2024). This is exacerbated by the invisibilization of technology itself: AI systems increasingly operate in the background, appearing seamless and natural while subtly shaping the conditions of entrepreneurial visibility and communication (Beerends & Aydin, 2024). At a deeper level, the temporality of human sense-making is disrupted. Technologies that compress interaction timeframes and generate seemingly human content challenge entrepreneurs’ capacity to ground their decisions in critical, value-laden reflection (Barthelmeß & Furbach, 2023; Pedersen & Ritter, 2024). AI-generated artifacts—whether texts, images, or simulations—now often mimic human output with such fidelity that their artificial nature becomes imperceptible, calling into question the provenance of meaning and the boundaries of authorship. Literature increasingly addresses the psychological and ethical implications of this mediated identity work. The risks include alienation, depersonalization, emotional disengagement, and erosion of agency (De Pisapia, 2024; Bonicalzi et al., 2023; Sundar, 2020). In response, some scholars call for deceleration and deliberate self-examination as a way to sustain inner alignment and restore “self-authenticating

acts" (de Jong, 2020; Wang et al., 2024). Others explore alternative design philosophies: Beerends and Aydin (2024), for instance, suggest embracing the inherent inauthenticity of AI rather than striving to humanize it — a move that reframes AI not as a flawed imitation of the human, but as a distinct interlocutor. Individual responses to AI vary widely, shaped by entrepreneurial personality, risk orientation, and beliefs about authenticity. Cotter (2019) shows how digital entrepreneurs develop different visibility strategies based on their interpretation of algorithmic logics, creating tensions between exposure and control. Similarly, Chukwuka and Igweh (2024), Knox et al. (2023), and Upadhyay et al. (2022) highlight how traits like extraversion or openness to experience correlate with greater willingness to adopt AI tools, while risk aversion or low ambiguity tolerance may inhibit integration. However, excessive reliance on AI can lead to standardization, loss of symbolic authorship, and brand dilution (Chen & Zhang, 2024; Menon, 2024; Marino et al., 2024). When outputs are accurate but devoid of internal reflection, the entrepreneur risks delegating key dimensions of identity construction to systems incapable of self-awareness, value evaluation, or intentionality (Dep-tula et al., 2025; Tamang & Singh, 2024; Lee et al., 2023; Noponen et al., 2023). The result is a hollow form of authenticity—what some define as “perceived” but not “lived” authenticity—where meaning is simulated rather than generated from within. Ultimately, the question is not whether entrepreneurs will use AI, but how they will do so in ways that preserve autonomy and coherence. The integration of AI into entrepreneurial practices thus demands more than technical proficiency; it requires an ongoing interpretive effort to safeguard the consistency of the entrepreneurial self in a context increasingly saturated with synthetic intelligences (Sundar, 2020; Bonicalzi et al., 2023). Whether authenticity becomes a negotiable trait or a non-negotiable compass remains a defining question for the entrepreneurial subject in the age of AI.

In sum, this cluster shows that in an AI-driven age, entrepreneurial authenticity depends on preserving spaces for slow, value-laden reflection that allow the self—rather than the algorithm—to remain the primary author of identity.

#### *b. Managerial implications*

The process, already activated in the pre-AI digital age, for which subjects must deal with hybrid environments (Pedersen & Ritter, 2024; Floridi, 2023), is now further exacerbated. If previously the online and offline worlds got to merge together and actions became

real no matter which the domain of reference, virtual or physical; today, virtual agents can even operate on human behalf, as well as literally become non-human relational agents with whom to interact (Murtinu & De Massis, 2025). AI adoption has been evidenced as depending on the entrepreneurial orientation and disposition to actually embrace this technology. It has, in fact, been highlighted that different profiles may respond differently to technological innovations (Chukwuka & Igweh, 2024; Knox et al., 2023; Chen & Zhang, 2024). Based on the way entrepreneurs will present themselves through these tools, whether fully adopting or refusing them, will define the way business processes are dealt, from the creation of value for the final customer – e.g., chatbot-related services vs human interaction – to HR practices, defining the way the company is positioned and how stakeholders perceive the identity of entrepreneurs. Without the capacity to critically manage the implementation of these tools, entrepreneurs risk diluting their identity, with potential threats like standardization. If all processes are delegated to AI without any sort of human reflection and consciousness, the human value risks to be lost and authenticity broken down in multiple pieces, as Joseph (2025) states through its definition of algorithmic self. Similar processes may even push the entrepreneur to a state in which he loses the reins of his/her enterprise and, mostly, its vision, leaving the company filled by a void of senseless actions that are driven by algorithmic logic and no real human intent or value. Such a state may really mine the foundations of the company and its long-term development, considering the established correlation between vision and company performance (Baum et al., 1998).

## *5.2 The Social Construction of Authenticity in AI-mediated contexts*

### *a. Thematic discussion*

Authentic individuals, even when fully immersed in their environment, are only perceived as authentic if they are socially recognized as such (Helmuth et al., 2024; Erickson, 1995; Mei & Genet, 2024; Noponen et al., 2023). This underscores the central role of external recognition—a concept gaining prominence in literature—as a necessary condition for entrepreneurial authenticity to hold social and market value. In the digital context, however, this recognition is increasingly fragile. The adoption of AI can compromise the perception of “truth” and human warmth traditionally associated with the entrepreneurial brand. Scholars highlight how AI technologies are capable of making entirely artificial content appear authentic to

others—a phenomenon known as “AI-thenticity”—with significant effects on consumer behavior (Pedersen & Ritter, 2024; Bui et al., 2024; Xia et al., 2024). Digital authenticity, in this view, refers to “the perceived quality of being real and true based on the seeming connection between a digital entity and a physical person, place and/or time” (Pedersen & Ritter, 2024, p. 165). What changes is not only the perception of authenticity, but also the interface and structure of connection: no longer rooted in exclusively physical or embodied contexts, these connections emerge within hybrid realities, where AI acts as both a potential enabler and a threat. It can amplify perceived authenticity—or erode it—even when grounded in genuine self-expression.

Scholars (Giuggioli & Pellegrini, 2023; Lee & Kim, 2024) evidence that AI-thentic solutions that appear too artificial fail to create others’ self-identification (Gonçalves et al., 2025; Deptula et al., 2025; Jago, 2019; Sundar, 2020; Lee & Kim, 2024). A way to surpass this paradox relies in the capacity of implementing transparent AI systems (Liu, 2021; Sundar, 2020) and transmitting humanity and personality through it (Knox et al., 2023; Liu, 2021). More precisely, Deptula et al. (2025), Jago et al. (2022) and Jago (2019) claim that entrepreneurs should valorize real-world experiences, emphasize human centeredness in their narratives (both of entrepreneurs and followers), strive for “good enough” rather than perfection – AIs have a natural tendency towards perfection that annihilates human creativity, innovation, and personal spirit -, and emphasize unique personality and style. To this purpose Cotter (2019) evidences the need for developing explicit strategies around algorithms, studying them in depth and providing a response to them. Empowering technology with human touch, algorithms with storytelling, and increasing speed with dynamics of slowing down, and vice versa (de Jong, 2020), would allow to generate self-authenticating acts also in AI age.

Self-authentication acts with underlying AI communicational processes will be recognized if, although the non-human nature, it is possible to perceive a substantive self-consciousness (Chen & Zhang, 2024). AIs, in fact, aren’t capable of moral evaluation and free decision-making ability yet (Chen & Zhang, 2024, p. 291; Harari, 2024; Schönecker & Kim, 2022; Satyawati & Iswati, 2023). Indeed, AIs lacks reflexive (self-awareness) capabilities in most cases (Todariya, 2024; Dehaene et al., 2021; Zhang, 2022). On the other hand, humans possess practical wisdom – *phronesis* – (the capacity to acknowledge the surrounding context and adapting to these complexities), virtuousness (are capable of interpreting and pondering socio-cultural norms) – *arete* -, and embody goodwill – *eudanoia* – (are self-direct-

ed but capable of embodying values shared with others), as well as empathy (Kelly, 2023), intuition (Giuggioli & Pellegrini, 2023), proactive thinking (Wang et al., 2024), creativity and spontaneity (Dep-tula et al., 2025), teleonomy and autopoiesis (Marino et al., 2024), all human distinctive qualities that should be valorized and preserved to obtain a competitive advantage, allowing entrepreneurs to self-authenticate differentiating in markets saturated by algorithmic content and AI-driven communication.

Some authors even believe AI should be taken as support to authentic leadership instead of substitution (Noponen et al., 2023; Kelly, 2023; Titareva, 2021; Shepherd & Majchrzak, 2022). Kelly (2023) makes an ulterior remark about authentic entrepreneurs, evidencing how their mindfulness may allow to better understand the implications of technology for humanity and integrate humanity and AI the best way possible. It might be potentially interesting to disclose how this may be achieved.

Overall, this cluster shows that in AI-mediated contexts where AI-thenticity unsettles external validation, entrepreneurs can sustain credible authenticity only by making their distinctive human qualities visible and using AI as a transparent, supportive extension rather than a substitute for the self.

#### *b. Managerial implications*

Concerning “the social construction of authenticity in AI-mediated contexts”, entrepreneurial insights and suggestions are strongly related to the first thematic cluster. Since it is acknowledged that authenticity is a socially constructed perception, it is fundamental for entrepreneurs to optimally manage the practices in which AI gets embedded considering the risk of being perceived as inauthentic (Pedersen & Ritter, 2024; Bui et al., 2024; Xia et al., 2024). In such dynamics, it is therefore highly suggested to maintain human qualities and implement AI as a supportive element to the domains in which human capacities are limited due to inevitable cognitive processes. On the other hand, if AI’s support is flanked by the valorization of human critical thinking, creativity, self-awareness and reflexivity the authenticity of entrepreneurs may be elevated to a whole new level in which AI becomes a tool for being perceived as authentic instead of being driven away from one’s self (Kelly, 2023), increasing at the same time performances and authenticity perception with its added value. Entrepreneurs should carefully examine the available AI systems and understand which is the best one for the needs of their company – where it can improve human qualities – and which al-

low for the preservation of distinctive human capacities that are not suffocated by algorithms, rather empowered. This implies the need for deeply understanding the available solutions with their pros and cons in order to make the best choice, since for the moment no artificial intelligence comes without a drawback.

### *5.3 Authentic Entrepreneurial Agency in Human-AI Co-creation*

#### *a. Thematic discussion*

In this cluster, authenticity is not seen in its self-expressive dimensions, rather as a relational competence that enables entrepreneurs to engage meaningfully in human–AI collaborative processes. Moreover, authenticity is defined by self-awareness, meta-cognition, domain cognizance, and internalized moral perspective, whereas the authentic entrepreneur is positioned as the “captain” steering co-creative systems and shared planning with artificial agents (Ge et al., 2022; Knox et al., 2023). Such qualities - captured in Knox et al.’s concept of cognitive agility - may allow entrepreneurs to act as interpretive filters, grounding AI-enabled outputs in the entrepreneur’s project and ethical framework (Chen & Zhang, 2024; Chukwuka & Igweh, 2024; Obschonka & Audretsch, 2020, Redondo-Rodriguez, 2024). It also could act as a mean to: a) set ethical boundaries and initial parameters for AI deployment and ensure systems operate within human-led intentions (Maadi et al., 2021; Noponen et al., 2023; Shepherd & Majchrzak, 2022), and b) safeguard human-centric values such as emotional connection, transparency, and context sensitivity, especially in decision-making processes mediated by AI (de Jong, 2020; Sundar, 2020; Liu, 2021).

This relational view of authenticity generates a shift from seeing AI as a passive technological backdrop to recognizing it as an active, dialogical partner in co-creative entrepreneurial processes (Giuggioli & Pellegrini, 2023; Rezwana & Maher, 2023; Schönecker & Kim, 2022; Sundar, 2020; Wang et al., 2024; Crockett, 2024; Floridi, 2023). The entrepreneur does not limit himself to a mere implementation of AI systems, but shapes their meaning, purpose, and trajectory through intentional, value-driven engagement. Such co-creation pushes to investigate how the entrepreneur can think and act to maintain a continuous interpretive stance—reading, adjusting, and reorienting AI behavior in light of evolving goals, contextual dynamics, and ethical commitments (Rezwana & Maher, 2023; Van Berkel, Skov & Kjeldskov, 2021). In this perspective, self-consciousness could be the hinge that connects technical competence with value-based leader-

ship (Knox et al., 2023; Chen & Zhang, 2024; Ge et al., 2022). It enables entrepreneurs to navigate complex, hybrid environments—where agency is distributed between human and artificial actors—without relinquishing authorship or accountability. The emerging co-creative dynamic unfolds across multiple levels of analysis: micro (individual interactions), meso (organizational structures), and macro (socio-cultural systems) (Ge et al., 2022). As scholars highlight authentic entrepreneurs will find themselves at operating across these layers to ensure coherence between internal self-understanding and external system design (de Jong, 2020)— and their challenge will be the one of maintaining alignment between who they are, what they stand for, and how intelligent systems are deployed. Particularly intriguing will be understanding how the authentic entrepreneur does not lose control to automation, reclaiming authorship by embedding relational agency at the heart of AI adoption. Authenticity, in this light, may emerge as not diminished by technology, but enacted through intentional, situated, and dialogical engagement. Simultaneously, it may also carry a potential change at the very bases of its paradigm.

Thus, this cluster shows that as AI becomes a new agentic and relational actor, authentic entrepreneurial agency rests on deeply self-aware leaders who design co-creative systems in which humans remain in the driver's seat of meaning, ethics, and direction.

#### *b. Managerial implications*

An “*authentic entrepreneurial agency in human-AI cooperation*” can be reached only when recognizing a series of necessary adaptations that must happen in the entrepreneurial strategies and in their companies. These modifications are needed because of the agentic nature of AI, that, substituting the human one in a series of tasks, challenges the assumption of full autonomy of human action (Giuggioli & Pellegrini, 2023). These tools are capable of driving and steering human decision-making and practices due to their artificial agency (Floridi, 2023). This calls for an unprecedented need for understanding how to cooperate with these actors. In such a cooperation the first thing that entrepreneurs must define is whether they will consider AI as a mere instrumental factor or a player to which attribute some higher status compared, for example, to a mouse and a computer. Especially if recognizing some agency to AI, it becomes a priority for entrepreneurs to design co-creative systems in which the human subject remains in the driving seat of projects and activities, that he can manage thanks to its distinctive qualities (Ge et al., 2022; Knox et al., 2023). However, the activity of designing similar systems is not easy

to be done, since different typologies of AI – human-inspired, humanized, and analytical (Kaplan & Haenlein, 2019) – can be inserted in the entrepreneurial journey and a careful balancing between the entrepreneurs' needs and the opportunities disclosed by AI is needed. Entrepreneurial processes need therefore to be redefined and should be based on flexible and agile structures ever more impellent to host artificial agents and make them fully merge with the environment of application (Ge et al., 2022). Simultaneously, the promised positive benefits of artificial intelligence can be reached only through the development of multidisciplinary teams that are not anchored in their respective fields of action and a process of training and AI-literacy that allows to interpret the data obtained and protect against the well-known hallucinations (Rady et al., 2026). Another way for protecting entrepreneurial action from AI-related mistakes is relying on transparent systems in which the black box of algorithms is opened up to the public and clearly presents its limits and potentials. Similarly, co-designed AIs, meant as tools developed in order to respond to the specific requests of the individuals (Pucci et al., 2024), are needed and may be obtained through a constant dialogue between developers and leaders (Knox et al., 2023). Not by chance, such systems allow the autonomous definition of a set of boundaries and rules before the actual launch of AI, which entrepreneurs need to identify before starting co-creating in the human-AI dialogue (Maadi et al., 2021).

#### *5.4 Relational Climate and Shared Intent in AI-Mediated Entrepreneurship*

##### *a. Thematic discussion*

The development of responsible and innovative AI adoption paths requires more than technical infrastructure: it demands the cultivation of a relational climate where shared intent, dialogical openness, and emotional connection guide how intelligent systems are designed and deployed. Scholars explore how the role of the entrepreneur using AI could remain that of a cultural enabler in companies and as such capable of shaping organizational settings that favor co-creation and long-term alignment between human and artificial agents (de Jong, 2020). It is renowned that authentic entrepreneurs endowed with reflective leadership qualities (Avolio & Gardner, 2005), are particularly suited to this task. Their ability to cultivate meaningful relationships and emotional alignment resonates with organizational values such as experience, wholeness, and wisdom

(de Jong, 2020; Salinas-Navarro et al., 2024; Shepherd & Majchrzak, 2022). These values are not abstract ideals but are conceived as design principles for entrepreneurial ecosystems capable of accommodating artificial agency without losing human intentionality and moral anchoring (Freeman & Auster, 2011; Derry, 2005). In this landscape, Knox et al. (2023) propose the OLB model as an operational structure for building shared mental models between entrepreneurs and AI developers. This structure includes three pillars that are: 1) O (Orienting): the ability to maintain a holistic perspective, underpinned by balanced information processing; 2) L (Locating): the skill to identify and respect others' needs and limits, closely tied to transparency; and 3) B (Bridging): the disposition to co-adapt and co-learn, echoing the poetic dimension of human relationships in organizational life. Such frameworks foreground the need for entrepreneurs to act not as solitary decision-makers but as dialogical nodes within distributed systems of agency (Noponen, 2019; Noponen et al., 2023). Within this view, the cultivation of positive psychological states (Knox et al., 2023), critical and dialogical pedagogies (Kelly, 2023; Titareva, 2021), and reflective learning (de Jong, 2020; Wang et al., 2024) emerge as necessary conditions for preparing both leaders and followers to participate meaningfully in human–AI collaboration. Education becomes not merely instrumental but existential, aiming to develop individuals capable of relational reflexivity and collective alignment.

Ultimately, only such a culture—distributed, intentional, and emotionally attuned—can generate the flexible and agile organizational structures needed to enact bricolage: the adaptive recombination of human and technological elements in entrepreneurial practice (Ge et al., 2022; Delponte, 2018; Giuggioli & Pellegrini, 2023; Kiani, 2024). This perspective does not deny the risks associated with AI—ethical opacity, automation bias, responsibility gaps (Bostrom & Yudkowsky, 2018; Marino et al., 2024; Schönecker & Kim, 2022; Floridi, 2023; Stahl et al., 2023; Chesterman, 2020; Zuboff & Bassotti, 2019; Crouch, 2019; Cath et al., 2018; Werthner et al., 2024)—but situates their mitigation in the entrepreneur's capacity to maintain authorship through situated relational agency. As Harari (2024) remind us, "[...] when we write the code of a computer, we don't limit ourselves to project a product. We redesign politics, society, and culture [...]" (p. 296). The entrepreneur, therefore, must not only implement AI but also shape its cultural implications—ensuring that the systems they co-create remain attuned to the human meanings they are intended to serve.

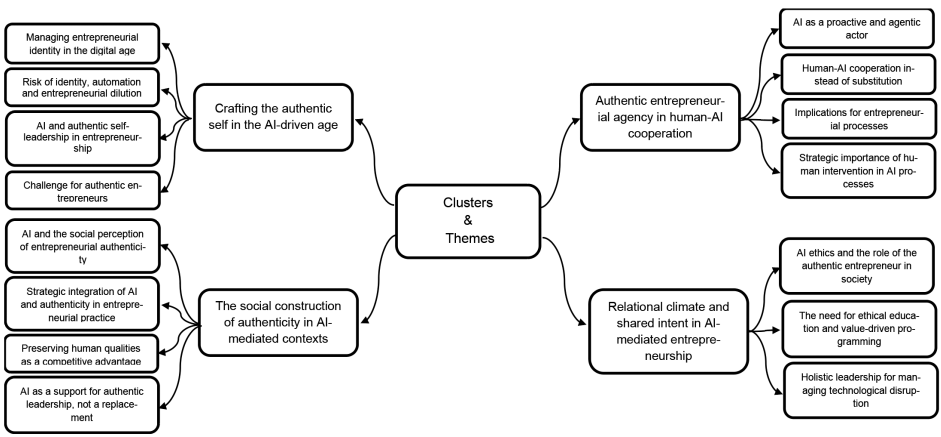
Ultimately, this cluster shows that fostering a relational climate and shared intent in AI-mediated entrepreneurship requires reflec-

tive leadership and robust digital education that render AI’s invisible risks thinkable and align technological choices with collectively endorsed values.

*b. Managerial implications*

To generate a “relational climate and shared intent in AI-mediated entrepreneurship” it is necessary that entrepreneurs share generally acknowledged ethical values and principles – such as the ones of beneficence, non-maleficence, autonomy, justice, explicability, and more (Floridi, 2023) – that make them capable of recognizing AI for its benefits, but also its threats (Beerends & Aydin, 2024; Harari, 2024). This requires campaigns by governments and institutions, as well as educational programs pursued and developed by entrepreneurs themselves. In this, authentic entrepreneurs may be more prone to understanding how to use AI for good. These educational campaigns should aim at developing on-field related skills necessary to master AI tools, as well as frameworks and models of behaviour, such as Knox et al. (2023)’s OLB framework. However, all of these rely on wider capacities to develop diametrically opposed sensibilities to the ones of AI, hence the ability to slow down, expand self-awareness and improve relational connection (de Jong, 2020). This would allow to grow entrepreneurs capable of balancing human and technological peculiarities through a holistic approach that develops a proper entrepreneurial culture. Educational programs are once again starting point for optimally completing a process of bricolage (Ge et al., 2022).

*Fig. 1 Thematic map emerging from the inductive thematic analysis*



## 6. Research Agenda: Rethinking Authenticity in the Age of AI-Enhanced Entrepreneurship

The interplay between authenticity and artificial intelligence in entrepreneurship opens a fertile space for theoretical refinement and empirical inquiry. As the preceding clusters suggest, AI not only mediates entrepreneurial practices but also reconfigures the temporal, relational, and moral dimensions of the authentic self. In light of this, a research agenda must explore how authenticity is redefined, negotiated, and enacted within AI-mediated contexts. Below, we outline six interconnected thematic directions that warrant further investigation. These have been reported also in Appendix B, which connects the research agenda with the thematic discussion and the basic theoretical contribution used as starting point for our paper.

- Reflexive Narratives in AI-mediated Self-authentication.

Entrepreneurial authenticity has traditionally been anchored in reflexive narratives that allow individuals to interpret, integrate, and perform their evolving identities. The integration of symbolic AI (e.g., language models, recommender systems) may support these dynamics but may also challenge these processes considering the potential deriving identity dilution and blurring. This highlights a need for preserving self-authenticating acts also in AI-age, achievable by totally embracing the new technological paradigm or adopting different still unrealized roads. Future research could investigate how AI-mediated self-authentication trajectories unfold, and how entrepreneurs navigate between introspection and algorithmic feedback loops. Do these narratives foster connection, virtue, and an authentic experience of time—or do they fragment the self and accelerate performativity? How does algorithmic feedback influence selfnarratives, and to what extent entrepreneurs develop a “techno-symbolic negotiation” with AI? How do entrepreneurs’ personality differences modulate the ability to preserve authenticity under algorithmic assistance?

- Emotional Resonance and Rational-Automated Systems: A Tension to Explore.

Authenticity, as discussed in the literature, is emotionally embedded, socially connected, and temporally grounded. AI systems, by contrast, operate through rational logic and disembodied automation. This raises the ontological question of whether—and how—authentic relations can emerge in interactions through non-human agents. Is a transparent process sufficient condition to reconcile an emotionally grounded self with affectively neutral technologies?

How can human personalities build meaningful connections through AI-thentic relations? How do mindfulness training programmes influence entrepreneurs' ability to use AI ethically and with emotional resonance? How to train and integrate human qualities into AI tools and how to measure their impact? These themes invite exploration into how human–AI interaction can be designed to preserve affective resonance and relational depth in entrepreneurial life.

- **Fragmented Selves and the Conditions for Recognition**

In a world shaped by hyperconnectivity and algorithmic personalization, entrepreneurial identities are increasingly fluid and fragmented. This calls into question how the perception of an authentic self can be activated in such conditions. Literature suggests that humanized qualities and personalized storytelling are prerequisites to make AI-mediated relations as close as possible to purely human ones. Future studies could examine the touchpoints through which fragmented or hybrid entrepreneurial selves find coherence and validation. How do digital traces, algorithmic performances, or hybrid storytelling help entrepreneurs be recognized as authentic by others—even when their internal identity is still in flux? How do different narrative forms (authentic founder-led videos, podcasts, microblogs) support recognition in hybrid contexts? How do consumers perceive and attribute authenticity to AI-generated or AI-assisted communications, and what role transparency and labeling play? Theories starting from dialogical view on the self of individuals can offer foundational insights.

- **The Paradoxes of Authenticity in the Age of AI**

AI challenges the boundaries between authentic and inauthentic expression. Entrepreneurs may appear authentic while relying on generative systems to simulate relational warmth or ethical intentionality. This gives rise to two important paradoxes: the presence of authenticity within inauthenticity (e.g., sincere engagement with AI-generated outputs) and inauthenticity within authenticity (e.g., strategic authenticity to satisfy perceived expectations). Research should interrogate how these paradoxes emerge, how they are perceived by stakeholders, and what they reveal about the evolving meaning of authenticity. Is authenticity now partially “outsourced” to algorithms? Who retains the agency—and the accountability—for its enactment?

- **AI-mediated Authenticity and Organizational Practices**

At the organizational level, AI is increasingly involved in a range of different strategic processes that ultimately rely on entrepreneurial decision-making. How does AI-mediated authenticity affect these

practices? Scholars evidence the need for more shared decisional processes and co-creative systems supported by artificial agents. Can organizations preserve a culture of authentic engagement when decisions are supported—or even driven—by AI systems? The organizational perspective must recognize and mitigate risks like ethical opacity, automated bias and accountability gaps. Integration ideas include forming internal ethics committees and implementing algorithmic auditing practices to ensure alignment with corporate values. Future research should explore how the values of transparency, intentionality, and emotional intelligence can be embedded in organizational design when artificial agents are involved, as well as investigate on how to reach a company climate that fosters a similar approach. This line of inquiry also invites the rethinking of leadership models in light of AI's relational affordances.

- **AI-mediated Authenticity and Entrepreneurial Decision-Making**

Entrepreneurial decision-making involves more than data analysis—it is often driven by intuition, moral reflection, and existential meaning-making. How does AI reshape this process? Does it dilute the entrepreneur's ability to reflect critically, or does it offer new tools to enhance moral clarity and strategic creativity? It is valuable to study how to preserve these capacities in decision processes, perhaps via guided reflection practices or critical-thinking prompts. Research could explore practices that help entrepreneurs balance AI-driven reflection with human-centred discussion, classify various entrepreneur-AI interaction types and evaluating their impact on autonomy, creativity and accountability. Further studies should explore how entrepreneurs use AI not merely as an informational tool, but as a co-author in decisions that involve identity, values, and long-term vision. This would deepen our understanding of decision-making under the lens of authentic leadership, particularly in fast-evolving, uncertain contexts. Critical could be the leader's capacity to exert self-conscious mechanisms that allow optimal human-AI interaction.

## **7. Conclusions and Limitations**

The present paper explores the nexus of AI, authenticity and entrepreneurship, illuminating a set of research questions poised to guide future investigations. Our semi-systematic literature review—complemented by an inductive thematic analysis of 55 scholarly works—reveals four critical arenas in which AI will reshape entre-

preneurial practice. These thematic clusters not only map the major transitions in how entrepreneurs define and enact authenticity, but also underscore their broader reverberations: from the inner mechanics of self-authentication to external perceptions of authenticity, from organizational cultures to strategic decision-making processes. In each domain, AI emerges as both a catalyst and a challenge, capable of transforming the entrepreneur's identity work, stakeholder recognition, corporate climate and choice architecture.

Despite its exploratory scope, this paper delivers insights of immediate relevance. It equips academics with a clear research roadmap—highlighting uncharted questions and conceptual gaps ripe for deeper analysis—while encouraging fresh critical perspectives on the AI–authenticity–entrepreneurship nexus. At the same time, it offers practitioners a practical mirror in which to examine their own AI initiatives, both at the organizational and the individual level, challenging them to integrate new technologies without sacrificing authenticity or ethical integrity.

This study has several noteworthy limitations. Its semi-systematic design necessarily restricts the sample to 55 articles, which may not exhaust the full breadth of emerging work on AI, authenticity and entrepreneurship. While the interdisciplinary lens yields rich, cross-cutting insights, it also prevents deep dives into any single sector or business domain. Moreover, given the rapid pace of AI research, findings that are current at publication risk being overtaken by new developments almost immediately.

Nonetheless, by mapping thematic clusters and posing targeted research questions, this paper offers a useful starting point for further exploration. Subsequent investigations can build on these insights, both by probing each cluster in greater depth and by testing them within specific industries and organizational contexts.

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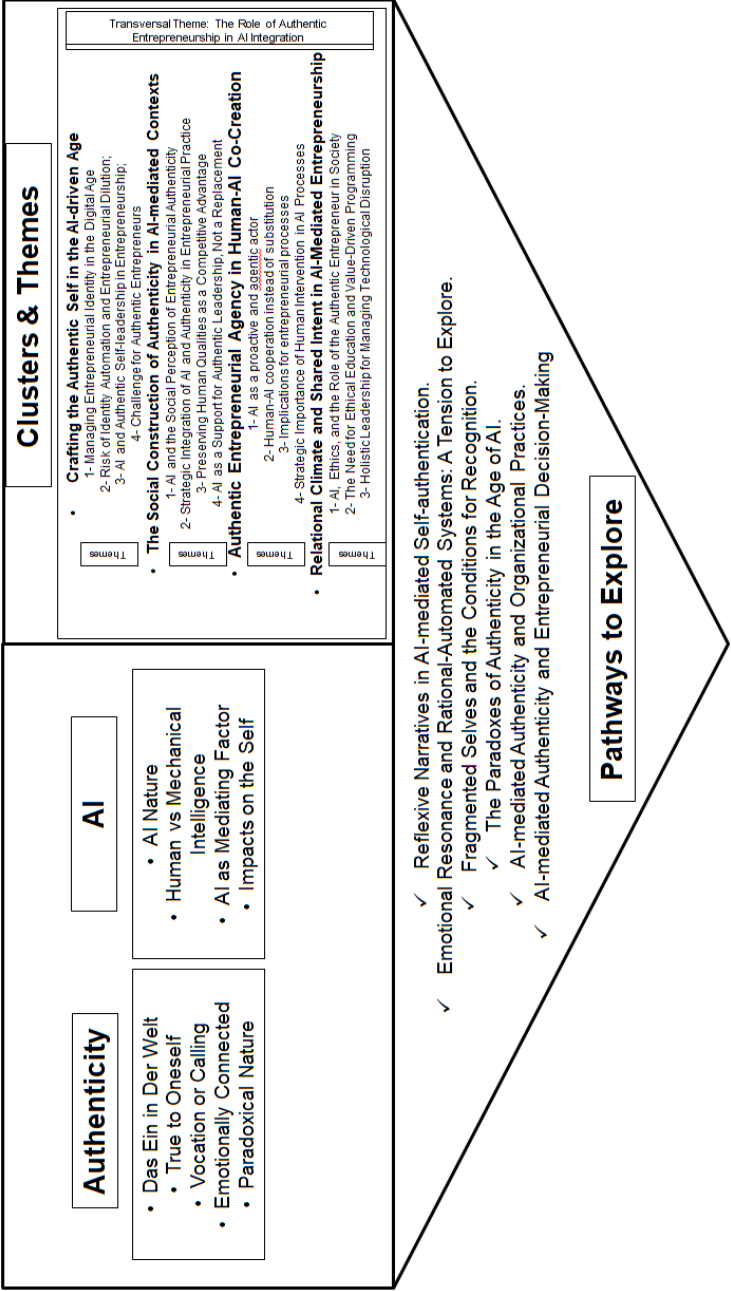
| Thematic track 1 - Crafting the Authentic Self in the AI-driven Age |      |                                                  |                                        |                                                                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------------------|------|--------------------------------------------------|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Author                                                              | Year | Research Design                                  | Sample                                 | Key Insights                                                                                                                                                                                                                                                                                                                   |
| Cotter                                                              | 2019 | Thematic Analysis                                | Facebook Groups                        | Algorithmic power influences users' strategies and behaviour in playing the "Visibility Game", hence in making choices that push them to a trade-off authentic-inauthentic. Users have to choose between different ways of adapting to algorithms.                                                                             |
| Mei & Genet                                                         | 2024 | Descriptive, correlation and regression analysis | 178 Youtube Videos                     | Social media entrepreneurs need to carefully manage their identity in order to remain authentic and be perceived like that. Different strategies correspond to different levels of authenticity negotiation. Some strategies give up authenticity for monetization, some others find an agreement.                             |
| Pedersen & Ritter                                                   | 2024 | Research Agenda                                  | No sample                              | Societies have entered in a new stage of the digital revolution in which digital authenticity has become ordinary. Such a condition makes it impossible to distinguish between authentic and inauthentic artifacts, interactions, and data, opening up to new undiscovered entrepreneurial insights.                           |
| Beerends & Aydin                                                    | 2024 | Discourse Analysis                               | Papers, programs, online discussions   | The human "authenticity negotiation process" has come to a new stage in which the existential condition of what means being human is jeopardized by AI. The latter poses new questions to what it means to be a Man, calling for the proper management of one's identity.                                                      |
| Deptula, Hunter & Johnson-Sheehan                                   | 2025 | Pilot Study                                      | Chat GPT (sole generative AI analyzed) | In order to create authentic content through generative AI it is necessary to develop self-conscious mechanisms that allow to transmit real-world engagement, human centrality, and personal style. Authenticity is interpreted under an Aristotelian perspective and read through Fromm's real and pseudo-self point of view. |

| Thematic track 2 – The Social Construction of Authenticity in AI-Mediated Contexts |      |                                                               |                                                                    |                                                                                                                                                                                                                                                                                                                                  |  |
|------------------------------------------------------------------------------------|------|---------------------------------------------------------------|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Author                                                                             | Year | Research Design                                               | Sample                                                             | Key Insights                                                                                                                                                                                                                                                                                                                     |  |
| Bui, Filimonau & Sezerel                                                           | 2024 | Survey, Regression Analysis, Mediation Analysis               | Two samples:<br>S1=200 pp.<br>S2=400 pp.                           | AI-generated destination images may be perceived as authentic by others, especially when aligning with self-authenticating acts of interested visitors. This dynamic disclosed important implications for authenticity in AI era, AI-thenticity.                                                                                 |  |
| Jago, Carroll & Lin                                                                | 2022 | Survey (Likert scale) Correlation estimation, Means, St. Dev. | S1=207 pp.<br>S2=227 pp.<br>S3=306 pp.<br>S4=219 pp.<br>S5=241 pp. | Perceived authenticity of AIs is evaluated through a quantitative analysis. Results demonstrate that perceived authenticity is higher when highlighting human origins of autonomous technologies and through anthropomorphizing them. Especially human origins enhance authenticity perception compared to anthropomorphic cues. |  |
| Dehaene, Lau & Kouider                                                             | 2017 | Conceptual paper                                              | No sample                                                          | Despite recent success and recognized capabilities of machines to perform in certain domains, the study evidenced that AIs still perform mainly unconscious processes (C0), while lacking real conscious computations (C1) and self-awareness (C2).                                                                              |  |
| Kelly                                                                              | 2023 | Conceptual paper                                              | No sample                                                          | AI, with its subdomains, is considered as a set of technologies that may empower authentic leadership in some of its most important characteristics. Among these especially moral and emotional intelligence.                                                                                                                    |  |
| Shepherd & Majchrzak                                                               | 2022 | Conceptual paper                                              | No sample                                                          | AI can be used as a power to strengthen entrepreneurial activity. AI is seen as a tool for augmenting entrepreneurial individual capabilities and not only increasing production processes, rather also internal conscious dimensions.                                                                                           |  |

Thematic track 3 – Authentic Entrepreneurial Agency in Human-AI Co-Creation

| Author                | Year | Research Design        | Sample                               | Key Insights                                                                                                                                                                                                                                                                                                                       |
|-----------------------|------|------------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rezwana & Maher       | 2023 | COFI system evaluation | 92 Co-creative systems               | <p>AI's need to be considered as agentic actors with which structuring co-creative systems. Interaction design is considered as a necessary step for developing real co-creative systems that allow for best results and enable human-AI partnership.</p>                                                                          |
| Sundar                | 2020 | Conceptual paper       | No sample                            | <p>Considering the AI agency increase it becomes fundamental real co-creative systems and human-AI synergies. It is suggested to deepen the human experience through algorithms, especially the psychological dimension of human-AI interaction (HAI).</p>                                                                         |
| Maadi et al.          | 2021 | Literature Review      | 2015-2020 papers respecting keywords | <p>Humans should remain in the loop, hence in the driving seat. More specifically human presence is fundamental in: 1- data producing and pre-processing; 2- ML learning; 3- ML evaluation and refinement.</p>                                                                                                                     |
| Chen & Zhang          | 2024 | Conceptual paper       | No sample                            | <p>Human-AI relationship is analyzed in the effort of understanding the differences and potential integrations between the two. A three dimensional model couples AI with significant human capital optimizing efficiency and effectiveness.</p>                                                                                   |
| Knox Sütterlin & Lugo | 2023 | Conceptual paper       | No sample                            | <p>AI is seen as a potential catalyst for innovation. However, in order to structure proper co-creative systems it is necessary to start interpreting human-AI interaction as a real relationship. Metacognition, domain cognizance, self-governance and cognitive agility are necessary to create real collaborative systems.</p> |

| Thematic track 4 – Relational Climate and Shared Intent in AI-Mediated Entrepreneurship |      |                              |                          |                                                                                                                                                                                                                                                                                                                                          |  |
|-----------------------------------------------------------------------------------------|------|------------------------------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Author                                                                                  | Year | Research Design              | Sample                   | Key Insights                                                                                                                                                                                                                                                                                                                             |  |
| Noponen Auvinen & Sajasalo                                                              | 2023 | Conceptual Paper             | 3 real world cases       | The chapter analyses the impact that AI may have on forms of leadership, evidencing how it may be a tool to enhance capabilities, but also undermine them. It makes a call for more shared forms of leadership.                                                                                                                          |  |
| Cath et al.                                                                             | 2018 | Conceptual paper             | US, UK, EU reports on AI | AI opens up wider implications for society, starting from institutions, reaching all stakeholders of a community. Three main topics emerge from the reports: a- the need for the development of a 'good AI society'; b- the role and responsibility of certain actors; c- where improvement should be needed.                            |  |
| de Jong                                                                                 | 2020 | Conceptual paper             | No sample                | Human-AI integration is needed in order to optimize AI use. However, there's a need to slow down and education is an essential factor in it. Specifically education should centre on the recovery of experience, wisdom and wholeness, as well as the ability to share, connect and engage with others.                                  |  |
| Giuggioli & Pellegrini                                                                  | 2023 | Systematic literature review | 60 papers                | Entrepreneurial AI augmentation can be reached only when addressing urgent ethical issues. Prerequisite for ethical behaviour is AI literacy for all, starting from the entrepreneur reaching the employee with the simplest job. At entrepreneurial level this would allow to grasp how to use similar tools in a more responsible way. |  |
| Wang et al.                                                                             | 2024 | Panel discussion results     | 4 panelists              | Human-AI relationship poses new challenges for human subjectivity and centrality, especially in cases of overreliance. Collaborative human-AI strategies for preserving human subjectivity are identified-                                                                                                                               |  |



*Appendix C – Full list of semi-systematic literature review*

| N. | Author                                           | Year | Journal/Editor                                                                   |
|----|--------------------------------------------------|------|----------------------------------------------------------------------------------|
| 1  | Barthelmeß, U., & Furbach, U.                    | 2023 | Springer Nature                                                                  |
| 2  | Beerends, S. & Aydin, C.                         | 2024 | AI & Society                                                                     |
| 3  | Bonicalzi, S., de Caro, M. & Giovanola, B.       | 2023 | Topoi                                                                            |
| 4  | Bostrom, N. & Yudkowsky, E.                      | 2018 | Cambridge Handbook of Artificial Intelligence                                    |
| 5  | Bui, H. T., Filimonau, V. & Sezerel, H.          | 2024 | Journal of Destination Marketing & Management                                    |
| 6  | Cath, C. et al., 2018                            | 2018 | Science and Engineering Ethics                                                   |
| 7  | Chen, X. & Zhang, S.                             | 2024 | Open Journal of Social Sciences                                                  |
| 8  | Chesterman, S.                                   | 2020 | Journal of Emerging Technologies                                                 |
| 9  | Chukwuka, E. J. & Igweh, F. K.                   | 2024 | International Journal of Business & Entrepreneurial Research                     |
| 10 | Cotter, K.                                       | 2019 | New Media & Society                                                              |
| 11 | Crockett, C.                                     | 2024 | AI, Consciousness, and The New Humanism                                          |
| 12 | Crouch, C.                                       | 2019 | Il Mulino                                                                        |
| 13 | de Jong, J. C.                                   | 2020 | AI Practitioner                                                                  |
| 14 | Dehaene, S., Lau, H. & Kouider, S.               | 2017 | Robotics, AI and Society                                                         |
| 15 | Delponte, L.                                     | 2018 | Eurocities                                                                       |
| 16 | Deptula, A., Hunter, P. T. & Johnson-Sheehan, R. | 2025 | Journal of Business and Technical Communication                                  |
| 17 | Floridi, L.                                      | 2023 | Oxford University Press                                                          |
| 18 | Ge, B., Wang, Q. & Yao, M.                       | 2022 | System Research and Behavioral Science                                           |
| 19 | Giuggioli, G. & Pellegrini, M. M.                | 2023 | International Journal of Entrepreneurial Behaviour & Research                    |
| 20 | Gonçalves, A. R., et al.                         | 2025 | Journal of Business Research                                                     |
| 21 | Harari, Y. N.                                    | 2024 | Random House                                                                     |
| 22 | Jago, A. S.                                      | 2019 | Academy of Management Discoveries                                                |
| 23 | Jago, A. S., Carroll, G. R. & Lin, M.            | 2022 | Journal of Experimental Psychology: Applied                                      |
| 24 | Kelly, L.                                        | 2023 | Springer International                                                           |
| 25 | Kiani, A.                                        | 2024 | International Journal of Managing Projects in Business                           |
| 26 | Knox, B. J., Sütterlin, S. & Lugo, R.            | 2023 | Handbook of Research on Artificial Intelligence, Innovation and Entrepreneurship |
| 27 | Lee, G. & Kim, H.                                | 2024 | Journal of Retailing and Consumer Services                                       |
| 28 | Lee, Y. K., Park, Y. & Hahn, S.                  | 2023 | Human Factors Psychology Lab                                                     |
| 29 | Liu, B.                                          | 2021 | Journal of Computer-Mediated Communication                                       |

| N. | Author                                       | Year | Journal/Editor                                                    |
|----|----------------------------------------------|------|-------------------------------------------------------------------|
| 30 | Maadi, M., Khorshidi, H. A. & Aickelin, U.   | 2021 | International Journal of Environmental Research and Public Health |
| 31 | Marino, D., Cananzi, D. & Aragona, F.        | 2024 | Springer Nature                                                   |
| 32 | Mei, M. Q. & Genet C.                        | 2024 | European Management Journal                                       |
| 33 | Menon, S.                                    | 2024 | Springer Nature                                                   |
| 34 | Noponen, N.                                  | 2019 | Electronic Journal of Business Ethics and Organization Studies    |
| 35 | Noponen, N., Auvinen, T. & Sajasalo, P.      | 2023 | Emerald Publishing Limited                                        |
| 36 | Obschonka, M. & Audretsch, D. B.             | 2019 | Small Business Economics                                          |
| 37 | Pedersen, C. L. & Ritter, T.                 | 2024 | Industrial Marketing Management                                   |
| 38 | Redondo-Rodriguez, M. D., et al.             | 2024 | The Journal of Technology Transfer                                |
| 39 | Rezwana, J. & Maher, M. L.                   | 2023 | ACM Trans. Comput.-Hum. Interact.                                 |
| 40 | Salinas-Navarro et al.                       | 2024 | Education Sciences                                                |
| 41 | Satyawan, M. D. & Iswati, S.                 | 2023 | Journal of Economics, Business, and Accountancy Ventura           |
| 42 | Schönecker, D. & Kim, H.                     | 2022 | de Gruyter                                                        |
| 43 | Shepherd, D. A. & Majchrzak, A.              | 2022 | Journal of Business Venturing                                     |
| 44 | Stahl, B. C., Schroeder, D., & Rodrigues, R. | 2023 | Springer Nature                                                   |
| 45 | Sundar, S. S.                                | 2020 | Journal of Computer-Mediated Communication                        |
| 46 | Tamang, S. & Singh, R. M.                    | 2024 | Springer Nature                                                   |
| 47 | Titareva, T.                                 | 2021 | Leading Change Conference                                         |
| 48 | Todariya, S.                                 | 2024 | Springer Nature                                                   |
| 49 | Upadhyay, N., Upadhyay, S. & Dwivedi, Y. K.  | 2022 | International Journal of Entrepreneurial Behaviour & Research     |
| 50 | van Berkel, N., Skov, M. B. & Kjeldskov, J.  | 2021 | Interactions                                                      |
| 51 | Wang, F., et al.                             | 2024 | ASIS&T Annual Meeting 2024                                        |
| 52 | Werthner, H. et al.                          | 2024 | Springer Nature                                                   |
| 53 | Xia, Y., et al.                              | 2024 | Journal of the Knowledge Economy                                  |
| 54 | Zhang, Y.                                    | 2022 | Theory of Science                                                 |
| 55 | Zuboff, S. & Bassotti, P.                    | 2019 | Luiss University Press                                            |



## FACING THE UNEXPECTED: EXPLORING ITALIAN WOMEN ENTREPRENEURS' LEARNING EXPERIENCE WHEN CONFRONTING EXTERNAL SHOCKS

Gail Denisse Chamochumbi Diaz

gail.chamochumbidiaz@uniurb.it  
University of Urbino

Annalisa Sentuti

annalisa.sentuti@uniurb.it  
University of Urbino

Francesca Maria Cesaroni

francesca.cesaroni@uniurb.it  
University of Urbino

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### Abstract

**Purpose.** In a world characterised by volatility, uncertainty, complexity and ambiguity (VUCA), exogenous shocks exert profound and often unpredictable effects on society and the economy, with particularly significant consequences for women entrepreneurs. Grounded in the field of entrepreneurial learning and drawing on experiential learning theory, this paper investigates what and how women entrepreneurs learn in response to such disruptive events.

**Design/methodology/approach.** Based on the experiences of a sample of Italian women entrepreneurs during the COVID-19 pandemic, chosen as an emblematic case of shocks, this study employs a phenomenological qualitative approach. Semi-structured interviews and thematic analysis uncover key aspects of the learning process and outcomes.

**Findings.** The COVID-19 pandemic presented a unique opportunity for women entrepreneurs to gain a deeper understanding of their businesses, their entrepreneurial roles and themselves. It triggered emotional, strategic and relational adaptations that fostered the development of new skills, resilience and changes in self-perception. Participants adopted reactive strategies such as digitalisation and financial learning, and relied heavily on social networks. Despite increased domestic burdens, they developed self-empowerment by reevaluating their work-family balance and perceived themselves as more resilient and aware of future exogenous shocks. Learning was socially embedded and context-dependent, strongly fostered by other subjects with whom the women interacted during their experience.

**Originality.** This study contributes to the literature by examining women entrepreneurs' learning processes during exogenous shocks through the lens of experiential learning theory, an area that remains underexplored. It offers novel insights into how emotional, strategic and relational dimensions interact in shaping entrepreneurial learning in crisis contexts. Furthermore, by focusing on women micro-entrepreneurs in Italy, the study offers context-specific evidence from a developed economy, highlighting how gendered constraints and contextual factors influence learning dynamics during VUCA conditions.

## 1. Introduction

Women entrepreneurs are increasingly recognised as key agents of change (Rosca *et al.*, 2020) and play a crucial role in achieving the Sustainable Development Goals (Raman *et al.*, 2022; Thomas, 2024), particularly within micro and small businesses (Sultan and Sultan, 2020; Hendratmi *et al.*, 2022). However, the contemporary business environment is characterised by growing volatility, uncertainty, complexity and ambiguity — commonly referred to as VUCA (Lawrence, 2013; Mack and Khare, 2016). Within this context, exogenous shocks such as economic crises, pandemics, natural disasters and geopolitical conflicts are becoming increasingly frequent, profoundly affecting firms and their ability to operate and survive (Ehsani and Osiyevskyy, 2022).

These shocks have particularly severe consequences for micro and small enterprises, which often face resource constraints, limited financial buffers and reduced strategic flexibility. Women entrepreneurs, in particular, encounter additional challenges due to persistent gender inequalities, including limited access to capital (Coleman and Robb, 2018), restricted access to resources (Henry *et al.*, 2022), gender stereotypes (Constantinidis, 2021) and disproportionate responsibility for unpaid care work (Cesaroni and Sentuti, 2014). These structural conditions shape how women experience crises and influence their ability to respond effectively to external disruptions (Afshan *et al.*, 2021).

In such turbulent environments, entrepreneurial learning becomes a critical mechanism through which entrepreneurs develop the skills, resilience and strategies needed to cope with uncertainty (GEM, 2023; Kromidha and Bachtiar, 2024; Ehsani and Osiyevskyy, 2022). Entrepreneurial learning is not only concerned with what entrepreneurs learn but also with how and when learning occurs (Wang and Chugh, 2014). It is inherently experiential, as it is rooted in direct engagement with real-world challenges and shaped by action, reflection and adaptation (Politis, 2005; Cope and Watts, 2000). In this regard, exogenous shocks can serve as powerful triggers of learning, forcing entrepreneurs to question assumptions, rethink strategies and develop new competencies (Cope, 2011).

Among the various theoretical perspectives on entrepreneurial learning, experiential learning theory (Kolb, 1984) provides a particularly relevant framework for understanding how individuals learn from critical events. This perspective emphasises the role of concrete experiences, reflective observation, abstract conceptualisation and active experimentation in shaping learning processes (Kolb, 1984; Kolb and Kolb, 2018). It is especially suitable for exploring how entrepreneurs make sense of disruptive situations and transform them into opportunities for growth and development.

Despite the growing body of research on women entrepreneurship

(Cardella *et al.*, 2020) and crisis contexts (Doern *et al.*, 2019), limited attention has been devoted to understanding what and how women entrepreneurs learn from exogenous shocks, particularly through the lens of experiential learning theory. Existing studies, such as Afshan *et al.* (2021), highlight the importance of learning processes during the COVID-19 pandemic, particularly in relation to digital transformation. However, further research is needed to deepen our understanding of these dynamics across different contexts, particularly in developed countries and within micro-enterprises, where structural constraints and contextual factors may significantly shape learning processes (Kromidha and Bachtiar, 2024; Nogueira, 2019). Accordingly, this study addresses the following research question: What and how do women entrepreneurs learn during exogenous shocks?

This research addresses these gaps by examining how women micro-entrepreneurs in Italy learn from exogenous shocks through the lens of experiential learning theory. Italy represents a particularly relevant context due to the prevalence of micro and small firms as well as persistent gender inequalities in entrepreneurship (GEM, 2025; ISTAT, 2023), making Italy a theoretically relevant setting to explore how contextual constraints shape entrepreneurial learning during crises. By focusing on women entrepreneurs operating in this setting during the COVID-19 pandemic, this research provides context-specific insights into how learning unfolds in response to crisis conditions.

The study makes a significant contribution to the literature in several ways. First, it extends experiential learning theory by showing how exogenous shocks trigger learning processes grounded in real-time action and adaptation. Second, it sheds light on the gendered dimensions of entrepreneurial learning, highlighting how women entrepreneurs integrate emotional, strategic and relational responses when facing crises. Third, it provides empirical evidence from a Southern European context, which remains underexplored in the literature.

To explore these issues, we have adopted a qualitative approach based on the experiences of six Italian women micro-entrepreneurs during the COVID-19 pandemic, which is regarded as an emblematic example of an exogenous shock. Our findings show that the pandemic triggered a multifaceted learning process involving emotional, strategic and relational adaptations. Women entrepreneurs developed new competencies, enhanced financial awareness and formed a stronger sense of self-empowerment while relying heavily on social networks to navigate uncertainty.

The paper is structured as follows: Section 2 presents the literature review (paragraphs 2.1, 2.2, 2.3). Section 3 addresses the methodology. Section 4 introduces the findings, and Section 5 delves into the results and conclusions, highlighting the main implications, contributions and limitations of the research.

## 2. Literature Review

### 2.1 *Exogenous shocks and entrepreneurship*

Exogenous shocks are unexpected and disruptive events that significantly alter the economic and competitive environment in which firms operate (Doern *et al.*, 2019; Ehsani and Osiyevskyy, 2022). Such events – including financial crises, pandemics, natural disasters and geopolitical conflicts – create sudden changes in demand, supply chains and market conditions, forcing firms to rapidly adapt their strategies and operations accordingly. While all organisations are affected by these disruptions, small and micro-enterprises are particularly vulnerable due to limited financial resources, reduced managerial capacity and constrained access to external support (Doern *et al.*, 2019; Kromidha and Bachtiar, 2024). Their smaller size often limits their ability to absorb shocks, diversify risk and implement long-term strategic responses.

At the same time, research suggests that these firms may respond to crises through adaptive and learning-oriented behaviours, leveraging flexibility, informal networks and experiential knowledge to cope with uncertainty (Cope, 2011; Politis, 2005). Exogenous shocks can therefore act not only as threats but also as catalysts for entrepreneurial learning, prompting firms to revise business models, develop new competencies and experiment with alternative strategies. Thus, understanding how entrepreneurs interpret and learn from such disruptive experiences is crucial, particularly in the context of micro-enterprises, where learning processes play a central role in ensuring survival and long-term resilience.

### 2.2 *Women entrepreneurs and challenges they face during exogenous shocks*

Exogenous shocks create significant challenges for all firms, but women entrepreneurs often face additional constraints due to pre-existing gender inequalities (GEM, 2025). While some empirical studies have shown that the reaction of women-led firms to exogenous shocks often highlights their resilience and the adaptability of their business model in responding to the demands made of them during the crisis (Cosentino and Paoloni, 2021), other research shows that these non-routine events tend to intensify certain challenges for women entrepreneurs. For instance, limited access to capital remains one of the primary obstacles faced by women entrepreneurs (Cesaroni and Sentuti, 2016; Coleman and Robb, 2018; Sentuti *et al.*, 2023; De Rosa, 2025). Lack of collateral, gender prejudices and insufficient knowledge of advanced financial instruments are common barriers (Alva

*et al.*, 2023). During periods of crisis, financial institutions often ratchet up their loan procedures, thus further marginalising women entrepreneurs (Ettl and Welter, 2010; Core and De Marco, 2021). This financing gap restricts their ability to change direction, innovate or sustain their operations in times of economic uncertainty.

Another critical challenge is the disproportionately onerous care responsibilities that fall to women (Andrew *et al.*, 2020; Ayatakshi-Endow and Steele, 2021; Ge *et al.*, 2022; González and Macias-Alonso, 2023). In many societies, women are expected to manage their domestic responsibilities alongside their professional ones, making it difficult to achieve a satisfactory work-life balance. As a result, they have limited time and energy to spend on expanding the business (Ayatakshi-Endow and Steele, 2021; González and Macias-Alonso, 2023). During crises like the COVID-19 pandemic, school closures, increased domestic demands and health responsibilities are added to this burden (Alon *et al.*, 2020). This dual role drains time and energy that women could devote to running their businesses and also hampers their ability to respond effectively to crises.

Women entrepreneurs are also more likely to operate in sectors that are hit the hardest by crises, such as the retail trade, the hospitality industry, crafts and personal services (GEM, 2021). They tend to have a more cautious approach to risk than their male counterparts (Block *et al.*, 2015), which often leads to small-sized businesses, minor financial exposure and fewer growth opportunities (Cesaroni and Sentuti, 2016; Coleman and Robb, 2018). Technological innovation and a readiness to internationalise appear to be limited overall, mainly because of the smaller-sized businesses and lack of dedicated resources (OECD, 2021). Moreover, these specific characteristics shape women entrepreneurs' responses to exogenous shocks. For example, during the COVID-19 pandemic, many businesses headed by women transitioned to digital platforms, offering online services or resorting to e-commerce as a way of reaching their customers (Papadopoulos *et al.*, 2020; Afshan *et al.*, 2021; Ge *et al.*, 2021; Kogut and Mejri, 2022). Others adapted their products to meet new demands, such as producing personal protection equipment or essential goods (González and Macias-Alonso, 2023). However, these adaptive strategies present their own challenges. The shift to digital platforms, for example, requires technical expertise and financial investments, resources which are not always readily available to women entrepreneurs (Scheidgen *et al.*, 2021; Alva *et al.*, 2023).

Women-led businesses also rely heavily on relational and social capital (Paoloni *et al.*, 2019; Arena *et al.*, 2025). Informal networks, such as family, friends and local communities, play a significant role in their operations. While these networks provide essential support, they can lack the breadth and influence needed to access larger markets, advanced technologies or institutional resources (Hunter and Lean, 2018). Other studies emphasise

the importance of social networks, noting that women entrepreneurs often leverage broader and more diverse networks compared to men, encompassing both personal and professional connections (Hunter and Lean, 2018; Williams, 2020). These networks not only facilitate access to vital information and financial resources but also offer emotional and motivational support, which proves particularly valuable during periods of crisis (Ettl and Welter, 2010; Haj Youssef *et al.*, 2024; Floris and Atzori, 2024). Additionally, crises highlight the importance of building diverse and robust networks, because relying solely on informal or localised networks may not be sufficient in times of systemic disruption (Cosentino and Paoloni, 2021; Scheidgen *et al.*, 2021; Haj Youssef *et al.*, 2024). Expanding their connections to include industry peers, mentors and institutional stakeholders has become a priority for future resilience.

Against this backdrop, it is now crucial not only to examine how women entrepreneurs respond to exogenous shocks but also to explore what and how they learn from these experiences, both at the individual and business level, to internalise the challenges, develop new capabilities and reconfigure their strategies, leading to the development of new competencies, shifts in mindset and changes in business practices.

### *2.3 Entrepreneurial learning and Experiential learning theory*

Entrepreneurial learning has become increasingly recognised as a crucial field of research that bridges the domains of learning and the entrepreneurial context (Rae, 2005; Wang and Chugh, 2014; Munawaroh *et al.*, 2023). With its focus on learning through action and reflection, it provides a valuable framework for gaining deeper insights into the entrepreneurial process (Cope, 2003). Entrepreneurial learning can be explored through various theoretical lenses, reflecting the multifaceted nature of entrepreneurial experience (Wang and Chugh, 2014). Among these, experiential learning theory (Kolb, 1984) has emerged as one of the most widely adopted frameworks. According to the experiential learning perspective, in the aftermath of an event, a person reflects upon the experience and transforms it into new knowledge, which, in turn, influences their future behaviour (Kolb, 1984; Kolb and Kolb, 2018; Lattacher and Wdowiak, 2020). In this sense, the experiential learning theory encompasses the cognitive dimension of learning and the individual's subjective experience.

Learning, in this framework, develops in four cyclical phases (Kolb, 1984): i) concrete experience is the starting point, i.e. undergoing a real, meaningful experience first hand; ii) reflective observation: in the wake of the experience we stop to reflect on what happened, what we felt and why things went the way they did; iii) abstract conceptualisation: we trans-

form the reflections into more general ideas, models or concepts; iv) active experimentation: finally we use our new knowledge to endure in future situations, thereby putting into practice what experience has taught us. If another unexpected experience arises from this experimentation, a new learning cycle is initiated. As a result, throughout entrepreneurial pursuits, the process is cyclical rather than sequential (Kolb and Kolb, 2018).

Moreover, as stated by Wang and Chugh (2014), 'Entrepreneurial learning is what entrepreneurs should or do learn during the process of exploring and exploiting an entrepreneurial opportunity in the creation of new ventures or management of existing firms' (Wang and Chugh, 2014, p. 24). Through learning, entrepreneurs are better equipped to navigate complex and high-risk situations (Lattacher and Wdowiak, 2020), such as exogenous shocks. Entrepreneurs can benefit from particularly fruitful learning in the aftermath of critical events (Cope, 2011; Politis and Gabrielsson, 2009).

Despite its potential, the entrepreneurial learning theory has been only marginally applied to the analysis of learning processes among women entrepreneurs facing exogenous shocks. Prior research has highlighted that, through concrete experiences, such as coping with the unexpected, these women begin a process of deep reflection that can lead to a reworking of their entrepreneurial experiences (Afshan *et al.*, 2021). The reflective observation phase is often mediated by emotions, cultural expectations and consultation with other individuals (Wang and Chugh, 2014), including other women entrepreneurs, leading to the development of new ideas and approaches, which are then tested in subsequent enterprises or in adjustments to the existing venture (Wang and Chugh, 2014). Thus, the experiential learning theory highlights the value of transformative learning (Cope, 2011), which characterises many women's entrepreneurial careers. Furthermore, it emphasises how learning derived from concrete experience is not only an individual experience, but also social and contextual (Lattacher and Wdowiak, 2020). Ultimately, the experiential approach recognises and gives due weight to the skills acquired in the field, offering a more inclusive and realistic perspective on women's entrepreneurial learning (Afshan *et al.*, 2021). In this regard, digital transformation is a key lesson that women entrepreneurs have learnt, specifically during the COVID-19 pandemic (Afshan *et al.*, 2021). The need to work in a virtual dimension during emergencies such as the pandemic has highlighted the value of digital platforms for various purposes: marketing, sales and communication. Numerous women entrepreneurs have reported an improvement in their digital competence, which enabled them both to weather that particular crisis and to place their business on a firm footing for long-term growth (Papadopoulos *et al.*, 2020). Crises also teach women entrepreneurs the value of resilience and adaptability. They learn to deal with uncertainty, to make decisions quickly despite information asymmetry and to innovate

under pressure. These experiences enhance their ability to handle future challenges and identify opportunities in adversity (Sharma *et al.*, 2024). Studies conducted in the Italian context during and after the COVID-19 pandemic have examined firms' adaptation to systemic crises, organizational resilience, and entrepreneurial responses to disruption (Paoloni *et al.*, 2021; Iannone and Piretti, 2023; Cucino *et al.*, 2023; Barnabè *et al.*, 2024; Onesti *et al.*, 2024). However, limited attention has been devoted to understanding these dynamics through the lens of entrepreneurial learning among women entrepreneurs.

In light of these considerations, experiential learning theory provides a robust conceptual framework for the investigation of how women entrepreneurs navigate and make sense of critical events such as exogenous shocks. By emphasising the centrality of experience, reflection and iterative adaptation, this perspective allows us to capture the dynamic nature of entrepreneurial learning processes. It is particularly well-suited for exploring how women transform adversity into opportunity, reframe their business strategies and reshape their entrepreneurial identities over time. In this study, VUCA is used primarily to characterise the environmental conditions surrounding the COVID-19 pandemic rather than as an analytical framework for interpreting the empirical findings. Accordingly, experiential learning theory constitutes the main theoretical lens through which the findings are interpreted.

### 3. Methodology

This study has adopted an interpretative phenomenological approach, allowing for an in-depth understanding of individual experiences and perceptions related to specific events or situations (Berglund, 2015). This approach is particularly suited to exploring how individuals make sense of lived experiences (Rajasinghe *et al.*, 2021), allowing for a nuanced understanding of entrepreneurial behaviours (Nazir *et al.*, 2025), entrepreneurial learning processes (Cope, 2011) and women entrepreneurs' lived experiences (Oliveira *et al.*, 2024). By focusing on the meanings participants assign to their experiences, the study aims to capture the complexity and subjectivity of women entrepreneurs' learning processes during exogenous shocks, highlighting what and how they learn through their experience.

The COVID-19 pandemic represents a paradigmatic example of an exogenous shock in a VUCA environment, characterised by sudden and drastic changes beyond individual control that disrupted routines and forced individuals and organisations to adapt. This unprecedented event profoundly affected economic and social systems, creating significant challenges for firms and entrepreneurs. Against this backdrop, Italy represents a particularly relevant empirical setting for exploring women's entrepre-

neurial learning during such disruptions. The country is characterised by a high prevalence of micro and small enterprises (ISTAT, 2023), persistent gender inequalities in entrepreneurship (GEM, 2025) and a strong influence of socio-cultural norms on business practices (GEM, 2025). These structural characteristics were further amplified by the disruptive impact of COVID-19 on the national economy and labour market (ISTAT, 2022), making Italy an appropriate context for examining how women entrepreneurs learn from exogenous shocks.

Since the aim of this study was not to produce a random or statistically significant sample, but to identify individuals with direct experience of the phenomenon under investigation, purposive sampling was adopted (Patton, 2002). This approach is consistent with the study's exploratory objective, which seeks to understand in depth what and how women entrepreneurs learn from exogenous shocks.

The inclusion criteria were defined as follows: i) the businesses had to be managed by women entrepreneurs and already active before the outbreak of the COVID-19 crisis; ii) the firms had to remain active at the time of the research; and iii) the businesses had to qualify as micro-enterprises according to the European Union definition (European Commission, 2003). Based on these criteria, potential participants were identified through the authors' professional networks and subsequently contacted by phone to verify eligibility and present the research objectives. Willingness to participate was considered only after confirming that the respondents met the inclusion criteria.

A total of six cases were selected for the study (see Table 1). All the participants were owner-managers with established professional experience, operating in service and retail sectors typical of the Italian micro-enterprise landscape. Data collection continued until theoretical saturation was achieved, indicating that no new relevant insights emerged from additional contacts. After the sixth interview, the themes identified were recurrent and consistent across participants. Additional potential participants were approached, but their preliminary responses confirmed the repetition of previously identified patterns. On this basis, data collection was concluded. In qualitative case-based research, sample size is not predetermined but depends on the research objectives and the achievement of saturation (Bowen, 2008; Glaser and Strauss, 1967; Patton, 2002; Strauss and Corbin, 1998).

Data were gathered through in-depth, semi-structured, face-to-face interviews conducted between April and May 2022. In-person interviews were preferred to facilitate richer interaction, allow the observation of non-verbal cues and enhance the depth of participants' narratives, which is particularly relevant in interpretative phenomenological research. The interviews were structured around four main thematic areas: i) the entrepre-

neurs’ personal and professional background, including motivations, prior experience and firm characteristics; ii) the impact of the COVID-19 pandemic on business activities, including operational challenges and access to bank financing with public guarantees; iii) attitudes toward debt, financial literacy and decision-making processes; and iv) learning outcomes and behavioural changes following the crisis, particularly in terms of financial awareness, entrepreneurial practices and strategic adaptation (see Appendix A). Each interview lasted approximately one hour, was recorded with participants’ consent and subsequently transcribed verbatim. In line with a social constructionist and interpretative phenomenological approach, the study focused on participants’ subjective sense-making processes. Therefore, secondary data sources were not used for triangulation, as the aim was to explore lived experiences rather than to validate objective outcomes (Cope, 2005; Smith *et al.*, 2021; Berglund, 2015).

Table 1 – Profile of women entrepreneurs

|         | Age | Marital status | Qualification | Experience | Industry sector                 |
|---------|-----|----------------|---------------|------------|---------------------------------|
| Case #1 | 36  | Married        | Undergraduate | 11 years   | Advertising agency sector       |
| Case #2 | 54  | Married        | Undergraduate | 25 years   | Personal care services          |
| Case #3 | 45  | Married        | Undergraduate | 20 years   | Clothing and accessories retail |
| Case #4 | 31  | Single         | Postgraduate  | 7 years    | Clothing and accessories retail |
| Case #5 | 44  | Married        | Undergraduate | 15 years   | Street market retail            |
| Case #6 | 40  | Married        | Undergraduate | 12 years   | Clothing and accessories retail |

Gioia’s method (Gioia *et al.*, 1994; Gioia *et al.*, 2013) is applied to obtain findings. This method was widely used in exploring issues related to women entrepreneurs, including the analysis of the experience of women entrepreneurs during times of crisis in other contexts, such as in Pakistan and Brazil (Afshan *et al.*, 2021; Ayatakshi-Endow and Steele, 2021; González and Macias-Alonso, 2023). In the first step, we open-coded the raw material to first-order codes. Then, we engaged in axial coding, drawing connections between the codes we identified in open coding. This process enabled these codes to be assembled into higher-order themes. In the last step, by following a logical path between themes, we grouped similar themes into several overarching dimensions, which form the basis for analysing the ex-

perience of women entrepreneurs, and what and how they learned during COVID-19. In line with the qualitative research method, the data analysis followed an iterative approach. First, two authors read the interview transcription independently, pooled their thoughts in a series of brainstorming sessions and discussed the emerging codes and dimensions. This phase was non-linear; different points of view and discrepancies emerged, requiring a review of the data analysis to find a congruent agreement between authors. Second, a third author was involved. Given her experience in qualitative research methods, she supervised the entire analysis process (i.e., raw material, codes, themes and dimensions), offering a third-party perspective that enables authors to understand the reliability of our data. Table 2 shows the final data structure: first codes, themes and aggregate dimensions identified through the data analysis process.

Table 2 – Data structure

| First Order Codes                               | Second Order Themes                                                      | Aggregate Dimensions   |
|-------------------------------------------------|--------------------------------------------------------------------------|------------------------|
| Business suspended                              | Impact of the pandemic on the business                                   | Impact of the pandemic |
| Financial losses                                |                                                                          |                        |
| No more orders                                  |                                                                          |                        |
| Huge seasonal losses                            |                                                                          |                        |
| Failure to achieve break-even point             |                                                                          |                        |
| Minimal negative effect                         |                                                                          |                        |
| Decline in customers                            | Impact of the pandemic on psychological well-being (personal and family) |                        |
| Nightmare and terror                            |                                                                          |                        |
| Sleeplessness and fear                          |                                                                          |                        |
| Need to control and protect family and business |                                                                          |                        |
| Considered giving up                            |                                                                          |                        |
| Sense of bewilderment                           |                                                                          |                        |
| Depression                                      |                                                                          |                        |
| Anxiety but not panic                           |                                                                          |                        |

|                                             |                              |                                    |
|---------------------------------------------|------------------------------|------------------------------------|
| Scarce and tardy public support             | Limited support              | Difficulties during pandemic       |
| Accumulated debts after payment respite     |                              |                                    |
| Delays in public support and uncertainties  |                              |                                    |
| Increasing costs due to the new regulations | Higher costs                 |                                    |
| High monthly expenses                       | Financial pressure           |                                    |
| Seasonal contracts to be respected          |                              |                                    |
| Difficulties in switching to e-commerce     | Lack of knowledge and skills |                                    |
| Not waiting for outside aid                 | Reactive approach            | Strategies adopted during pandemic |
| Use the network and relationships           |                              |                                    |
| Cooperation with longstanding suppliers     |                              |                                    |
| Adopt a plan                                |                              |                                    |
| Turning to new products                     |                              |                                    |
| Boosting online business                    |                              |                                    |
| Special offers and free masks               |                              |                                    |
| Social media for advertising                |                              |                                    |
| New more flexible suppliers                 |                              |                                    |
| New method of purchase                      |                              |                                    |
| Low prices                                  |                              |                                    |
| More attention to expenses                  | Defensive approach           |                                    |
| Cutting costs                               |                              |                                    |

|                                                     |                            |                  |
|-----------------------------------------------------|----------------------------|------------------|
| Investments                                         | Motivations                | Access to credit |
| To avoid delays in payments                         |                            |                  |
| Dealing with monthly expenses                       |                            |                  |
| To have liquidity                                   |                            |                  |
| To buy new products to sell                         |                            |                  |
| To have money to meet unexpected expenses           |                            |                  |
| To cover losses due to the business being suspended |                            |                  |
| Bank and Industry Association                       | Networks and Relationships |                  |
| Consultant of the Industry Association              |                            |                  |
| Bank                                                |                            |                  |
| Personal network                                    |                            |                  |
| Easy without obstacles                              | The procedure              |                  |
| Quick money                                         |                            |                  |
| Fast                                                |                            |                  |
| Accountant                                          | Service support            |                  |
| Accountant and bank manager                         |                            |                  |

|                                              |                           |          |
|----------------------------------------------|---------------------------|----------|
| Prudent in purchases                         | Professional competencies | Learning |
| Adopt new method of purchasing               |                           |          |
| Use of social media                          |                           |          |
| Awareness to improve IT and marketing skills |                           |          |
| Work with more banks                         | Financial awareness       |          |
| More caution with financial issues           |                           |          |
| This loan makes me comfortable               |                           |          |
| You are not free but it is necessary         |                           |          |
| If small, I am not anxious                   |                           |          |
| Be cautious, debt only if necessary          |                           |          |
| Debt is part of the job                      |                           |          |
| You make the difference                      | Self-empowerment          |          |
| More resolute, decisive and enterprising     |                           |          |
| Don't overreach yourself                     |                           |          |
| Ready to face the unpredictable              |                           |          |
| Rediscover the value of the family           |                           |          |

*Source: Authors own work*

## 4. Findings

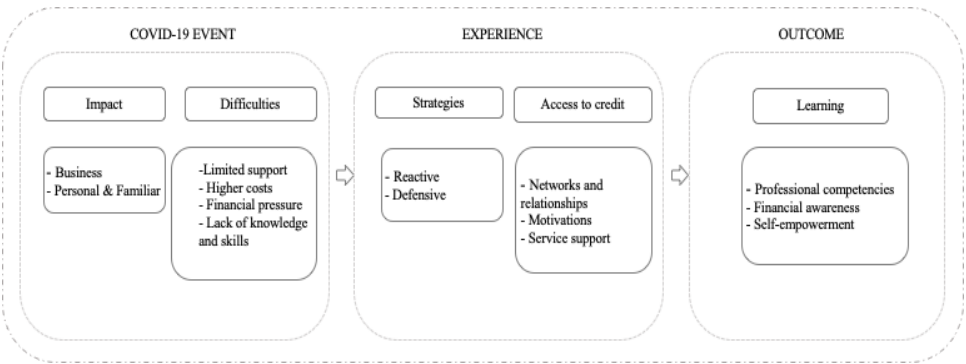
Based on the data structure and following the logic of experiential learning theory, the framework synthesised in Figure 1 emerged. Consistent with experiential learning theory (Kolb, 1984), learning is inherently iterative. Figure 1 should therefore be interpreted as an analytical simplification of the dominant learning trajectory identified in the data rather than as a literal representation of how entrepreneurial learning unfolds in practice.

The framework is consistent with Kolb's (1984) experiential learning cycle. The pandemic represents the concrete experience, the responses adopted during the crisis reflect processes of reflection and experimentation, and the learning outcomes capture the knowledge generated through this experiential process.

Before the exogenous shock, participants already relied on a set of competencies and resources, including relational capital, prior and professional

experience, which shaped their responses to the crisis and influenced subsequent learning processes. This process was structured into three main phases. The event, which represents the initial context of the pandemic crisis, includes two dimensions: impacts and difficulties. The experience, the intermediate phase, includes two dimensions: strategies adopted and access to credit. The outcome, the final phase, shows that the results of learning become evident.

Figure 1 – Women’s entrepreneurial learning process during the COVID-19 pandemic



Source: Authors’ own work

***Impact of the COVID-19 pandemic and difficulties (event)***

The impact of this unusual event on the entrepreneurial and personal lives of women represents a unique experience that may yield new knowledge and insights into managing their businesses. Hence, our results shed light on the effect of COVID-19 on women entrepreneurs’ learning (Figure 1).

From the thematic analysis, two main areas of impact emerged: on business and psychological well-being (personal and family). In the first area, the most frequent impact was the financial losses due to business suspension and the decline in customers or orders. Owners stressed that reopening, after lockdowns, was very difficult because customers had changed their lifestyle and needs, or they were worried about getting infected. Only one entrepreneur, operating in the advertising agency sector, reported that the lockdown had a minimal impact on her business, mainly due to a significant order received from a key client, which ensured business continuity. This outcome appears to be attributable both to the nature of the service sector, which was less constrained by physical closure, and to the entrepreneur’s ability to maintain strong client relationships and secure strategic opportunities during the crisis. The analysis also showed that, in general,

almost all businesses were forced to temporarily suspend their activities until the lockdown measures were lifted by the government.

"The first year, we were literally closed for two and a half months, so what was lost was lost. The older customers were terrified of catching COVID, and they didn't come back to the shop for a long time" (#2).

In the second area of impact, on psychological well-being, interviewees described their concerns about the extraordinary event they were experiencing in different ways: terror, fear, depression, a sense of bewilderment, a need to control and protect family and business.

"Psychologically it was really tough ... I even thought about closing the business because of all the difficulties. I just felt completely bewildered in a way I had never before" (#4).

Moreover, during the pandemic period, women entrepreneurs faced numerous difficulties, which severely tested the response capacity of these firms. Limited public support, described as scant and belated, is the difficulty most frequently mentioned by interviewees. Other included financial pressures resulting from accumulated debts and the higher costs due to new work safety regulations (e.g. masks, disinfectants, other protective devices) and lack of knowledge and skills in switching to new forms of business, such as e-commerce.

"There were certainly expenses. This bonus from the State – which materialised, but we have to repay anyway – arrived much later, but in the meantime, we had to pay" (#1).

These experiences constituted the concrete experience that initiated the entrepreneurial learning process, providing the basis for subsequent reflection and adaptation.

### *Strategies and access to public credit guarantees during the pandemic (experience)*

The COVID-19 event initiated an experiential process, which took the form of a combination of plans and actions (i.e. adopting strategies and accessing credit) carried out by women entrepreneurs to survive and overcome the negative effects of the pandemic. These responses were often grounded in competencies developed before the pandemic, such as established relationships with suppliers and customers, familiarity with social media and previous managerial experience, which facilitated rapid adaptation and experimentation.

Regarding strategies, thematic analysis revealed two different approaches adopted by women entrepreneurs: reactive and defensive. They primarily confronted the emergency resulting from the pandemic by opting for reactive behaviour. In some cases, this entailed concentrating on innovation – for instance, turning to new products, boosting online business

and using social media for advertising – in other words, seizing the opportunity offered by the crisis to put into practice ideas that had long been unrealised ambitions. In other cases, women entrepreneurs reacted by cutting prices and launching special offers in an attempt to reverse the decline in sales. Further reactive approaches included rethinking their purchasing policy: seeking new, more flexible suppliers or adopting new purchasing methods aimed at alleviating the financial pressure of payments. Finally, the reactive behaviour of the businesswomen also took the form of activating their network of contacts and working closely with longstanding suppliers, i.e., countering the effects of the pandemic by exploiting the social connections they had formed over the years.

“You need to be clear-headed and react, devise a plan, a strategy for moving forward [...] The market was calling for lower prices, so I adapted to market demands by reconsidering my suppliers [...] I doubled down on e-commerce ... which I’d started before the pandemic – I was already on Instagram and Facebook –” (#4).

The adoption of a defensive approach, on the other hand, was limited to a single case and was characterised by a strong focus on cost containment, including stricter control of expenses, reduction of non-essential investments and cautious financial management aimed at preserving liquidity. Moreover, one entrepreneur adopted a mixed approach, combining cost-control measures with selective innovation strategies, such as maintaining core operations while simultaneously exploring new sales channels. These strategic responses also appear to be influenced, at least in part, by sectoral characteristics. For instance, the entrepreneur operating in the advertising agency sector was able to rely more on digital and relational strategies, while businesses in clothing and accessories retail and street market retail faced greater constraints related to physical sales and customer access during lockdowns.

Access to public credit was also integral to the experiential process set in motion by the COVID event. To stem adversities and difficulties generated by the COVID crisis, grants for entrepreneurs were made available by government, such as fiscal measures, direct grants and mainly public guarantees on private credit, to support firms and help ensure their survival. In particular, public credit guarantees allowed entrepreneurs to access bank loans backed by the State, reducing collateral requirements and facilitating liquidity during the emergency. These instruments typically covered a large share of the loan amount, enabling micro-entrepreneurs to obtain financing more easily and under simplified procedures. At a time of intense financial stress, mainly due to a severe liquidity crunch, for women entrepreneurs, access to public credit guarantees was both a means of alleviating short-term debts and a further experiential feature from which they could profitably learn.

The analysis shows that most women entrepreneurs did, in fact, make use of credit with public guarantees to have liquidity, avoid delays in payments and cover losses. Other motives – although few businesswomen cited them – included making long-overdue investments, buying new products to sell or having money available to meet unexpected expenses.

Networks and relationships were crucial in discovering this form of State support. Banks, industry associations and personal networks are the information channels that interviewees highlighted. Moreover, even though all the women entrepreneurs described the application process for State credit as easy, swift and trouble-free, recourse to networks of contacts and personal relationships proved necessary in getting the application procedure underway. In fact, all the businesswomen took their accountants' advice.

These responses illustrate how women entrepreneurs reflected on the challenges posed by the crisis and experimented with alternative ways of managing their businesses, consistent with the reflective observation and active experimentation stages of Kolb's (1984) experiential learning cycle.

### *Learning from COVID-19 (outcome)*

Building on their pre-existing competencies and resources, women entrepreneurs in our research reported that the COVID-19 experience expanded their stock of entrepreneurial learning and led to the development of new capabilities.

Entrepreneurial learning has extended to various spheres of business and personal life. After the COVID experience, women said that they had developed several professional competencies essential to the betterment of their business. For instance, today they are firmly convinced that a prudent attitude towards business management is crucial in facing crises stemming from the pandemic.

"I've got a lot better since COVID: I'm naturally very impulsive, so I may well have placed larger orders... these days I'm more cautious about purchasing" (#4).

Moreover, the need to react to survive the impact of COVID has led women entrepreneurs to equip themselves with new skills, such as the use of social media, and has increased their awareness of the importance of improving their IT and marketing skills.

Under these extraordinary circumstances, the women entrepreneurs have also improved their financial awareness. Some of them now understand the importance of establishing relationships with more than one bank because it may increase their opportunities of obtaining funds and extend their network of contacts. Other women said that they have become more cautious over financial issues, confirming that the weight of debt is a burden that can sink a business in times of crisis.

The thematic analysis also highlighted an attitude to indebtedness

which could be described as generally mindful and cautious. Respondents expressed the view that “being in debt” was part of being in business – it comes with the job. Although on the one hand, they claim that owing money causes them anxiety and restricts their freedom, on the other, they concede that it is a necessary means of ensuring business continuity, especially in crisis periods like those they experienced during the pandemic.

“Having debt takes the wind out of your sails ... you’re handicapped because you already have debt ... but, in any case, it’s obvious that this credit proved very useful” (#3).

From the analysis, it is clear that businesswomen prefer a level of indebtedness carefully calibrated to their needs. It is a cautious approach which appears to be borne out by their experience of the pandemic.

“Seeing that the future is always uncertain; I stick to my idea: get into debt if you must, but only when necessary” (#5).

Our analysis highlights that women entrepreneurs who are normally immersed in running their own businesses have rediscovered the value of family life, mainly thanks to lockdowns. As a result, they have reconsidered the best way to manage their work-life balance.

“COVID has taught me that there’s more to life than work; it’s important to enjoy your family more... I’ve rediscovered the value of spending more time at home with my daughter” (#6).

Furthermore, despite the formidable impact of COVID on their business and their psychological well-being, the women entrepreneurs interviewed proved staunchly reactive in confronting the crisis. Moreover, they appear to have weathered the critical phase of the crisis with a fuller awareness of themselves, i.e. self-empowerment. Today, they now claim to be more resolute, decisive and enterprising, ready to face the unpredictable.

“I’ve learnt that the unpredictable can happen. It’s the individual who makes the difference by how he or she reacts to the event: I reacted” (#4).

“With the pandemic, I’ve learned that everything can change from one moment to the next. Nothing is certain... You need to know how to adapt” (#6).

The findings can also be interpreted through the lens of Kolb’s (1984) experiential learning cycle. The pandemic constituted a concrete experience that disrupted established routines and generated uncertainty. Participants’ reflections on their emotional responses, entrepreneurial role, and business challenges are consistent with the reflective observation phase. These reflections contributed to the development of new understandings regarding financial management, digitalisation, and business resilience, corresponding to abstract conceptualisation. Finally, the adoption of new practices, such as the use of social media, e-commerce, and revised financial strategies, illustrates active experimentation through the application of

newly acquired insights.

Overall, the findings suggest that entrepreneurial learning during exogenous shocks extends beyond the acquisition of professional knowledge to encompass financial and personal learning. Rather than emerging as separate outcomes, these forms of learning developed throughout the experiential learning process, as entrepreneurs reflected on the challenges posed by the crisis, generated new understandings, and translated them into new business practices.

## 5. Discussion and Conclusions

This study aimed to explore how women navigate challenges, adapt their practices, develop new competencies and construct knowledge in response to exogenous shocks. Starting with the research question, *“What and how do women entrepreneurs learn during exogenous shocks?”*, we adopted an entrepreneurial learning perspective, grounded in experiential learning theory, and selected the COVID-19 pandemic as a representative case of an exogenous shock within the VUCA world. Italy was chosen as the empirical setting, where we employed a qualitative research approach based on a sample of women micro-entrepreneurs to explore their lived experiences and the learning processes triggered by the shock in their specific context. The findings suggest that the COVID-19 pandemic, as a paradigmatic exogenous shock occurring in a VUCA environment, acted as a powerful trigger for entrepreneurial learning within the specific context examined. This supports the theoretical proposition that discontinuous and unexpected disruptions can foster higher-level learning (Cope, 2003; Kolb, 1984). The experiences of the women entrepreneurs interviewed illustrate how such systemic shocks not only undermine business continuity but also activate adaptive responses that lead to the development of new skills, greater resilience and transformations in self-perception. Three key insights emerged from the findings, highlighting what and how women entrepreneurs learn during times of crisis. More specifically, the findings reveal different but interconnected forms of learning, including personal and identity-related learning (e.g., self-empowerment and changes in self-perception), managerial learning (e.g., financial awareness and strategic adaptation), and behavioral learning reflected in the adoption of new practices and routines.

The first key insight concerns the emotional and psychological burden carried by women entrepreneurs during the pandemic and the self-empowerment they developed accordingly. As highlighted in previous literature (Afshan *et al.*, 2021; Andrew *et al.*, 2020), participants in this study reported heightened levels of fear, anxiety and uncertainty. These reactions were not only related to economic survival but also stemmed from

increased domestic responsibilities during lockdowns, a dual burden that significantly impacted their well-being and entrepreneurial focus. This finding reiterates the gendered impact of crises (Ayatakshi-Endow and Steele, 2021; Alon *et al.*, 2020; Andrew *et al.*, 2020), where women are disproportionately affected due to social expectations and caregiving roles. However, this experience spurred forms of self-empowerment. Women reported becoming more resolute, enterprising and better prepared to face future uncertainties. This shift is emblematic of transformative learning, wherein individuals undergo a fundamental change in their perspectives and capacities as a result of disruptive experiences (Cope, 2011). Additionally, participants reflected critically on the relationship between their professional and personal lives, indicating that learning occurred not only at the business level but also in self-management and life balance (Rae, 2005; Ayatakshi-Endow and Steele, 2021). This finding aligns with experiential learning theory, which emphasises that disruptive experiences can foster reflective processes leading to transformative learning and identity reconstruction (Kolb, 1984; Cope, 2011). It also supports prior research on women's entrepreneurship, highlighting how gendered experiences shape learning and adaptation during crises (Afshan *et al.*, 2021). From a managerial perspective, this self-empowerment translated into more deliberate decision-making, greater attention to work-life balance and a more proactive attitude toward managing uncertainty, as illustrated by participants' reflections on redefining priorities and planning for future disruptions.

Second, our findings suggest that the pandemic induced both reactive and defensive strategic responses among participants, with most favouring the former. These included rapid digitalisation, product innovation and the mobilisation of informal networks. The adoption of e-commerce and use of social media, in particular, echo broader patterns identified in the literature, whereby crises accelerate digital transitions in women-led firms (Papadopoulos *et al.*, 2020; Ge *et al.*, 2022). At the same time, the reactive strategies observed are consistent with those identified in other studies (Alva *et al.*, 2023), which highlight how entrepreneurs leverage available resources and social ties to navigate uncertain environments. Access to public credit guarantees emerged as a critical support mechanism, not only for liquidity but also as a learning opportunity. Despite the initial fear of indebtedness, entrepreneurs reported gaining financial literacy and a deeper understanding of institutional mechanisms, a finding consistent with past work showing how crises can lead to increased financial awareness and competence (Politis and Gabrielsson, 2009; Afshan *et al.*, 2021). Interestingly, the entrepreneurs demonstrated a cautious and reflective stance toward debt, indicating that experiential learning extended beyond operational domains and into financial decision-making. These results are consistent with prior studies suggesting that critical events enhance op-

portunity-driven learning and capability development (Politis, 2005; Cope, 2011). They also reinforce the role of experiential learning in addressing competency gaps, particularly in digital and financial domains, through action-based adaptation. This interpretation is further supported by evidence from the Italian context, which highlights the importance of resilience and adaptive responses among firms facing systemic crises (Paoloni *et al.*, 2021; Cucino *et al.*, 2023; Barnabè *et al.*, 2024). At the managerial level, these findings suggest that learning may have influenced managerial practices, particularly through greater attention to financial management, digitalisation, and strategic adaptation during periods of uncertainty.

Finally, our findings help explain how women entrepreneurs learn during exogenous shocks, highlighting the role of social and contextual dimensions, including relational networks, institutional intermediaries and family support (Rae, 2005; Wang and Chugh, 2014; Lattacher and Wdowiak, 2020). The women entrepreneurs did not learn in isolation, but rather through interaction with networks, institutional intermediaries (e.g., banks, accountants) and family members. This result supports the argument that learning is socially constructed and embedded in a specific context, confirming the socially embedded nature of entrepreneurial learning emphasised in the literature (Rae, 2005; Wang and Chugh, 2014) and highlighting how contextual and relational dimensions influence learning processes, particularly for women entrepreneurs. These findings also suggest that learning may have encouraged entrepreneurs to rely more extensively on advisors, accountants, banks, and professional networks when making strategic decisions. In sum, this study highlights how the COVID-19 pandemic, as a paradigmatic example of a VUCA context, catalysed not only immediate survival strategies but also longer-term processes of learning and development among women entrepreneurs. These insights contribute to a more nuanced understanding of entrepreneurial learning as a dynamic, multi-dimensional and socially embedded process shaped by highly uncertain and disruptive environments.

This research contributes to enriching experiential learning theory by analysing the learning process of women entrepreneurs in a developed country in response to an exogenous shock. More specifically, rather than simply confirming the applicability of Experiential Learning Theory in the context of exogenous shocks, this study contributes to the theory by showing that entrepreneurial learning is a multidimensional process in which personal, managerial and behavioural learning develop simultaneously and reinforce one another through entrepreneurs' interactions with their social and institutional environment. In particular, the empirical evidence differentiates four interconnected forms of learning emerging from exogenous shocks: professional learning, reflected in the development of managerial and digital capabilities; financial learning, reflected in greater

financial awareness and a deeper understanding of financial decision-making; personal learning, reflected in increased resilience and changes in the relationship between professional and personal life; and identity-related learning, reflected in greater self-confidence, self-awareness and entrepreneurial self-empowerment.

The findings extend prior research on entrepreneurial learning (Cope, 2003; Wang and Chugh, 2014) by demonstrating that crises not only trigger reactive adaptation but also support the development of emotional resilience, strategic flexibility and financial awareness. Moreover, the results highlight how learning helps address pre-existing competency gaps, particularly in digital capabilities and financial literacy, thereby supporting the transformative role of critical events emphasised in experiential learning theory (Kolb, 1984; Cope, 2011).

The study also contributes to the literature on women's entrepreneurship by confirming that learning processes are shaped by gender-related experiences, social capital and contextual constraints, in line with prior research emphasising the socially embedded nature of entrepreneurial learning (Rae, 2005; Lattacher and Wdowiak, 2020). By integrating insights from experiential learning theory and women's entrepreneurship literature, this research provides a more comprehensive understanding of how women entrepreneurs learn and adapt during exogenous shocks. Furthermore, it responds to Afshan *et al.*'s (2021) call for further research in developed country contexts and highlights the dynamic and iterative nature of learning that unfolds when entrepreneurs face unforeseen challenges.

Building on the findings, this study offers relevant practical implications for both entrepreneurs and policymakers. For women entrepreneurs, the findings suggest that proactively developing capabilities that enhance resilience is essential in increasingly turbulent environments characterised by recurrent crises. Strengthening relational networks, improving digital competencies and increasing financial awareness can support more effective responses to unexpected disruptions. Investing in professional training, adopting flexible business strategies and building diversified support networks that include peers, advisors and institutional actors may reduce vulnerability and foster adaptive capacity during periods of uncertainty.

For financial institutions, the findings underline the importance of providing accessible financial support accompanied by advisory services that help women entrepreneurs better understand financial instruments and debt management during crises. Banks and other financial intermediaries can play an important educational role by supporting informed financial decision-making and facilitating access to emergency financing, thereby strengthening entrepreneurs' resilience during periods of uncertainty.

For policymakers, the findings highlight the need for targeted support measures for women micro-entrepreneurs, who are particularly exposed

to external shocks. Policymakers should design evidence-based initiatives aimed at enhancing entrepreneurial resilience, such as training programs focused on digital skills and financial literacy, mentoring and networking initiatives and simplified access to financial instruments during crises. Moreover, strengthening collaboration between public institutions, financial intermediaries and entrepreneurial networks may improve the effectiveness of support mechanisms. In a VUCA environment, these policy interventions are crucial to enabling women entrepreneurs to cope with uncertainty and sustain business continuity during exogenous shocks.

Despite these contributions, several limitations should be acknowledged when interpreting the findings, and they also point to directions for future research.

First, the findings have limited generalisability due to the small sample size and the use of purposive sampling through personal networks. Although this approach is consistent with interpretative phenomenological research and allows access to participants with direct experience of the phenomenon, it may introduce selection bias and limit the diversity of perspectives captured. Consequently, the results should be interpreted as context-specific insights rather than broadly generalisable conclusions, and caution is required when extending them beyond similar settings. These constraints also highlight the exploratory nature of the study. Future research should therefore involve larger and more diverse samples to assess the transferability of these insights across a broader population of women entrepreneurs. Second, an additional limitation concerns the potential survivorship bias of the sample. As all participating firms survived the pandemic and remained active at the time of data collection, the findings reflect the experiences of entrepreneurs who successfully adapted to the crisis. Different learning trajectories may have emerged among entrepreneurs whose businesses did not survive. Future research could therefore explore the experiences of non-surviving ventures to develop a more comprehensive understanding of entrepreneurial learning during exogenous shocks. Third, this study has focused on the individual perspective of women entrepreneurs. However, entrepreneurial learning during crises may also be influenced by contextual factors such as support programs, policy measures, cultural norms and network structures. Future research could examine these dimensions through comparative studies across different institutional, regional and sectoral contexts, to assess whether similar learning processes emerge across industries and entrepreneurial environments. Moreover, longitudinal and mixed-method approaches would help us better understand how cognitive and non-cognitive attributes, as well as prior experience, shape experiential learning processes over time during crises.

Overall, the findings should therefore be interpreted in light of the spe-

cific empirical context of this study, which is based on a small qualitative sample of women-owned firms that successfully survived the COVID-19 pandemic. While this context limits the transferability of the findings, it also provides rich insights into entrepreneurial learning during exogenous shocks.

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## BOOK REVIEW

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**FASHION AND ENVIRONMENTAL SUSTAINABILITY:  
ENTREPRENEURSHIP, INNOVATION AND TECHNOLOGY,  
EDITED BY LÉO-PAUL DANA, ROSY BOARDMAN, AIDIN  
SALAMZADEH, VIJAY PEREIRA, AND MICHELLE BRANDSTRUP,  
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*Emanuela Conti*  
*emanuela.conti@uniurb.it*  
*University of Urbino*

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**Abstract**

*This volume offers an original multidisciplinary perspective on how environmental sustainability challenges the contemporary fashion industry, creating opportunities to reduce environmental and social impacts through entrepreneurship, innovation, technology, and marketing. Drawing on multidisciplinary contributions, the book examines sustainability across the entire fashion value chain, from materials and production processes to supply chain management, circular economy, sustainable business models, and consumer behaviour. International case studies illustrate how sustainability challenges are shaped by different economic, institutional, and cultural contexts. Findings highlight that sustainable transformation requires technological innovation, responsible managerial practices, and changes in consumption behaviours. The study ultimately highlights the importance of shared responsibility and greater awareness among firms, consumers, and society in driving the sustainable transformation of the fashion industry.*

## Review

The volume *Fashion and Environmental Sustainability: Entrepreneurship, Innovation and Technology*, edited by Léo-Paul Dana, Rosy Boardman, Aidin Salamzadeh, Vijay Pereira, and Michelle Brandstrup, examines how sustainability is reshaping the contemporary fashion industry, with particular attention to innovation processes, technological development, business models, marketing strategies, and managerial practices.

Bringing together scholars from different disciplinary backgrounds, the book offers an integrated and multidisciplinary perspective on the transformation of the fashion sector. It addresses a broad range of interconnected research areas, including textile materials, innovation and production processes, supply chain management, marketing, circular economy, and sustainable business models. This multidisciplinary approach reflects the complex environmental, technological, managerial, and social challenges currently facing the fashion industry, which are closely connected to broader international sustainability goals.

The volume is original for two main reasons. First, the book approaches environmental sustainability as an issue that involves the entire fashion value chain, going beyond materials and production processes. The chapters show that environmental sustainability also depends on supply chain decisions, marketing practices, consumer awareness, and changes in consumption behaviours.

Second, although the title focuses on environmental sustainability, the volume clearly highlights the relevance of its social dimension. Issues such as working conditions, workers' health and safety, and wages are presented as central challenges for the fashion industry, questioning business models that continue to rely on cost advantages derived from low-cost labour and highlighting the need for shared responsibility among companies, consumers, and policy makers.

The volume is organised into five sections. The opening section provides a historical perspective on the relationship between fashion and environmental sustainability and examines the evolution of the textile and garment industry, highlighting the main transformations that have shaped the sector over time. Starting from traditional textile production, the chapter traces the transition towards industrialisation and, more recently, towards a phase characterised by technological innovation and digital transformation. It shows how mechanisation and mass production significantly increased productivity and accessibility but also contributed to the environmental and social challenges that face the fashion industry today. Sustainability therefore emerges as a response to the limitations of a production model historically centred on efficiency, growth, and large-scale manufacturing.

In this context, the introductory chapter also highlights the growing role of technologies such as computer-aided design (CAD), computer-aided manufacturing (CAM), robotics, artificial intelligence (AI), e-commerce, and digital marketing in reshaping production processes and the relationship between firms and consumers, anticipating many of the themes explored in the subsequent chapters. This historical perspective frames textiles not simply as products, but as the result of continuous interactions between natural resources, technological development, economic choices, and society. This premise provides the basis for understanding sustainability as an issue that extends beyond environmental concerns to encompass economic, technological, and social dimensions.

The analysis then focuses on three traditional materials - wool, leather, and cotton - which are presented as a starting point for understanding the environmental and social impacts of the textile and garment industry. Moving beyond a purely technical perspective, the chapters examine their historical development, production processes, and sustainability implications, showing how decisions made at the material level influence the environmental and social impact of fashion long before products reach the market.

Particularly interesting is the analysis of synthetic fleece, which shows that technological innovation does not necessarily lead to more sustainable outcomes. Although synthetic materials may improve product performance and functionality, they can also generate new environmental challenges, including microplastic pollution and end-of-life management. This example reinforces one of the central messages of the volume: sustainability requires a life-cycle perspective in which material choices are considered strategic decisions with implications that extend beyond production processes.

The second section broadens the perspective through a series of international case studies from Canada, India, Bangladesh, Ethiopia, and several African countries. Together, these contributions illustrate how sustainability challenges are shaped by different economic, institutional, and cultural environments, highlighting the influence of local contexts on the strategies adopted by fashion firms. Rather than proposing a single pathway towards sustainable fashion, the contributors show that local conditions, industrial structures, and policy frameworks play a central role in shaping both opportunities and constraints.

The case studies also reveal the diverse ways in which sustainability is interpreted across different settings. The Canadian Lubertex case illustrates how industry transformations can require a profound rethinking of traditional business models. Facing the decline of textile manufacturing in Canada and increasing competition from Chinese producers, the family-owned company shifted from fabric manufacturing and supply towards

finished products, particularly bedding and linens for the hotel industry. The case highlights how entrepreneurial adaptation involved redefining resources, customer relationships, and the firm's value proposition.

The chapters on India and Bangladesh offer a different perspective, highlighting the tensions faced by major garment-producing countries, where sustainability objectives intersect with issues related to production costs, working conditions, and the pressures of global supply chains. The Ethiopian case examines the role of foreign direct investment, mainly from Asian manufacturing countries, in expanding the textile and apparel industry through export-oriented industrial parks. While these investments create opportunities for employment, industrial development, and integration into global fashion supply chains, the chapter also raises questions about dependence on foreign firms, knowledge transfer to local companies, workers' wages and skills development, as well as the pressure generated by large-scale textile production in terms of energy use, water consumption, and waste management.

The inclusion of a chapter on contemporary kink fashion further extends this perspective by introducing the role of cultural contexts and consumer practices in shaping approaches to sustainability. Focusing on a segment associated with alternative fashion communities and garments such as latex clothing, leather pieces, and corsetry, the chapter shows how fashion products can acquire meanings linked to identity, self-expression, and personal attachment.

Overall, the section shows that the transition towards sustainability in fashion is strongly context-dependent, requiring approaches that consider the specific characteristics of different production systems, institutional environments, market dynamics, and consumer practices.

The third section focuses on the role of innovation in advancing sustainability across the fashion value chain. The chapters examine how technological innovation, digitalisation, supply chain management, and consumer behaviour contribute to redefining how fashion firms create, communicate, and deliver value. Rather than viewing innovation simply as technological progress, they argue that sustainability also requires a rethinking of production models through demand-driven manufacturing, closer collaboration across the supply chain, and longer product life cycles to reduce the industry's environmental footprint.

A relevant contribution is the chapter on the Digital Product Passport, which addresses one of the key challenges of sustainable fashion: improving transparency across increasingly complex global supply chains. Conceived as a digital identity accompanying products throughout their life cycle, the Digital Product Passport provides verified information on materials, production processes, and environmental performance, thereby strengthening traceability for firms, regulators, and consumers. Through

the case of PaperTale, the authors explore whether the Digital Product Passport can become the fashion industry's long-awaited "killer app". Their analysis suggests that the main obstacle is not technological but organisational. Although the necessary digital solutions are already available, their widespread adoption remains constrained by the absence of common standards, limited data sharing, and the reluctance of firms to collaborate across the supply chain. The chapter therefore argues that the transformative potential of the Digital Product Passport depends less on technological progress than on governance mechanisms capable of fostering trust, information sharing, and cooperation between fashion and technology firms.

The section also explores the relationship between sustainability and consumer behaviour, showing how impulse buying and fast-fashion consumption continue to hinder the transition towards more sustainable consumption patterns. Sustainability assessment systems and fashion brand ratings further highlight the growing importance of reliable indicators for evaluating corporate sustainability performance.

Taken together, these chapters highlight the tensions that continue to characterise the transition towards a more sustainable fashion industry. Although digital technologies and new production models offer important opportunities, global sourcing strategies are still strongly influenced by labour costs, with much of production concentrated in low-cost manufacturing countries, particularly in Asia. The section suggests that technological innovation alone cannot address the challenges of sustainability without broader changes in production models, supply chain management, and consumer behaviour.

The fourth section explores circular economy strategies, highlighting the strategic role of marketing in supporting sustainability. The contributors argue that marketing extends beyond encouraging consumers to purchase "green" products and can instead reduce waste throughout the product life cycle by promoting product personalisation, digital technologies - particularly artificial intelligence - and greater consumer engagement. A substantial share of waste is attributed to the misalignment between supply and consumer demand, which often results in overproduction and unsold inventory. Data analytics and artificial intelligence can help firms better anticipate consumer preferences and align production more closely with actual market demand.

One of the main insights emerging from the chapter is that reuse and recycling should not be viewed merely as end-of-life waste-management practices, but as the result of decisions taken much earlier in the value chain, including product design, marketing strategies, and customer relationships. The chapter further highlights the potential contribution of marketing in moving from standardised mass production towards more

personalised products and services. This approach encourages firms to develop offerings that better reflect consumer needs, reducing impulse purchases, product returns, unused garments, and ultimately waste.

The authors also emphasise a more active role for consumers, suggesting that digital technologies enable closer interaction between firms and customers and support value co-creation. Digital tools such as virtual fitting rooms, virtual reality, three-dimensional product visualisation, and artificial intelligence are presented as solutions for improving the purchasing experience, allowing consumers to evaluate products more accurately before buying and thereby reducing unnecessary returns. More broadly, marketing is presented not only as a tool for influencing demand, but as a strategic function that can support reuse, recycling, and the transition towards more circular models of production and consumption.

From this perspective, the case of Kringloopwinkel Steenwijk, a Dutch non-profit social enterprise underlines how circular business models can combine product reuse with social inclusion. Beyond collecting, sorting, and redistributing donated goods, the organisation reinvests its revenues in community initiatives, including a training café that provides work experience and employment opportunities for disadvantaged people, while garments unsuitable for the local market are redirected to international reuse channels.

Although more concise than the previous parts of the volume, the section effectively broadens the discussion of circular economy beyond waste reduction by showing that extending product life cycles requires not only technological solutions but also innovation in marketing, distribution, and consumer practices.

The final section examines future directions of the fashion industry focussing on entrepreneurship, innovation, and responsible management. The chapters address unconventional materials, sustainable business models, corporate environmental strategies, responsible brand identity, human resource management, and workers' rights. Together, they broaden the concept of sustainability beyond environmental performance, showing that the future of fashion also depends on organisational change, ethical practices, and social responsibility.

The chapter on sustainable fashion business models is particularly relevant because it links the need for change to the environmental and social impacts generated by the traditional fashion industry. Events such as the Nike labour controversy in the 1990s and the Rana Plaza disaster in Bangladesh contributed to increasing public awareness of the hidden costs of global fashion production and strengthening consumer activism. In response to these challenges, the authors argue that the transition towards sustainability requires the integration of three main dimensions: sustainable materials, re-

sponsible labour practices, and innovative business models.

Focusing on the latter dimension, the authors examine a range of sustainable fashion business models that illustrate how digital technologies and innovation can reshape traditional approaches to design, production, and consumption. Among these models, fashion-on-demand is particularly relevant because it challenges the traditional logic of producing large quantities before demand is known, seeking instead to align production with actual consumer needs. Similarly, technologies such as 3D virtual sampling, body scanning, and virtual changing rooms show how digital innovation can reduce the need for physical prototypes, improve product fit, and create new forms of interaction between firms and consumers. These approaches suggest that sustainability requires a rethinking of the fashion system rather than incremental improvements in isolated activities. The case of Levi's further illustrates how established companies can incorporate sustainability principles by redesigning specific stages of their production processes. Focusing on the high water consumption traditionally associated with denim manufacturing, the chapter shows how innovations in finishing techniques and water-saving processes can reduce resource use while maintaining product quality.

The comparison between Veja and Twins for Peace, two French sneaker brands operating in the Brazilian market, further extends the analysis by showing how sustainability can become part of entrepreneurial brand identity. While Veja illustrates an eco-sustainable strategy focused on reducing environmental impacts across the value chain, Twins for Peace represents a socially responsible approach centred on community development, education, and working conditions. The chapter illustrates the importance of coherence between sustainability communication and concrete practices to build consumer trust and long-term brand value. However, the broader challenge remains whether these alternative models can scale sufficiently to transform an industry still strongly influenced by fast-fashion dynamics, global competition, and cost-driven production strategies. The section therefore suggests that sustainable transformation depends not only on the adoption of new materials and technologies, but also on firms' ability to rethink business models, organisational practices, and the principles guiding value creation.

A recurring message emerging from these chapters is that moving towards sustainability requires changes from both companies and consumers. For firms, investment in training and the development of knowledge, skills, and managerial capabilities is essential to guide this transition, while greater consumer awareness plays an important role in challenging fast-fashion consumption patterns.

Overall, one of the strengths of the volume is the interpretation of sustainability as a multidimensional concept that extends well beyond envi-

ronmental concerns. The five sections reveal a coherent editorial framework in which sustainability is progressively examined from the environmental implications of raw materials to the technological, managerial, organisational, and social transformations shaping the future of the fashion industry. This progression represents one of the book's main strengths, underlining the interdependence between materials, production processes, supply chains, marketing, circular economy, entrepreneurship, and social responsibility.

*Fashion and Environmental Sustainability: Entrepreneurship, Innovation and Technology* is a valuable contribution to the growing literature on sustainable fashion. Its multidisciplinary perspective and international scope make it particularly relevant for scholars, students, business leaders, and policymakers. Beyond its academic contribution, the book also encourages reflection on the responsibilities shared by different actors across the fashion value chain. A more sustainable fashion industry ultimately depends not only on how companies design, produce, and manage their activities, but also on how consumers understand the impact of their choices and reconsider their relationship with fashion products.

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