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Unveiling the «power» of Entrepreneurial Ecosystems: driving regional growth through an integrated exploration

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TABLE OF CONTENTS

List of Tables

Chapter 1

Chapter 2

Chapter 3

Appendix A

Appendix B

List of Figures

Introduction

Chapter 1

Chapter 2

Chapter 3

Introduction

The present PhD thesis aims to shed light on the role of Entrepreneurial Ecosystems (hereafter EEs) from both theoretical and empirical perspectives, particularly focusing on their influence on entrepreneurial activity and regional development. It is crafted as a collection of three interconnected papers, each depicting a distinct but integral stage of the research pathway.

The first chapter – titled «*Fostering Regional Growth: A wider overview of Entrepreneurial Ecosystems through an integrated methodological approach*» – provides a systematic literature review and bibliometric analysis which lays a solid foundation to advance the current knowledge and sets the basis for the subsequent chapters, aiming to address extant research gaps and contribute empirical insights to this research strand.

The second chapter – entitled «*Evaluating Performance Indicators within Regional Entrepreneurial Ecosystems*» – focuses on the development of a composite index to assess the performance of EEs at the NUTS-2 hierarchical level, namely at the regional level. Such comprehensive index is deemed a critical tool for evaluating and comparing the performance of different regional EEs.

In the third chapter – titled «*Navigating the Regional Entrepreneurial Ecosystem: Evidence from the Italian Setting*» – an in-depth empirical analysis is carried out to examine the influence of the EE index. The latter investigates how the performance of regional EEs affects various outcomes, including entrepreneurial activity, productive entrepreneurship, and overall regional economic development. This chapter not only provides empirical evidence of the influence of EEs but also offers valuable insights into how these EEs can be enhanced to foster economic growth and innovation at the regional level.

The overview of the thesis, encompassing its aims, methodological approaches, and key findings from each chapter, is depicted in Figure 1.

Background, relevance of the study and research questions

In an era where globalisation and technological advancements are promptly reshaping the world's economic panoramas (Malecki, 2010), understanding the drivers of regional development has become increasingly crucial. This transformation is portrayed by a switch from traditional economic models to more dynamic systems, where innovation, entrepreneurship, and networking play pivotal roles (Gries & Naudé, 2010). In this scenario,

EEs emerged as a significant concept to drive regional growth and innovation (Brown & Mason, 2017).

EEs represent a paradigm shift in how the interplay between actors (e.g., entrepreneurs, investors, policymakers, etc) and their specific settings (e.g., infrastructures, networks, innovation, institutions, etc.) is perceived. Unlike traditional models that often focus on individual companies or industries, EEs offer a holistic view, emphasising the importance of interactions and interdependencies among different players to spur innovation and competitiveness (Bakry et al., 2022; Fernandes & Ferreira, 2022; Sitaridis & Kitsios, 2020). This perspective's change covers a crucial meaning in the current global context, where challenges such as digital transformation, environmental sustainability, and social inclusion require combined and collaborative solutions.

An EE can be deemed as a network of interconnected actors, factors, and processes that jointly support and enhance entrepreneurial activities within a region (Stam, 2015; Stam & van De Ven, 2021). In essence, EE is characterised by the ability to foster innovation, encourage risk-taking, and promote knowledge-transfer among its constituents (Erina et al., 2017; Martínez-Fierro et al., 2020; Varga, 2020). This dynamic system is shaped by various factors, encompassing cultural, political, economic, and social elements, which contribute to its complexity and multifaceted nature (Acs et al., 2018; Shane & Venkataraman, 2000; Sussan & Acs, 2017). Key attributes of successful EEs involve a supportive culture that encourages entrepreneurial activity, access to finance for new ventures, quality human capital with crucial skills and expertise, and a regulatory framework enabling business growth (Frimanslund et al., 2023; Harrison & Leitch, 2010; North, 1990). Still, the role of universities and research institutions is pivotal in raising innovation and providing the essential knowledge to trigger entrepreneurial success (Erina et al., 2017; Wagner et al., 2021). Contrarily to the traditional models of economic development that typically attract external investment, EEs flourish through internal collaboration and the natural growth of local companies and innovations (Pustovrh et al., 2020; Spigel & Harrison, 2018). This approach not only bolsters economic development but also improves the resilience and adaptability of regional economies, enabling them to better handle global challenges (Annoni et al., 2019; Ryan et al., 2021).

The present PhD thesis aims to address some research questions to unravel the complexities of EEs and their effect on regional growth.

To this end, the first chapter's research questions seek to clarify:

RQ1: *"What is the state of the art in EEs research field?"*

RQ2*: "How can we summarise the main antecedents that foster the regional economic development of an EE?"*

Despite the extensive body of literature on EEs, this research adopts a distinct approach to summarise prior findings, especially highlighting the elements that contribute to regional economic development within these EEs. Although previous scholars explored EEs (e.g., Leendertse et al., 2022; Mack & Mayer, 2016; Roundy & Fayard, 2019), the quantitative analysis deals with the need for a systematic literature review to thoroughly uncover the research and practical potential of EEs in promoting regional development. The first chapter acknowledges that technological changes and globalisation converted entrepreneurial landscapes, needing a reassessment of regional development strategies. Indeed, EEs can handle change (Ratten, 2020), stimulate innovation (Scott et al., 2021), and new business creation (De Clercq et al., 2013). The methodology involves a systematic literature review – by the PRISMA protocol (Moher et al., 2009) – and bibliometric analysis – using VOSviewer software (van Eck et al., 2006; van Eck and Waltman, 2010) – to identify and support key findings. The results reveal three main well-polarised clusters: the red cluster highlights the role of government in fostering a conducive environment for regional development; the green cluster focuses on the role of innovative firms in adapting to evolutionary dynamics within EEs; and the blue cluster emphasises the role of universities in promoting an entrepreneurial culture. In detail, the study attempts to provide a comprehensive understanding of the complex mechanisms within EEs, highlighting the roles of governments, innovative firms, and universities. The empirical evidence suggests that policymakers should deeply examine regional issues and related policies, while entrepreneurs should be fully aware of the elements within the EE to effectively seize entrepreneurial opportunities.

The second chapter explores the following research questions:

RQ3: *"How can the key variables from the most widely proposed EE indexes be integrated to create a comprehensive EE composite index?"*

RQ4: *"To what extent are the different elements of EEs interdependent within the Italian context?"*

Given the pivotal role of contextual factors and actors within EEs in shaping entrepreneurial paths, it is essential to identify key indicators for nurturing business activities. Hence, EEs serve as a framework to encapsulate the essential attributes of regions that

support entrepreneurial activity and innovation (Spigel, 2017). While various EE indexes have been developed, a gap in integrating these variables into a comprehensive index still persists. In particular, some scholars call for further refinement to fully capture the region's complexities over time (Iacobucci & Perugini, 2021). This research aims to address these shortcomings by enhancing the EE index with additional variables and examining the interdependence of EE elements within the Italian context. To this end, a comprehensive EE index, consisting of twenty-one indicators, has been crafted in the time span of 2009-2019. The study provides significant conceptual and empirical contributions to further understanding EEs and regional performance. In particular, it offers insights into the selection of EE elements, the evaluation of regional EEs' performance across twenty Italian regions, and the potential adoption in different geographical contexts.

The third chapter goes into the following research questions:

RQ5: *"How does EE affect entrepreneurial activity, productive entrepreneurship, and regional economic development?"*

RQ6*: "How does EE differ between developed and less developed regions?"*

Given that EEs are distinguished by a dynamic mix of actors, institutions, and socio-economic factors that nurture new business creation and augment regional value creation (Kenney, 2000; Nelson, 1993), the purpose is to empirically quantify their influence on entrepreneurial activity, productive entrepreneurship, and regional economic growth. The understanding of these interrelationships is pivotal, as they cover a broad spectrum of indicators relevant to entrepreneurial activities at both individual and regional scales, thus shaping strategies for regional development. Despite the extant research at the regional level (Knox & Arshed, 2022; Stam & van de Ven, 2021; Szerb et al., 2019), there is an ongoing need for more comprehensive measurement methodologies. This chapter intends to investigate these research gaps emerged in the current literature, going beyond the mere descriptive analyses to look into the influence of EEs on firm creation and regional economic growth across different regions (Perugini, 2023). Specifically, it responds to the call for more comprehensive empirical analysis by examining Italian NUTS-2 regions over the period from 2009 to 2019Drawing upon institutional and embeddedness theories, the empirical analysis underscores regional disparities and advocates for implementing effective practices to promote inclusive economic development. Institutional Theory, which posits that institutions influence behaviours through norms and regulations, helps to probe the relationship between EEs and entrepreneurial activity (Bruton & Ahlstrom, 2003; DiMaggio

& Powell, 1991; Scott, 2007). At the same time, Embeddedness Theory offers a theoretical lens to understand how startups as well as small and medium-sized enterprises (SMEs) are shaped by their social and environmental contexts (Dacin et al., 1999; Granovetter, 1985; Nohria & Eccles, 1992), thereby clarifying their role in regional development. The empirical analysis covers a sample of twenty Italian regions and takes root in a dynamic panel data approach by the Generalised Method of Moments (GMM) to test the research hypotheses. The analysis categorises regions as either developed or less developed, following EU standards (namely, the EU Regional Policy and Cohesion Policy for 2014-2020). This classification highlights significant disparities and emphasises the relevance of EEs in promoting regional entrepreneurship and economic development.

Therefore, the research goes beyond the mere academic pursuit regarding the need to move the current body of knowledge forward, since it reveals a valuable practical tool for assessing regional EEs. On closer inspection, regions should increasingly focus on cultivating vibrant EEs as a strategy to achieve economic revival and sustainable growth. The findings stem from an integrated examination of EEs and sheds light on their complex effects on regional economies and communities, thereby contributing to a more thorough understanding of their prominence.

Figure 1. Thesis overview

Unveiling the «power» of Entrepreneurial Ecosystems: driving regional growth through an integrated exploration

CHAPTER 1: Fostering Regional Growth: A wider overview of Entrepreneurial Ecosystems through an integrated methodological approach

RQs
1) "What is the state of the art in EEs research field?"
2) "How can we summarise the main antecedents that foster the regional economic development of an EE?"

Type of study:	**Methodology**:	**Main findings:**
Mixed approach	Systematic literature review	Three well-polarised clusters
	Bibliometric analysis	Future research agenda

CHAPTER 2: Evaluating Performance Indicators within Regional Entrepreneurial Ecosystems

RQs
1) "How can the key variables from the most widely proposed EE indexes be integrated to create a comprehensive EE composite index?"
2) "To what extent are the different elements of EEs interdependent within the Italian context?"

Type of study:	**Methodology**:	**Main findings**
Quantitative/descriptive	Composite index methodology	High interdependence among EE elements
	Confirmatory Factor Analysis (CFA)	Different performance of Italian regional EEs

CHAPTER 3: Navigating the Regional Entrepreneurial Ecosystem: Evidence from the Italian Setting

RQs
1) "How does EE affect entrepreneurial activity, productive entrepreneurship, and regional economic development?"
2) "How does EE differ between developed and less developed regions?"

Type of study:	**Methodology**:	**Main findings**
Empirical/longitudinal	Dynamic panel data	EE index and its sub-indexes prove different influences
	Generalised Method of Moment (GMM)	Distinct effects between developed and less developed regions

Source: Authors' elaboration

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Chapter 1. Fostering Regional Growth: A wider overview of Entrepreneurial Ecosystems through an integrated methodological approach[1]

Abstract

Over the last years, entrepreneurial ecosystems have developed into a relevant research field, and it has exponentially grown for prominent reasons across multiple contributions. Our work aims to systematize the main antecedents able to spur regional development. In particular, we carried out a systematic literature review and bibliometric analysis of 118 peer-reviewed articles published on entrepreneurial ecosystems and regional development over a 26-year period (from 1996 to 2022). We identified, examined, and reviewed three research streams and outlined some future research avenues to help scholars and practitioners in addressing new challenges and emerging issues in a changing economic environment. The research agenda proposes different approaches to catch new nuances of the phenomenon, through a greater use of quantitative methods and a deeper understanding of the entrepreneurial ecosystem evolution, supported by reliable and novel results.

Keywords: Entrepreneurship · Regional development · Systematic literature review · Bibliometric analysis · VOSviewer

[1] Please note that this paper was developed in collaboration with other co-authors, to whom I extend my sincere gratitude: Prof. Alessandro Cirillo, and Prof. Antonio Corvino. I am deeply thankful for their valuable contributions. However, all the errors within the chapter are my own responsibility.

1.1. Introduction

In recent decades, scholars, policymakers, and entrepreneurs have increasingly focused their attention on the significance of Entrepreneurial Ecosystems (henceforth EEs) as catalysts for regional economic development (Acs et al., 2017; Stam, 2015; Yun et al., 2017). Escalating forces, such as technological change and globalization, have reconverted the entrepreneurial landscape, compelling regions to reassess their development strategies. As a result, EEs play a critical role to manage change (Ratten, 2020) through the promotion of innovation and fostering new firms' creation.

Although the EEs topic has been widely explored in the existing literature (Bichler et al., 2022; Bouncken & Kraus, 2022; Lopes & Franco, 2019; Theodoraki et al., 2022), this study takes a dissimilar approach and fills the gap to synthesize the findings of previous evidence, clarifying the underpinning elements that contribute to regional economic development within an ecosystem context (Cavallo et al., 2019). In more detail, the aim to systematize the paramount antecedents that fuel the dynamics of regional growth by answering the following research questions:

1) *"What is the state of the art in EEs research field?*
2) *"How can we summarise the main antecedents that foster the regional economic development of an EE?"*

Therefore, our study might provide intriguing food for thought over the following literature strands: EEs and regional development.

We conduct a systematic literature review and bibliometric analysis, in order to provide a wider overview of the research field, and by means of VOSviewer software, to compute specific indicators for corroborating our findings. In other words, three well-defined clusters emerge from our empirical analysis, to which has been randomly assigned as many colours by the VOSviewer software. Firstly, the red cluster stresses some issues, the role of governments in orchestrating a conducive environment for regional economic development. Secondly, the green cluster includes research works on the role of innovative firms to face evolutionary dynamics within EEs. Lastly, in the blue cluster, the focus is on the role of universities in promoting entrepreneurship culture within EEs.

Through an-depth study of these critical antecedents, the purpose is to provide a holistic understanding of the intricate mechanisms within EEs. By underlying the roles of governments, innovative companies, and universities, this study not only provides a major understanding of the theoretical framework of EEs suitable to fuel academic debate, but

the findings provide managerial and policy implications. Moreover, the empirical evidence suggests to policymakers a deeper examination of regional issues and related policies; in addition, entrepreneurs should be aware of the elements surrounding the EE, in order to catch entrepreneurial opportunities (Daniel et al., 2022; Mack & Mayer, 2016).

1.2. Theoretical background

Aldrich (1979), and Hannan & Freeman (1977) emphasized an ecological perspective on entrepreneurship and organizational analysis. In the academic debate, there are several definitions over EE (Cohen, 2006; Isenberg, 2011; Mack & Mayer, 2016; Spigel, 2017; Spilling, 1996). Some scholars describe EEs as interconnecting constituents which bring up new ventures in a specified regional background (Mack & Mayer, 2016), while others define them as a vigorous association of related actors and institutional and socioeconomic contexts (Audretsch & Belitski, 2017), which trigger the allocation of resources across the new firm creation (Acs et al., 2014). In essence, we go along with the most shared notion posited by Stam (2015), for which EE is *"(..) a set of interdependent actors and factors coordinated in favour of productive entrepreneurship"* (Stam, 2015, p.1765), within a particular territory (Stam & van de Ven, 2021). The main strength refers to the interplay between the elements of EE that promote new firms' creation and entrepreneurial initiatives at the regional level, such as high-growth firms or innovative start-ups. Such benefits contribute to the creation of new economic and social value that, in turn, represents the outcome of an EE, in the narrow sense.

In our attempt of understanding the intricate interconnections within an EE and their effect on the encompassing environment, we draw upon the model framed by Stam (2015) where conditions are classified into two categories: the framework (formal institutions, physical infrastructures, cultural dynamics, and demand), and the systemic (e.g., networks, leadership, knowledge dissemination, support services, etc.) that engage in mutual interactions. The symbiotic interplay among these constituents nurtures a fertile ground for productive entrepreneurship (Baumol, 1996), ultimately resulting in the generation of aggregated value.

EE, therefore, plays a key role at regional level, in terms of both an innovation enabler and a system for nurturing partnerships at local and non-local level. Local and regional development literature has been historically dominated by economic concerns,

such as growth, income, and employment (Armstrong & Taylor, 2000), essentials for prosperity and wellbeing. Despite the countless definitions of regional development in the literature, we deemed the widely acknowledged meaning provided by Pike et al. (2016). They assume that local and regional development is an uneven process, generating diverse economic, social, and environmental outcomes as localities and regions wrestle with processes of growth, decline, and adaptation. Indeed, the pillars regarding local and regional development vary both within and between countries, and their differing articulations change over time (Beer et al., 2003).

Over the recent years, the dominant economic focus has often broadened in an attempt to address social, ecological, political, and cultural concerns (Ferreira et al., 2020; Geddes & Newman, 1999), such as reducing social inequality, promoting environmental sustainability, encouraging inclusive government and governance, and recognizing cultural diversity (Counsell & Haughton, 2004). A homogeneous understanding of development for localities and regions does not exist, but incremental and, sometimes, radical shifts occur, shaped by practice, experience, assessment, and reflection. However, regional and national interests determine local and regional development in specific contexts, albeit regarding broader economic and political processes.

It is necessary to consider some essential components to generate regional development, such as partnerships and dynamic capabilities to trigger innovation. Given the existence of several actors involved, (e.g., universities, research institutions, industries, governmental organizations, etc.), innovation should be considered as an interactive, networking and collaboration process (Scott et al., 2021). Moreover, business success depends not only on the firm's behaviour (e.g., workforce skills, level of investment in innovation strategies and internationalization, etc.), but also on the quantity and quality of interactions with stakeholders (e.g., investors, public administrations, universities, and research institutions, etc.) (Fernandes & Ferreira, 2022).

The industry-government-university relationship, called "Triple Helix", is the key to knowledge-based economic development, where universities can play an enhanced role in innovation in an increasingly knowledge-based society (Erina et al., 2017). Knowledge transfer capabilities are affected both by the dynamic capabilities and universities' culture. To date, universities' knowledge transfer activities have underlined several difficulties in the interactive process with other institutions. Therefore, a method is required to facilitate understanding related to the transfer of university knowledge. By analysing the

relationship between EE and regional development, we intend to identify the pillars driving innovation. Hence, this study aims to place greater attention to the determinants of entrepreneurial development still to be explored at regional level.

1.3. Methodology

The methodological research flow and the selection of papers are described below (Figure 1.1). As known, the main goal of a systematic literature review is to sum up and compare evidence originating from distinct studies, while positing specific research questions. The systematic search process ensures methodological transparency and reproducibility, aiming to report policymakers and practitioners about current topics in the research field (Snyder, 2019).

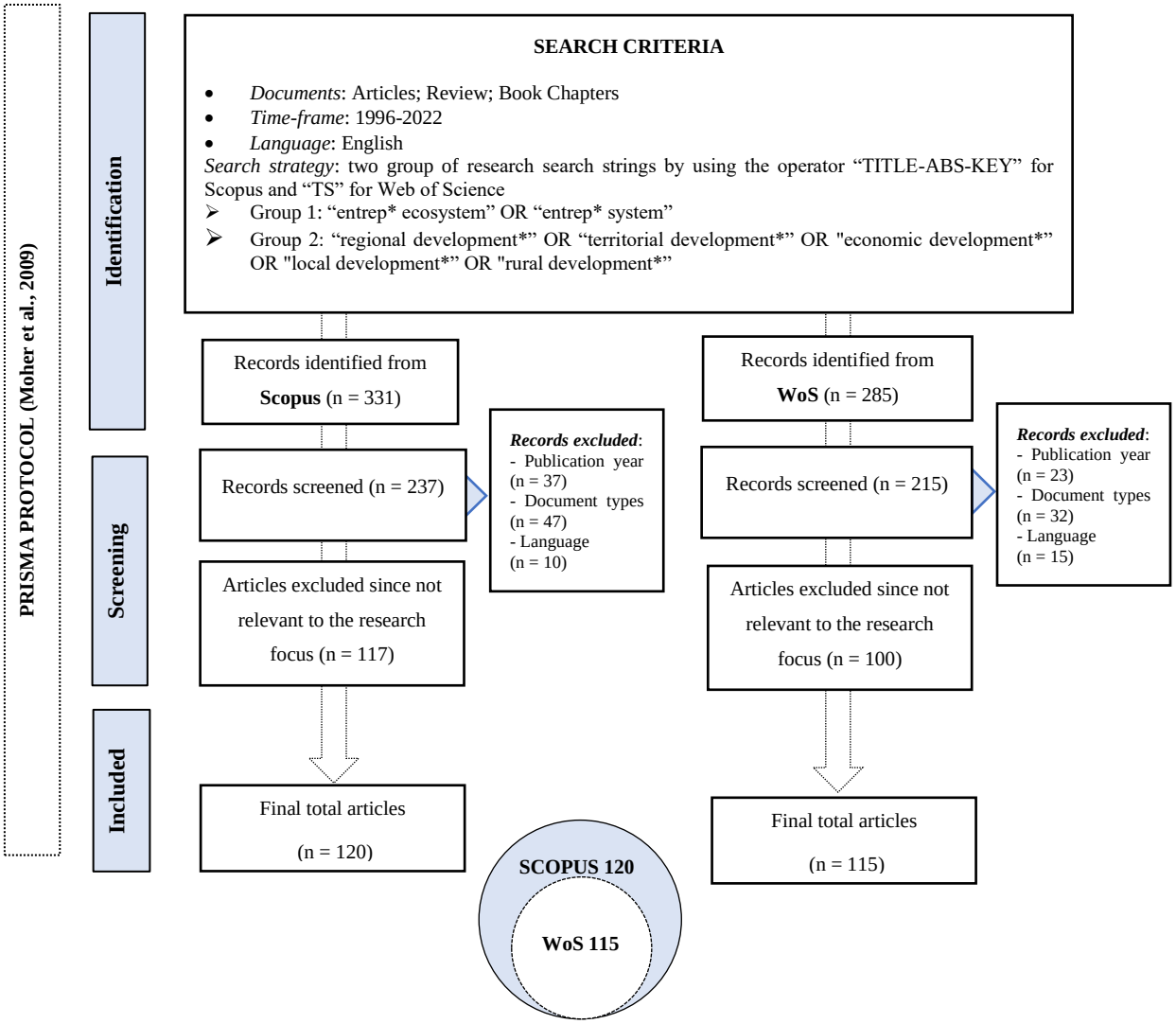
This study was performed through a mixed approach: the clustering of papers was carried out using the visualisation of similarities (VOS) procedure (van Eck et al., 2006; van Eck and Waltman, 2010), while the literature review followed the approach proposed by Tranfield et al. (2003). Thoroughly, the bibliometric analysis consists of a set regarding the quantitative techniques used to evaluate physical published and bibliographic units, or surrogates for both (Broadus, 1987; Zupic & Čater, 2015). Conversely, the literature review aims to summarise the state of the art to identify future research routes (Rowley & Slack, 2004). To safeguard the selection of records process, we developed the PRISMA protocol (Moher et al., 2009) (Figure 1.1). This approach has already been adopted in the entrepreneurship research field (Delgado García et al., 2015; Sassetti et al., 2018), where its effectiveness and reliability were earlier shown (Ding et al., 2014; Mohammadi & Karimi, 2021). Both methods have strengths and limitations, but a complementary use has been advocated and increasingly adopted by academics reviewing scientific literature (Dabić et al., 2019). The whole process involved the following six steps.

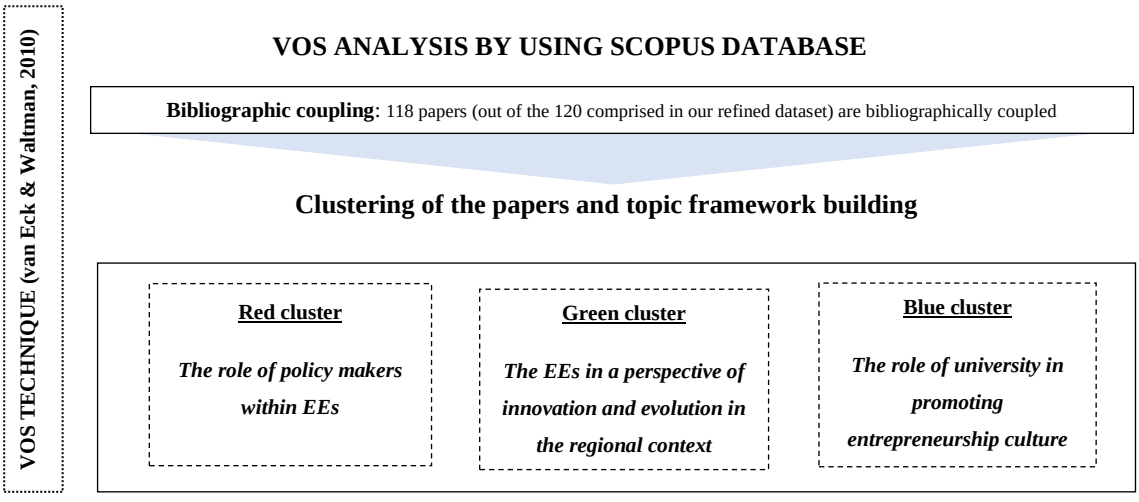
In the first step, we reviewed the prolific papers on the research fields to acknowledge an updated framework of the research strand and pick up the keywords frequently used by academic audiences. In addition, a methodological triangulation was applied for a more suitable cognition of the insights of this research method adopted, and later than several iterations and refinements.

As the second step, we posited our research query. Figure 1.1 displays the combination of two search strings to identify manuscripts encompassing relevant terms in the title,

abstract, and keywords. The first set refers to EEs (Cao & Shi, 2021; Cavallo et al., 2019), while the second one is on regional development (Dawkins, 2003).

Figure 1.1. Research flow and selection of the papers





Source: Authors' elaboration

Thereafter, we ran the query in Scopus Database employing the operator "TITLE-ABS-KEY", which searched for prominent content within the titles, abstracts, and keywords of each paper. We delimited the query to articles, reviews (in order to include only high-quality material submitted to a double-blind peer-review process), and book chapters. The paper extraction was conducted in August 2023 and includes manuscripts published from 1996 to 2022.

After setting up the search criteria, the third step was devoted to collecting data. As the starting point, we attained a preliminary sample of 120 documents from the Scopus Database. To cross-validate the data coverage, we replicated the analysis on Web of Science Core Collection Database, resulting 115 entries. Remarkably, the matching between the two databases revealed no missing documents in Scopus. Referring to prior research suggesting that Scopus provides greater coverage than the Web of Science Core Collection and our own cross-validation procedure proving this, we chose Scopus as the suitable database due to its inclusive coverage of the sample articles in this specific field (Bragge et al., 2019).

In the fourth step, we finalized our paper collection by reviewing each of the 120 manuscripts, involving studies fitting the definition of EE and regional development outlined in this analysis. The papers included in the final dataset are signed with an asterisk (*) in the Reference section.

The fifth step was devoted to performing the bibliometric analysis. We used the VOSviewer 1.6.16 software, applying bibliographic coupling as the aggregation criteria (van Eck and Waltman, 2010). A similarity matrix was obtained from the VOSviewer routine by normalizing a co-occurrence matrix of items, that is the graphical output of the VOS analysis – a 2-D map where closer references point out stronger interconnections. Our analysis revealed that out of the 120 refined dataset manuscripts, 118 were bibliographically coupled. Therefore, we excluded two items (De Jager et al., 2017; Isenberg, 2016) from the dataset as they were not correlated in the VOS analysis. The resolution value was set to 0.90, and the minimum cluster size was determined to be 5. We adopted normalized citations to weigh the items, ensuring adequate depiction even for the most recent papers (van Eck & Waltman, 2010). Figure 1.3. demonstrates a strong nexus of connections, consisting of 4089 links and a total link strength value of 12663.

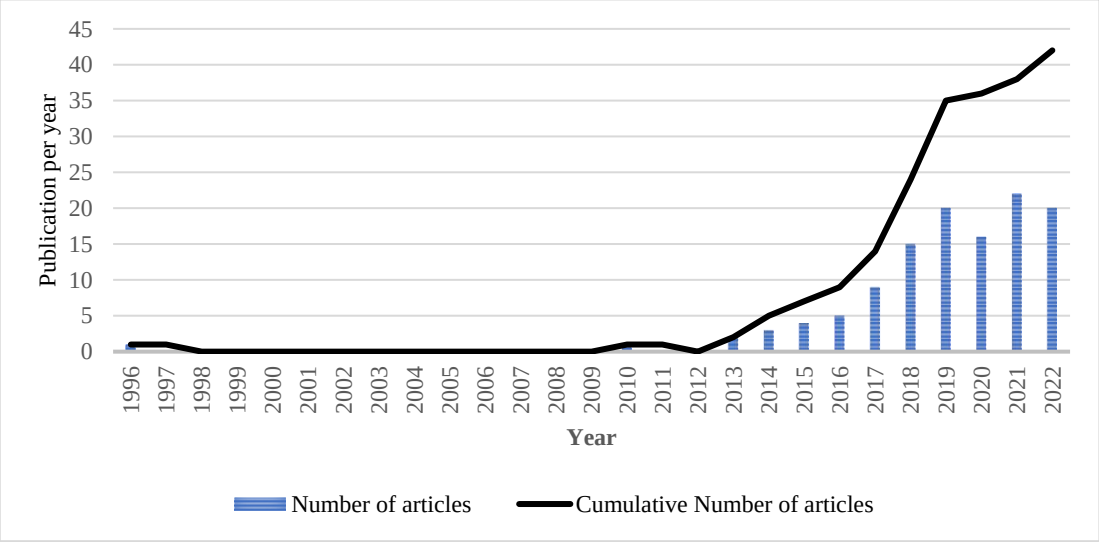
Lastly, relying upon the output of the VOS analysis, we carried out a systematic literature review using the methodological approach proposed by Tranfield et al. (2003)

and following the PRISMA protocol (Moher et al., 2009). Notably, we systematically analyzed all the papers, classifying them in descending sequence of normalized citations as the main guiding criterion. We clustered the papers based on their similarity and a strong level of interconnection in terms of themes. The list of the 118 manuscripts included in the present study is described in Appendix A, Table A1.

1.4. Results of the bibliometric activity indicators

Figure 1.2. shows the distribution of the papers over time, namely from 1996 to 2022. The interest began in the early 1990s, precisely in 1996, from Spilling's (1996) study. This field remained unexplored for 14 years until the number of publications has shown an increasing trend from 2015 onwards. Afterwards, there is a piecemeal but growing interest by scholars, so as to reach a peak in the year 2021 when are released 22 papers.

Figure 1.2. Distribution of the papers over the years



Source: Authors' elaboration from VOSviewer 1.6.16 software

Since 2015, the great interest in this research field might be due to a generally slow growth of the gross domestic product and the following European Commission's plan named «*Entrepreneurship 2020 Action Plan - Reigniting the entrepreneurial spirit in Europe*» (European Commission, 2013) to put in place a business plan to reawakening the entrepreneurial spirit. Unemployment, fiscal deficits, public debt, and pressure on exchange rates are only determinants highlighting the deep structural deficiencies of the European economy. Since 2008, Europe has been suffering the effects of the most severe

downturn, which generated, for the first time, over 25 million unemployed. In the bulk of the European member States, small and medium-sized enterprises are not yet been able to go back to their pre-crisis levels. It is therefore necessary to bring Europe back to growth and higher levels of employment, through the setting up of new firms. The action plan includes: investing in entrepreneurship education; creating an environment where entrepreneurs can flourish and grow, and changing entrepreneurial culture through a renewed perception of their role. Overall, these actions might stimulate the development of a sustainable and efficient EE. Furthermore, in September 2015 the United Nations published the 2030 Agenda for sustainable development. In particular, the sustainable development goal n. 8 promotes entrepreneurship, development-oriented policies, and proliferation of small-medium enterprises, by leveraging on an easier access to financial capital. These findings highlight the relevance that this topic is gaining in academic and practitioner audiences, also driven by the several policy programs that place entrepreneurial issues at the top of their agendas.

In our bibliometric analysis, the total number of academic journals amounts to 71, but in Table 1.1 we show only the top 15, based on the number of papers per Journal and citations. Such journals are not surprisingly based on the field of entrepreneurship and regional/local economic development.

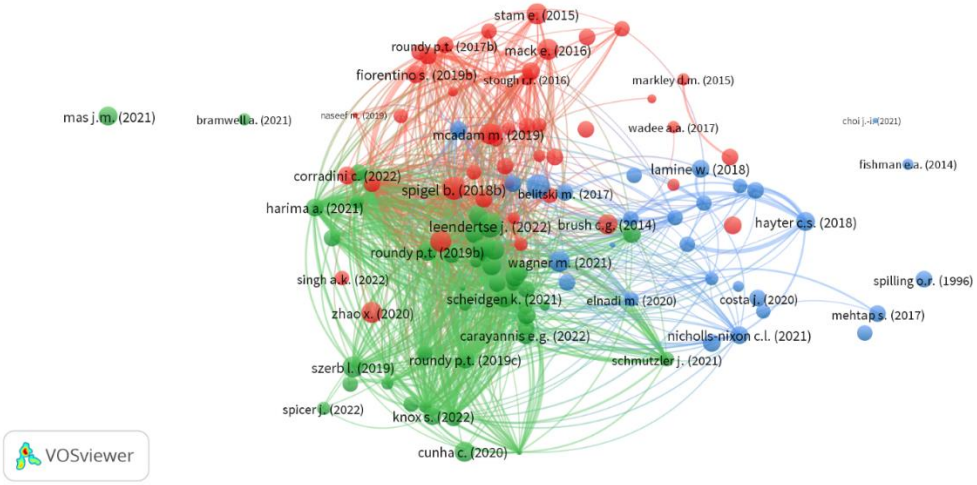
Table 1.1. Main academic journals publishing studies on EE and regional development

Journal	Number of papers	Citations	Normalised citations
Entrepreneurship and Regional Development	8	277	10.55
Small Business Economics	7	700	16.23
Local Economy	6	58	3.11
European Planning Studies	5	1082	6.19
Journal of Technology Transfer	5	275	5.18
International Entrepreneurship and Management Journal	4	77	3.90
Regional Studies	4	327	8.81
International Journal of Entrepreneurship	3	27	1.26
International Studies in Entrepreneurship	3	128	1.88
Journal Of Entrepreneurship and Public Policy	3	22	1.01
Research Policy	3	79	7.50
Technological Forecasting and Social Change	3	38	2.17
Cambridge Journal of Regions, Economy and Society	2	41	0.94
Environment and Planning Studies	2	19	1.04
Growth and Change	2	6	0.33

1.5. Results of the VOS analysis and the systematic literature review

Figure 1.3. exhibits an output of the VOS analysis, which highlights the presence of three well-polarised clusters representing the research streams within EEs field, in a territorial development perspective.

Figure 1.3. Results of the VOS analysis



Source: Authors' elaboration from VOSviewer 1.6.16 software

Table 1.2. displays the descriptive statistics regarding each cluster. Despite the red cluster is the biggest, in terms of the total number of papers, it gathers fewer citations. Five papers (Acs et al., 2017; Mack & Mayer, 2016; Spilling, 1996; Spigel & Harrison, 2018; Stam, 2015) collect 2.376 citations and represent the pillars of the entire EE field in regional development. Such results confirm that the earlier research stream is relevant, and in an ongoing development.

Table 1.2. Descriptive statistics concerning the clusters

	Number of papers	Total citations	Total Normalised Citations	Tot. cit./Num. of papers
Red	45	788	47.38	17.51
Green	44	2964	46.63	67.36
Blue	29	1625	25.05	56.03
Total	**118**	**5377**	**119.06**	**50.73**

1.5.1. Red cluster: the role of policy makers within EEs

In the red cluster, the key topics pertain to the policy makers' role and stakeholder engagement. Public policy has a pivotal role in fostering the emergence and evolution of EEs (Meshram & Rawani, 2019; Meutia et al., 2021; Nordling, 2019). Policy makers have

to look at the evolutionary characteristics of the EE, as a way of implementing measures to support entrepreneurship (Schmutzler et al., 2022; Spigel et al., 2020). The main driver is the explicit connection to an urban development agenda commonly accepted and politically supported by local government (Bramwell, 2021). In regions with poor entrepreneurship, decision-makers can promote regional performance by redirecting resources to an innovative entrepreneurial spirit (Szerb et al., 2019). A proposed solution resides in the resource injection by transnational entrepreneurs (Harima et al., 2021) and in the institutional support (Dal Bello et al., 2021), paying close attention to the heterogeneous structures of EEs (Roundy, 2019b; Scheidgen, 2021).

Nonetheless, it is insightful to identify both the weaknesses and the crucial factors of the whole ecosystem (Szerb et al., 2020). In this regard, policy makers should make more efforts in the pillars of risk acceptance, networking, and educational dimension (Ali et al., 2021; Komlósi et al., 2022). Improving instruments for EE development policies requires a data-driven approach to understand the EE of a specific region before making any attempts to change (von Bloh, 2021). However, greater attention must also be paid to over-reliance on policy instruments. This creates a "vicious" circle that reinforces the dependence relationship and prevents the region from transforming into a self-sustaining and resilient ecosystem (Ryan et al., 2021).

The second issue regards the key role of resources within an EE. Two specific strategies for managing resource dependence emerge: bridging and buffering. In the former case, firm develops a buffer between itself and its external environment by isolating core operations from environmental influences and engaging in internal actions to run resources. Buffering strategies include stockpiling resources, attempting to anticipate environmental changes, and expanding or reducing production scales. By contrast, the latter case (i.e., bridging) considers the dependence of resources from the external environment. Bridging activities include mergers, vertical integration, alliances, board interconnections, and governmental linkages (Roundy & Bayer, 2019).

At the root of a sustainable development system both sufficient human capital (Cao & Zhang, 2021) and adequate stakeholder engagement (Cunha et al., 2020; Schmutzler, et al., 2021) are required, which must be the fulcrum of business strategy (Cao & Zhang, 2021, 2022; Levenda & Tretter, 2020). High-trained human capital is considered a strategic resource capable of generating dense blocks of innovation (Mas & Gómez, 2021; Roundy, 2019a; Roundy & Fayard, 2019; Spigel & Vinodrai, 2021). In this regard, learning

is vital within an EE to develop the skills necessary to implement the available resources in firm endowment. Universities might help spread and embed learning within their regional ecosystems (Pugh et al., 2021) and act as an incubation and acceleration mechanism inside EE.

The last theme appertains to stakeholder engagement, which has a central role in the provision of resources and implementation of networking activities. Both are essential for the endurance of a vibrant EE (Carayannis et al., 2022; Knox & Arshed, 2021; Roundy, 2018; Santos, 2021).

The main theoretical constructs supporting the topics amenable to this cluster are: the evolutionary (EvT), the stakeholder (ST), the institutional (IT) and the dynamic capability (DCT) theories.

The former asserts that a firm is not a static entity, but it adapts through experimentation and learning to its environment. According to this assumption, firm responds to innovation and creates a competitive advantage through change (Nelson & Winter, 1982). The latter (Freeman, 2010) underlines the relationships between firm and its customers, suppliers, employees, investors, communities, etc. In short, firms should create value for all stakeholders, rather than just shareholders. Indeed, creating value through different relationships within EE might promote regional/local development.

The IT (North, 1990) essentially focuses on how being compliant with the norms and rules in an institutional environment and it serves as the theoretical tenet for research on policy makers' role.

Lastly, the DCT contends that in face of environment changes, firm can only maintain its competitive advantage by developing resources and routines, adapting to the new context (Winter, 2003). The dynamic capabilities are therefore pivotal to preserve value creation path in the long run and to adapt business models (Teece et al., 1997).

1.5.2. Green cluster: the EEs in a perspective of innovation and evolution in the regional context

In the green cluster, settings with dissimilar properties were examined (Spigel & Harrison, 2018). Firstly, the focal point is the entrepreneur, rather than the firm. The EE approach begins with the entrepreneurial actor. Entrepreneurship arises from the entrepreneurs who are actors themselves in creating the ecosystem and caring for it in good shape (Stam, 2015). The entrepreneur who desires activating innovation processes

- along with the other EE components - for regional development, has to reflect on evolutionary dynamics (Lopes & Franco, 2019). These have a significant impact on the institutional environment (Lowe & Feldman, 2017; Mack & Mayer, 2016). In this regard, it is required to bring attention to an additional critical issue: the peculiar factors in the surrounding environment (Naseef & Jyothi, 2019). Indeed, new business creation is less challenging in regions where there is an easier access to resources and the presence of institutions easing transactional relationships. By contrast, the regions that do not activate these conditions might be perceived less supportive towards EE (Freitas & Kitson, 2018).

The amount of "unicorn" firms is a typical yardstick to evaluate the level of innovative entrepreneurship, in a specific regional setting. It is pivotal the presence of innovative firms within an EE, and the understanding on how it might improve their performance and survival (Bandera & Thomas, 2018; Stough, 2016), also through strategic resources provided by stakeholders working in a local environment (Assenza, 2016; Brush, 2014; Godley, et al., 2021; Roundy, 2017b; Sleuwaegen & Ramboer, 2020; Wadee & Padayachee, 2017). Indeed, innovative capabilities are crucial for knowledge and skill transfers among firms (Erina et al., 2017; Martínez-Fierro et al., 2020; Roth et al., 2013). Such knowledge interchange might be raised by social trust, which involves both the components promoting entrepreneurial processes and geographic proximity including institutions (Corradini, 2022). Basically, the entrepreneur must be able to understand the value of novel knowledge, recognize its potential and create new entrepreneurial opportunities. This ability is called "entrepreneurial absorptive capacity" (Qian, 2018).

A further topic emphasizes some ideas that might bring industrial policy to an urban level, in a new direction. For instance, co-working spaces represent new soft institutions able to sharpen manifold effects on regional development (Fiorentino, 2019a). Urban regeneration strategies include the "maker economy", which implies a development based on consumption, innovation, entrepreneurship, etc. (Fiorentino, 2019b).

The last argument refers to the business strategies in a small town, such as nonlocal connections, local cultural resources, and social networks (Rice et al., 2020). According to Roundy (2017a), a small town is a community of individual and institutional agents, with a population of less than 250,000. Factors that might drive success to involve non-local connections, local cultural resources, and social connections in catalysing local business expansion. Therefore, connectivity reveals a priority among different common and central

elements, such as finance, local governments, university, and other kinds of organizations (Motoyama & Knowlton, 2016).

The main theoretical constructs supporting the earlier topics stemming from our empirical analysis are: the resource dependence theory (RDT), the embeddedness theory (ET) and the knowledge spillover theory of entrepreneurship (KSTE).

The former emphasises the critical resources for exploiting entrepreneurial opportunities and backing business survival and growth (Ulrich, & Barney, 1984). The latter asserts that firms might exploit their capabilities through linkages embedded in social relations and networks inside the firms. Such relationships are able to invoke informal circumstances of trust and cooperative behaviours, which promote resource transfers among different actors (Granovetter, 1985).

At last, the KSTE maintains that an escalation in the amount of knowledge has a positive influence on the degree of entrepreneurship (Acs et al., 2009). Such quantity is often measured by the financial resources deployed on R&D investments, and the number of articles published in scientific and academic journals (Varga, 2000).

1.5.3. Blue cluster: the role of university in promoting entrepreneurial education within EEs

The themes in the blue cluster gravitate on the role of universities that are analysed as both actors of cultural development and providers of entrepreneurial education (Belitski & Heron, 2017; Choi & Lee, 2021; Huang-Saad, et al., 2018), through business incubators in the regional setting, with the aim to disseminate an aware and strong entrepreneurial culture for implementing new business creation (Acs, et al., 2017; Harrison & Leitch, 2010).

Such institutions are often key players in economic development. Moreover, university's proximity is deemed an essential determinant for entrepreneurship (Spilling, 1996), given that it fosters academic spin-offs and higher education institutions. Both exert a positive influence on regional and national economy (Hayter et al., 2018). University business incubators are relevant strand of the ecosystem to support entrepreneurial ventures (Lamine et al., 2018; Nicholls-Nixon et al., 2021). For instance, university start-up programs positively affect the start-up activities worked out by students and graduates (Elnadi et al., 2020) and improve their perceptions on the strengths of the surrounding environment (Wang, 2021).

This relationship takes root in the need to provide participants individual advices and guidance and in the requirement to develop partnerships with stakeholders to trace resources in the external EE (Mason et al., 2020). Start-up programs, supported by university business incubators, are more successful than private business incubators. The latter do not entirely exploit their potential, since they are often centered on just temporary solutions (van Weele et al., 2018).

Another issue refers to entrepreneurship education ecosystems as a driver for knowledge spillover of entrepreneurship by scholars and entrepreneurs within a collaborative framework among university, industry, and government. Indeed, universities are more and more transforming in institutions driven by a third mission, coupled with traditional teaching and research responsibilities. Such third pillar seems highly consistent with sustainable regional and economic development (Ferreira et al., 2022; Wagner et al., 2021).

The main theoretical constructs supporting the topics above mentioned are: the RDT and the KSTE. The former underlines the influence of external constraints on firm's survival and the ways to design and handle fitting solutions to overcome such hindrances (Pfeffer & Salancik, 1978). In this cluster, the KSTE allows to investigate the proximities with strategic institutional actors to create a competitive advantage in a regional context. Some empirical findings suggest that local universities and industrial research interact for boosting the knowledge output of the region (Acs & Varga, 2005).

1.6. Discussion

Our main purpose is to better understand EEs and their key attributes to support entrepreneurial liveliness. Several scholars looked into EEs, but a systematic literature review on their influence over regional development is still lacking. Therefore, we intend to fill this gap by leveraging on EEs as a «fly-wheel» of entrepreneurship policies in a specific geographical area meant to grab entrepreneurial opportunities (Spigel & Harrison, 2018).

EE field has significantly grown as evidenced by the prevalence of the manuscripts published in several distinguished academic journals (Acs et al., 2017; Motoyama & Knowlton, 2016; Pugh et al., 2021) and the relevant increase recorded over the last seven years (Mack & Mayer, 2016; Roundy, 2017a; Spigel & Harrison, 2018; Stam, 2015).

Moreover, there were manifold attempts to provide an exhaustive definition and limit its boundaries.

Since the '90s, the topic developed, but only after 2015 a great interest occurred (Stam, 2015). EE approach was seen as a framework that could accommodate the transition from entrepreneurship policy towards policy for an entrepreneurial economy. Stam's contribution offers a meticulous and pertinent starting point for subsequent studies into EEs and regional policy implications. His research work provides a causal scheme of systemic conditions in an EE leading to specific entrepreneurial activities. In 2017, the relationship between regional development and strategic management literature emerges (Acs et al., 2017).

Thanks to the previous studies that laid the foundations for developing this research stream, EE was also explored by the theoretical construct concerning the dynamic capabilities, in 2019 (Roundy & Fayard, 2019). The rationale resides in the fact that in vibrant EEs entrepreneurs are more able to sense, seize and reconfigure respectively opportunities and resources. Figure 1.2. shows an increasing trend that reached its peak, in 2021. However, the opportunity to further advance the current body of knowledge still exists by using different theoretical and methodological approaches (see Table 1.3.).

Table 1.3. Main topics discussed and future research avenues

Topics	Research gaps	Suggested methodology
	RED CLUSTER	
Expanding the quantitative studies set	• How can we overcome the problem of the difficulty of collecting quantitative data on the EEs functioning at regional level? • What is the variance between large and small business ecosystems in resource levels?	Quantitative method
Understanding EE evolution and performance over time in a comparative context	• Why do some territories fail to evolve and remain trapped in a specific stage of the evolutionary process? • What are the institutional factors that could help explain the differences between different ecosystems?	Multiple case study
The EE components and their role in the different stages of economic development	• What are the dominant lines of action required to promote entrepreneurship at every stage of economic development? And how can EEs be developed to foster the creation and development of high-potential firms? • How can the different elements of the ecosystem promote, connectivity between entrepreneurs? • How do EEs develop and what kinds of events or conditions can limit their growth? What good practices can be transferred from one place to another?	Qualitative method

Examining ecosystems holistically	• What are the processes that encourage high-quality businesses creation and give these businesses a kind of competitive advantage that helps them to grow and prosper?	Conceptual paper
Implementing models to assess economic, social, and environmental impacts measuring, the performance of a region	• How can we measure the performance of the Lopes & Franco model in order to compare it between different regions?	Quantitative method
GREEN CLUSTER		
Implementing studies using Econometrics (statistical analyses such as bivariate analysis)	• What is the relationship between lifestyle motivations and management practices that improve sustainable business ecosystems?	Quantitative method
Bridging activities to acquire critical resources impact in the early stage in the EEs lifecycle	• Are there specific bridging or buffer activities that are better geared towards short-term critical resources than other activities that are better suited to acquiring the resources for long-term EE development?	Conceptual paper
BLUE CLUSTER		
Conducting new studies by combining quantitative and qualitative research	• What is the relationship between incubation practices and the success of European start-ups?	Quantitative method
The EEs contributions at university and incubator level	• What are the interactions with regional development entities to coordinate incubators engaged in academic entrepreneurship? • Given the variability of the university business incubator service offerings over time, what is the relationship between life cycle phases and temporal influences?	Multiple case-study Quantitative method
Social entrepreneurial ecosystem strategies	• Where might social entrepreneurship be most needed? What are the main actors' strategies in the social entrepreneurship ecosystem to address structural and social changes that could have the most influence?	Qualitative method

We explored the epistemological structure of EE and regional development research by using the bibliographic coupling method. A mixed research methodology allows to observe the research field from a holistic point of view. In so doing, we outlined the theoretical and methodological evolution of research, in the last 26 years. The results contribute to the academic debate on extant EE and regional development literatures by spotting the contributions of the most influential scholars. Three major clusters emerge from our findings (see Table 1.4.), which encapsulate the main theoretical and practical implications of this study. From a conceptual standpoint, the results shed light on the building blocks that underpin an EE which is oriented towards socio-economic development.

Table 2.4. An overview of the findings

Cluster colours	Main topics	Key contents	Key references
Red	The role of policy makers within EEs	Policy makers have the duty in fostering EEs. They should reconfigure their supporting interventions when the external environment changes, due to the fact EEs have evolutionary characteristics.	Leendertse, J. 2022; Cunha et al., 2020; Szerb et al., 2019; Roundy & Fayard, 2019
Green	The EEs in a perspective of innovation and evolution in the regional context	Understanding the EE evolution over time is considerable to apply appropriate organisational planning and policies, paying attention to the changing complexity of the components. In this evolutionary framework, innovation plays a key role. It is understood both from the point of view of the firms' performance, and from the perspective of the innovative capabilities possessed by human capital to generate knowledge transfer.	Spigel & Harrison, 2018; Mack & Mayer, 2016; Mcadam 2019; Stam, 2015.
Blue	The role of university in promoting entrepreneurship culture within EEs	The antecedents and determinants for regional development can be found within the different EE domains. Universities within EEs are intended as cultural development actors as business incubators. University spin-off firms contribute to the entrepreneurship education ecosystem creation, in order to implement industry and government partnership. Therefore, university business incubators are an integral part of sustainable regional and economic development and play an important role at social level.	Acs et al., 2017; Wagner et al., 2021; Nicholls-Nixon et al., 2021; Hayter et al., 2018

The bibliometric analysis enables to figure out the structure of the research field, the most influential publications, and the development of the research clusters. A critical examination was necessary to elicit a consequent research agenda.

The three clusters point out some management theories (see Appendix A - Table A1). Therefore, although such theoretical richness, there are still several opportunities to deepen unexplored niches and broaden the theoretical and empirical evidence.

Building on the future research avenues uncovered by our findings, EE and regional development might be looked into along these crucial scopes:

1) the role of EE components in different stages of the economic development (Yamamura & Lassalle, 2020);
2) the performance measurement between an EE and a comparable geographical context (Roundy, 2017a);
3) the pillars of social strategies in an EE (Villegas-Mateos & Vázquez-Maguirre, 2020);
4) the focus on the support given by universities and incubators over the regional development.

1.6.1. Theoretical and practical implications

Our study marks out intriguing implications in regional policy issues. Firstly, scholars and policymakers should become more sensitive to the macro context of entrepreneurship. Primarily, governments play should shape institutional processes of a high-quality level, thereby fostering an environment of transparency, and designing tailored support mechanisms aimed explicitly at nurturing and catalyzing growth initiatives (Leendertse et al., 2022). Therefore, a deeper analysis of the local context is needed on how cultural, social, political, and economic structures and processes influence all features of EE.

Besides, EE has prominent implications for entrepreneurs which should make strategic choices concerning the kinds of resource endowments, and the key partners to be engaged in the accomplishment of self-interest and collective goals. For instance, entrepreneurs should acknowledge the potential drivers of their own territory: they should go beyond regional boundaries and increase their businesses through innovative firms extending their influence on other regional ecosystems.

1.7. Conclusions

The present study might contribute to EEs research field by answering the call for Cavallo et al. (2019) and adding knowledge on regional/territorial development. The limitations inferable by Cavallo et al. (2019) are overcome, because their literature review relied on a selected sample of pertinent papers addressing EE research, rather than being a comprehensive or systematic procedure. In more detail, their paper collection was partly influenced by the research team's subjectivity over the relevance or not of a work with respect to EEs. Therefore, other studies potentially relevant might have been neglected during the selection process. *Vice versa*, focusing our literature review on the more inclusive Scopus database, we tried to reduce this shortcoming. To the best of our knowledge, our study represents a first attempt to sum up the main antecedents at the regional level. From the bibliometric analysis, we identified three well-polarised clusters and found that the bulk of the research currently conducted on EEs was focused on specific topics, such as the policymaker's role in fostering high-quality institutional process to increase the amount of firms within EE in the regional context; dynamic capabilities' development to support EE; the crucial role of universities in an EE to promote and

disseminate entrepreneurial culture (Schaeffer & Matt, 2016). Our empirical evidence suggests some novel research avenues to move the body of knowledge on EEs and regional development forward. For instance, they pave the way to steer the changes in the development policies based on the inception of innovative start-ups (Cavallo et al., 2021), with the aim to revitalize a geographical area. The main limitations of the present study are tied to the nature of the bibliometric analysis and the use of a single database, which naturally leans to simplify the structure and properties of a research field. To this end, we carried out a systematic literature review of the papers in each cluster, that allowed us to understand the content and methodological interconnections among papers and research streams. Indeed, our paper - based on a review of 118 documents - cannot encompass the complexity of the results depicted in each paper. Despite the adoption of a rigorous methodological approach, our review covers just academic articles literature reviews, and book chapters in order to include only high-quality references submitted to a double-blind peer-review process and, as a consequence, to keep out conference papers and working papers. Therefore, future research avenues might advance our quantitative study by including the earlier kinds of documentary sources.

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Chapter 2. Evaluating Performance Indicators within Regional Entrepreneurial Ecosystems[3]

Abstract

Despite the growing interest on Entrepreneurial Ecosystems, a few studies developed a comprehensive metric to examine the contextual factors of entrepreneurship. Our research emphasises the relevance of a systemic approach to investigate the entrepreneurial landscape. We aim to craft a measure for assessing the performance of Entrepreneurial Ecosystems (EEs) at a regional scale, namely at the NUTS-2 hierarchical level. To this end, a composite EE index comprising twenty-one indicators was developed to capture the multifaceted nature of an EE. The robustness of the index was analysed using various weighting, normalisation, and aggregation techniques, including Confirmatory Factor Analysis. The data collection encompasses the Italian regions during the period from 2009 to 2019. The EE index reveals considerable variability across the regions and exhibits a high level of persistence over time within each of them. Our examination highlighted the key differences within the Italian landscape. As a result, the conditions of the composite index, such as the framework, systemic, and human factors, should be meticulously fine-tuned. The findings feed substantial implications for regional policymakers, scholars, and entrepreneurs operating in certain contexts.

Keywords: Entrepreneurial Ecosystems · Regional performance · Confirmatory Factor Analysis (CFA) · Composite index · Regional policy

[3] Please note that this paper was developed in collaboration with other co-authors, to whom I extend my sincere gratitude: Prof. Esin Yoruk, Prof. Alessandro Cirillo, and Prof. Antonio Corvino. I am deeply thankful for their valuable contributions. However, all the errors within the chapter are my own responsibility.

2.1. Introduction

Entrepreneurship is a multifaceted topic that draws the attention of various stakeholders within a specific context (Shane & Venkataraman, 2000). Scholars, for instance, delve into entrepreneurship domain to provide insights that can shape the strategic decisions of practitioners and drive the interventions of policymakers. Entrepreneurs are deeply engaged in identifying, evaluating, and exploiting opportunities to introduce new products, services, organisational methods, and processes, to address unmet market needs (Venkataraman, 1997). Therefore, the essence of entrepreneurial activity lies in discovering and leveraging business opportunities through timely analysis of the context and prevailing conditions, along with an understanding of how different actors influence the process of new business creation (Shane & Venkataraman, 2000).

The surrounding environment, involving its actors and influencing factors, is critical in shaping the trajectory of entrepreneurship over time (Nelson, 1993). In this regard, the development of supportive Entrepreneurial Ecosystems (henceforth EEs) is recognised as a key enabler. EEs nurture and facilitate business activities by providing a conducive environment that stimulates the establishment and growth of new firms (Spigel & Harrison, 2018). These insights underscore the earnest significance of context in entrepreneurship. It is not merely about identifying opportunities but also understanding the complex ties of influences within EEs that determine how opportunities are realised.

The EE has emerged as a framework for typifying and discerning the attributes of regions fostering entrepreneurial activity and innovation (Spigel, 2017). Although various measures of the EE index exist (Iacobucci & Perugini, 2020, 2021; Stam & van de Ven, 2021), there is currently no study that integrates the variables from the most proposed indexes to compute a comprehensive EE composite index. Consequently, the first research gap identified within the existing literature is the absence of consensus regarding the principal antecedents and determinants of EEs. This shortcoming of standardisation could result in considerable confusion when evaluating the performance of EEs. This issue may partly stem from the diverse definitions of EEs, the varying scales at which they are studied, the different research methodologies employed, and the range of data sources used. The second research gap refers to the analysis carried out in the Italian context by previous scholars. Although the study by Iacobucci & Perugini (2021) provides a significant foundation for understanding EEs in Italy, the current analysis seeks to build upon their work. Therefore, our purpose is to refine the existing composite EE index, which comprises 14 indicators, by incorporating

further variables that better represent the intricacies of a region characterised by notable disparities.

Moreover, we answer Perugini's (2023) call for a deeper investigation, emphasising the need to delve into the interactions among EE components and to use longitudinal data for a more robust empirical analysis. Consequently, we formulated the following research questions:

1) *"How can the key variables from the most widely proposed EE indexes be integrated to create a comprehensive EE composite index?"*
2) *"To what extent are the different elements of EEs interdependent within the Italian context?"*

In addressing these questions, a composite EE index comprising twenty-one indicators has been developed to capture the multifaceted nature of an EE and evaluate its performance. The dataset covers Italian regions over the period from 2009 to 2019. Hence, this study aims to consolidate existing research and craft an analytical framework delineating the determinants and impacts of an EE.

Our research contributes to the fields of EEs and regional performance both conceptually and empirically. Firstly, we provide insights into the selection of EE elements and the evaluation of the regional EEs' performance. Secondly, our empirical evidence ensues from the application of the EE index across twenty Italian regions. Lastly, we suggest the applicability of such measurement methodology in various geographic contexts.

The paper is structured as follows: Section 2 delves into the theoretical background. Section 3 proposes an integrated framework of EE elements. Section 4 depicts the methodological approach, describing the sample, and the selection variables included in the measurement of EE composite index. Section 5 shows the results of the quantitative analysis. Finally, Section 6 highlights the empirical evidence, concluding remarks, as well as outlines the limitations and future research avenues.

2.2. Theoretical Background

The concept of EE emerged from a fierce academic debate during the 1980s and 1990s (Aldrich, 1990). Notably, there was an increasing perception that solely focusing on the attributes of a founder, or the startup team was inadequate to fully understand entrepreneurship process. As emphasised by van de Ven (1993), individual entrepreneurs do not hold all essential resources (e.g., institutions, markets, networks, knowledge, etc.) to support their entrepreneurial ventures. Therefore, entrepreneurship arises as a collective

outcome which is not merely the result of individual entrepreneurs' actions, but it also depends on pivotal contributions from a multitude of stakeholders across both the public and private sectors. This perspective has been enriched by several empirical studies demonstrating the great influence of socio-cultural, political, and economic dynamics on business creation process (De Clercq et al., 2003; Fritsch et al., 2019; Vaillant & Lafuente, 2007). Indeed, many studies investigated the «entrepreneurial infrastructure», underscoring the meaningful impact of regional economic and social factors on entrepreneurial process (Dubini, 1989; Gnyawali & Fogel, 1994; Pennings, 1982; van de Ven, 1993). Building on previous research that shifted the focus from considering the individual entrepreneur as the exclusive driving force of value creation, current perspectives underline the need to understand entrepreneurship within a broader context. This includes taking into account the temporal, cultural, spatial, social, organisational, and market facets of the entrepreneurial setting (Malecki, 2018; Zahra, 2007; Zahra et al., 2014).

Although intriguing, the EE concept presents certain challenges. The rapid adoption of EE across diverse contexts has advanced faster than the resolution of key conceptual, theoretical, and empirical issues. At first glance, the EE construct appears somewhat tautological (Stam & van de Ven, 2021). Indeed, thriving entrepreneurship is often ascribed to effective EEs, while areas with successful entrepreneurship ventures are considered evidence of robust EEs. Such «drop-down» reasoning offers tiny insights for researchers, practitioners, and policymakers. Moreover, the prevailing approach tends to list relevant factors without elucidating their causal relationships or tying them to place-based histories. Finally, no universally established model can be applied consistently across different global regions.

In light of the earlier considerations, the academic debate on EEs is still ongoing. A burgeoning corpus of empirical research highlights how a lively EE can foster entrepreneurship and contribute to the creation of aggregate value at the regional level (Audretsch & Belitski, 2021; Autio et al., 2014; Capello, 2019). For instance, Mack & Mayer (2016) explore how the early entrepreneurial achievements in Phoenix (Arizona) led to a consistently robust EE marked by prominent success stories, a dynamic entrepreneurial culture, and encouraging public policies. Similarly, Audretsch & Belitski (2021) investigated EEs in European regions and empathised the EEs role in moderating the relationship between the variety of entrepreneurial activities (i.e., self-employment, job creators, and new-firm birth rates) (Bögenhold, 2019; Parker, 2009; Stam & van Stel, 2011) and regional

economic development. They found that regional economic development might differ widely due to the variety of entrepreneurship. These findings underscore the deep interplay between entrepreneurship and its surrounding environment. However, it remains necessary to conduct in-depth analyses upon the intricacies of EEs to understand their underpinnings and the consequent implications for both practice and policy.

Nowadays, the EE topic has been extensively investigated by many scholars (Acs et al., 2017; Spigel, 2017; Stam, 2015), yielding a spectrum of definitions that, despite their differences, often share common conceptual ground. On one hand, EEs are perceived as a dynamic interplay of different actors, institutions, and contextual factors that collectively influence entrepreneurial activities within a specific region (Isenberg, 2011). On the other hand, Mason & Brown (2014) emphasise the evolving nature of EEs and their capacity to adapt over time to meet the changing demands of entrepreneurs. While there is not an established definition of EEs, a particularly influential depiction stems from Stam (2015), who defines them as *"(…) a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship"*. This concept inherently revolves around the entrepreneurship process, which covers a combination of different players and factors deeply embedded within a specific context. They interact to identify, assess, and exploit opportunities to create new goods and services (Schumpeter, 1934; Shane & Venkataraman, 2000).

Significant uncertainty persists regarding the optimal geographic scale for analysing an EE over time (Malecki, 2018). The examination could focus on a city, a region, or a country. Still, it might also encompass less geographically confined systems, such as specific industries or technologies that facilitate new business creation and contribute to regional growth. According to Stam & van de Ven (2021), for most EE elements, it seems possible to delineate them at a sub-national (i.e., regional) level. However, the transition from the regional to international scale could be nurtured by networking capabilities, especially through high-growth firms and entrepreneurial employees in established companies (Malecki, 2011). In so doing, it could be possible to trigger knowledge spillovers across different scales by transcending geographical boundaries (Acs et al., 2009; Qian, 2018).

Despite some scholars (Iacobucci & Perugini, 2021; Stam, 2015; Stam & van de Ven, 2021) attempted to define the core conditions of an EE, a universally accepted framework is still lacking. The categorisation of EE elements into the framework, systemic, and human conditions, remains an open issue. Some studies encompass human capital as part of the framework conditions (Stam, 2015; Stam & van de Ven, 2021), whereas other scholars deem

human conditions as distinct from both framework and systemic conditions (Audretsch & Belitski, 2017; Iacobucci & Perugini, 2021). Still, some place human capital within the realm of systemic conditions (Torres & Godinho, 2022), while others exclusively consider human capital in the human dimension (Leendertse et al., 2022; Xie et al., 2021). Building on the valuable insights provided by the World Economic Forum (2013), we take cues from prior research that treats human conditions as distinct, such as the work by Iacobucci & Perugini (2021). Nonetheless, current models do not adequately capture the several nuances to holistically define the combined conditions of EEs.

2.3. Mapping the EE elements

As previously mentioned, the notion of EE comprises the essential elements that sustain entrepreneurial activity within a specific territory. Van de Ven (1993) was among the pioneers to outline four key components of EE, namely the «entrepreneurial infrastructure». These elements embraced: 1) regulatory and institutional frameworks that can either promote or hinder entrepreneurship; 2) access to scientific knowledge, financial resources, and a skilled workforce; 3) market demand characterised by consumers informed about the new products and services; and 4) the entrepreneurial endeavours themselves, encompassing R&D, manufacturing, marketing, and distribution.

Subsequent studies have refined and broadened the components of the EE (Woolley, 2017). Feld (2020), for instance, underscores the dynamic interactions among actors in the EE – portrayed by networking between established companies and local startups. He also highlights the relevance of access to key resources, such as talent, business services, capital, and supportive government policies.

While various conceptualisations of EEs exist (Isenberg, 2010; Van de Ven, 1993), this analysis essentially ensues from the frameworks proposed by Stam (2015) and Iacobucci & Perugini (2021). Stam (2015) suggested an integrative model of EEs comprising ten elements, along with various entrepreneurship outputs. Conversely, Iacobucci & Perugini (2021) included twelve elements.

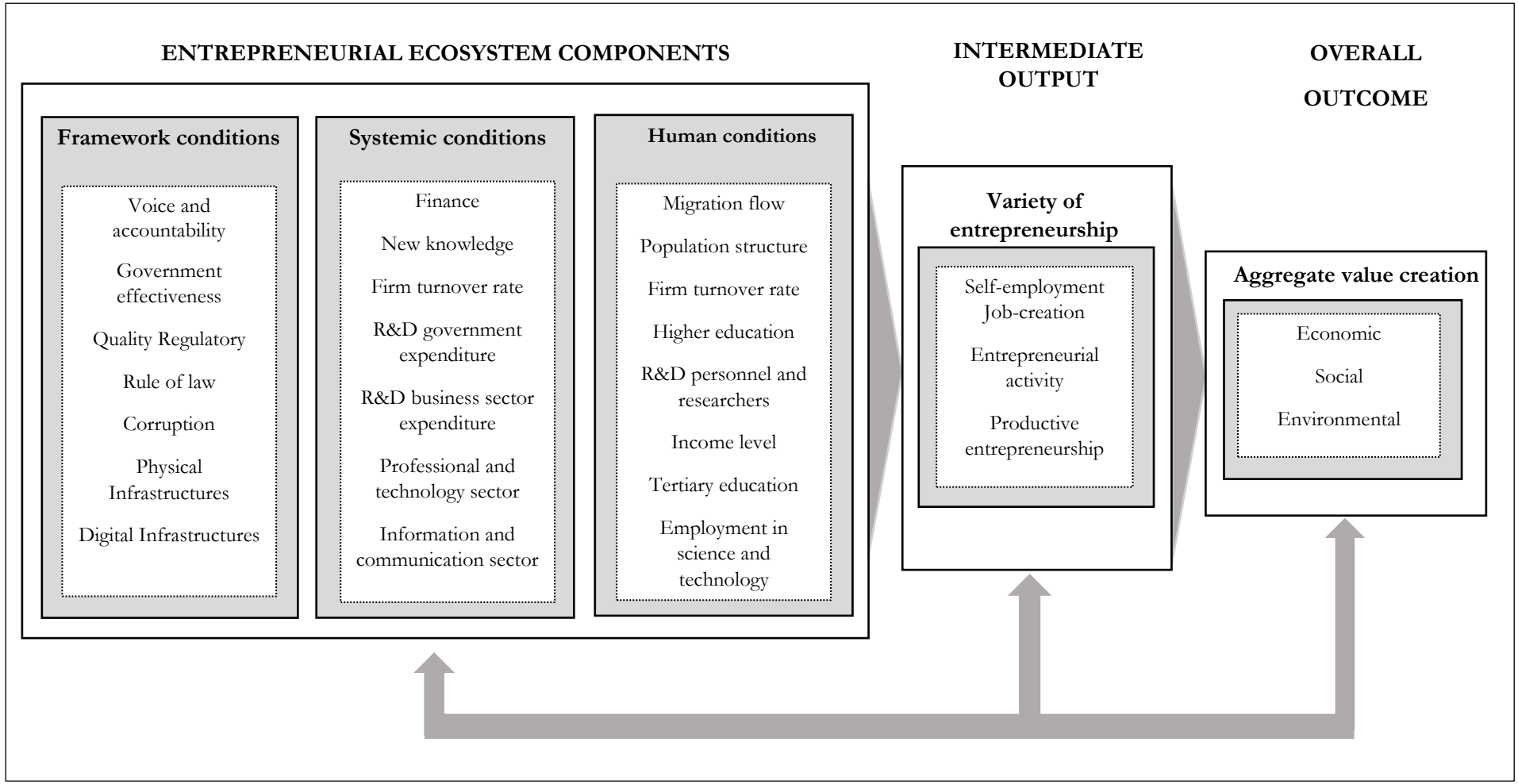
Building on prior academic research, a comprehensive EE model consisting of twenty-one elements is put forward. The latter is structured across five interrelated layers: *Framework conditions*, *Systemic conditions*, *Human conditions*, *Intermediate outputs*, and *Outcomes*. The interactions between the different tiers are conveyed through a complex of causal relationships that flow upward and downward. From the bottom up (upward causal relationship), the creation of

aggregate value is prompted by EE elements and the variety of entrepreneurial endeavours (see Figure 2.1.). Analysing the model in reverse, from outcomes to inputs, reveals that the socio-economic results feed back into the EE, stimulating its recalibration or reconversion. In this way, the individual and combined elements of EE significantly influence both the entrepreneurial activities and the overarching economic fabric. Specifically, the underlying socio-economic conditions exert a great influence on the evolution of the EE's components. Accordingly, EE is enduringly shaped by an iterative process of feedback and interactions that foster entrepreneurship within a particular territory through the creation of new value.

To gain a deeper understanding, the *intermediate output* assesses the EE's «health», namely its effectiveness in catalysing entrepreneurship (Stam & van de Ven, 2021). Although specific measures for entrepreneurship are not universally established, the existing academic debate recognised a variety of conceptual frameworks (Stam, 2015). For instance, «productive entrepreneurship» builds on the notion of ambitious entrepreneurship (Stam et al., 2011), denoting high-quality entrepreneurial initiatives (Baumol, 1996; Guzman & Stern, 2016). Furthermore, «entrepreneurial activity» is associated with the creation of new firms in a specific territory. Phenomena such as self-employment (Fotopoulos & Storey, 2017) and job-creating entrepreneurship are also considered relevant proxies to evaluate the quality of the system (Dvouletý, 2019).

Conversely, the *overall outcome* measures the wider socio-economic influence of EE on community. Metrics such as Gross Value Added (GVA) or Gross Domestic Product (GDP) serve as proxies for regional economic development, reflecting regional performance (Audretsch & Belitski, 2021). Other indicators, such as employment and population growth rates, alongside income levels, are employed to compute regional productivity (Fritsch & Mueller, 2008; Glaeser et al., 2010; van Stel et al., 2004). These measures extend beyond mere economic performance, capturing also social outcomes. For instance, increased employment growth could lead to a reduction in poverty and an improvement in living standards, while GDP growth often correlates with enhanced public services and infrastructure (Iimi, 2005). Therefore, these indicators are impactful on multiple levels, influencing both the social and economic fabric of a region.

Figure 2.1. Domains, output, and outcome of an EE



Source: Authors' elaboration from Stam's (2015), Iacobucci & Perugini's (2021) and Audretsch & Belitski's (2021) frameworks

2.4. Data and methodology

2.4.1. Entrepreneurial Ecosystem components

To clarify the proposed model (Figure 2.1.), Table 2.1. details the twenty-one elements to craft the EE index.

Table 2.1. The elements of EE index

EE Conditions	EE elements	Element Definition	Data Source	Year	Related literature
FRAMEWORK CONDITIONS	1. Voice and accountability index	Index reflecting the degree of citizen participation in public elections, engagement in civic and social associations, the number of social cooperatives, performance on INVALSI tests, and cultural vibrancy as measured by the number of books published	Italian of Society and Industrial Economics Policy (SIEPI)	2009-2019	Abegaz et al., 2023; Mikic et al., 2021; Stam, 2018
	2. Government effectiveness index	Index measuring the availability of economic and social structures in Italian regions, along with the effectiveness of regional governments in implementing policies, such as waste management, and environmental protection	Italian of Society and Industrial Economics Policy (SIEPI)	2009-2019	Mikic et al., 2021; Stam & van De Ven, 2021; Wei, 2022
	3. Regulatory quality index	Index refers to the economy's openness, the firms' mortality rate, and business density	Italian of Society and Industrial Economics Policy (SIEPI)	2009-2019	Dwumfour & Ntow-Gyamfi, 2018; Lu et al., 2014; Zhang et al., 2023
	4. Rule of law index	Index comprising data on crimes against individuals or property, magistrate productivity, trial times, tax evasion and the shadow economy	Italian of Society and Industrial Economics Policy (SIEPI)	2009-2019	Audretsch et al., 2023; Dwumfour & Ntow-Gyamfi, 2018; Estrin et al., 2013
	5. Corruption index	Index of crimes against the Public Administration, as well as the frequency of local governments being overruled by federal authorities, and the Golden-Picci Index	Italian of Society and Industrial Economics Policy (SIEPI)	2009-2019	Iacobucci & Perugini, 2021; Leendertse et al., 2022; Zhang et al., 2023
	6. Digital infrastructures	Percentage of households with Internet access at home	Eurostat	2009-2019	Elia et al., 2020; Sussan & Acs, 2017; Zhang et al., 2023
	7. Physical infrastructures	Motorway and railway potential accessibility index	Messina (2007)	2007	Audretsch & Belitski, 2017; Audretsch et al., 2015; Theodoraki & Messeghem, 2017
SYSTEMIC CONDITIONS	8. Finance	The share of loans issued to households and firms relative to the Value Added	Bank of Italy and Istat	2009-2019	Frimanslund et al., 2023; Iacobucci & Perugini, 2021; Stam, 2015
	9. New knowledge	Share of research institutions and experimental stations for research (expressed as a percentage)	Istat	2009-2019	Carayannis et al., 2016; Cherubini Alves et al., 2021; Dubina et al., 2017
	10. Turnover rate (birth rate-exit rate of firms)	Net turnover rate of firms (expressed as a percentage)	Istat	2009-2019	Fritsch, 1996; Mason & Brown, 2014; Johansson, 2005
	11. Government expenditure on R&D	Share of R&D expenditure in GDP (GERD)	Eurostat	2009-2019	Chen & Hung, 2016; Griffiths et al., 2009; Švarc et

					al., 2020
	12. Business sector expenditure on R&D	R&D expenditure per capita (BERD)	Eurostat	2009-2019	Coad & Vezzani, 2019; Raghupathi & Raghupathi, 2019; Švarc et al., 2020
	13. Professional and technology sector	Share of professional, scientific and technical activities; administrative and support service activities (percentage in total active enterprises)	Eurostat	2009-2019	Fernández Fernández et al., 2015; Iacobucci & Perugini, 2021; Stam & van De Ven, 2021
	14. Information and communication sector	Share of information and communication firms (percentage in total active enterprises)	Eurostat	2009-2019	Song, 2017; Sussan & Acs, 2017
HUMAN CONDITIONS	15. Migration flow	Difference population between immigrants and emigrants over resident population (expressed as a percentage)	Istat	2009-2019	Iacobucci & Perugini, 2021; Perugini, 2023, Schmutzler et al., 2021
	16. Population structure	Share of the population in the 24 to 39 years old age group	Istat	2009-2019	Curci & Micozzi, 2017; Iacobucci & Perugini, 2021; Shane, 1996
	17. Higher education	Percentage of higher educated in the adult population (from 25 to 64 years old age)	Istat	2009-2019	Annoni et al., 2019; Audretsch & Belitski, 2021; Sarrico, 2022
	18. R&D personnel and researchers	People employed in R&D over the total population (percentage)	Eurostat	2009-2019	Auerswald & Dani, 2017; Buerger et al., 2012; Kim et al., 2017
	19. Income level	Household income level per capita	Eurostat	2009-2019	Agiropoulos et al., 2021; Kantis et al., 2020; Neumeyer & Santos, 2018
	20. Tertiary education	People with tertiary education over the total population	Eurostat	2009-2019	Kantis et al., 2020; Leendertse et al., 2022; Lehmann et al., 2020
	21. Employment in science and technology	People employed in science and technology over the total population (percentage)	Eurostat	2009-2019	Annoni et al., 2019; Audretsch & Belitski, 2021; Cohen, 2006

Source: Our elaboration based on Iacobucci & Perugini (2021)

Framework conditions

Framework conditions outline the institutional context and consist of seven indicators. In line with previous literature (e.g., Iacobucci & Perugini, 2021; Stam & van de Ven, 2021), they are divided into two main constructs:

- *Formal institutions* (i.e., Voice and accountability index; Government effectiveness index; Regulatory quality index; Rule of law index; Corruption index), define the regulatory framework within a country (North, 1990). They shape entrepreneurial activities by affecting social and economic well-being (Baumol, 1996), such as by minimising corruption, ensuring administrative quality, and streamlining bureaucratic procedures. Institutions provide the ground for entrepreneurial activity (Granovetter, 1992), and guarantee the efficient utilisation of resources. The indicators chosen for

our analysis stem from the Institutional Quality Index (IQI[4]), which assesses institutional effectiveness (Nifo & Vecchione, 2014).

- *Infrastructures* (i.e., Physical Infrastructure and Digital Infrastructures) are critical aspects that enable economic interactions and entrepreneurial activities (Audretsch et al., 2015; Sussan & Acs, 2017). Physical infrastructure is evaluated through a composite index including indicators for motorway and railway accessibility (Messina, 2007). Motorway accessibility is measured by taking into account the regional population and adjusting it based on travel times by car; similarly, railway accessibility is determined by considering the regional population and adjusting it on the basis of travel times by train. Digital infrastructure serves as a «digital motorway», interconnecting various systems and networks at global, national, regional, industrial, and corporate levels. It is a dynamic element of EE including technological and human aspects, networks, and processes, fostering self-reinforcing feedback loops (Sussan & Acs, 2017).

Systemic conditions

Systemic conditions refer to resource endowments that define a particular context and comprise:

- *Financial resources* are pivotal for the growth and survival of both emerging and established firms (Parker, 2004). Indeed, an effective financial market is crucial to provide funds to new entrepreneurial ventures. In our analysis, the data concerning the volume of loans given to households and firms is expressed as a percentage of Value Added (Frimanslund et al., 2023; Iacobucci & Perugini, 2021; Stam, 2015).
- *New knowledge* represents a crucial driver of entrepreneurial opportunities (Mason & Brown, 2014), emerging through various routes, such as R&D investments, patents, and innovation projects, etc. (Stam & van de Ven, 2021). The metric for new knowledge employed in our study reflects the proportion of research institutions and experimental research stations, expressed as a percentage of all institutional entities (Carayannis et al., 2016; Cherubini Alves et al., 2021; Dubina et al., 2017). This

[4] The IQI draws on the World Governance Indicator (WGI) model (Kaufmann et al., 2011). This composite index is built by combining various elementary indexes that refer to five distinct aspects of the institutional framework. For more details on the IQI, resources are available at https://sites.google.com/site/institutionalqualityindex/home.

measure captures a wider range of resource endowments beyond merely R&D investment. For this analysis, the latter is considered by dividing into government (i.e., GERD) and business (i.e., BERD) expenditure.

- *Turnover rate of firms,* representing the sum of firm birth and exit rates as a percentage within a specific territory (Johansson, 2005), could indicate the pace at which new business opportunities are identified, potentially fostering regional development.
- *Government expenditure in R&D (GERD)* is crucial for spurring economic growth in both developed and emerging nations. As a percentage of GDP, GERD reflects the commitment to enhancing technological innovation and R&D, key priorities in governmental strategies globally (Chen & Hung, 2016; Griffiths et al., 2009; Švarc et al., 2020).
- *Business sector expenditure in R&D (BERD)* is a significant indicator regarding firm's engagement to innovation. Prioritising R&D expenditure demonstrates a commitment to implementing and applying new ideas, culminating in innovative products and services. BERD is measured as the amount spent on R&D per capita (Coad & Vezzani, 2019; Raghupathi & Raghupathi, 2019; Švarc et al., 2020).
- *Professional and technology sector* offers critical support that helps overcome entry barriers for new ventures and facilitates the execution of startup business strategies. It is quantified by the proportion of business service firms (classified as sectors M-N in Nace Rev. 1.1) in relation to the total number of active enterprises (Fernández Fernández et al., 2015; Iacobucci & Perugini, 2021; Stam & van De Ven, 2021).
- *Information and communication sector* acts as a catalyst for entrepreneurial activity. It underpins the digital transformation of businesses and enables the expansion and scalability of both startups and established firms. This sector is measured by the proportion of information and communication companies compared with the total number of active enterprises.

Human conditions

Human conditions refer to the human capital features that affect EE and include seven indicators:

- *Migration flow flows* exert significant impacts on regional EEs, enhancing both human and social capital (Harima et al., 2021; Schmutzler et al., 2021). The concept of mixed embeddedness, which encompasses transnational and local dimensions (Bagwell,

2015; Kloosterman & Rath, 2001), endows migrants with extensive access to networks. It is measured by the net migration rate, which is the difference between the number of immigrants and the amount of emigrants, divided by the resident population (Iacobucci & Perugini, 2021).

- *Population structure* is a key driver of a vibrant EE, since young people often exhibit a stronger inclination towards entrepreneurship compared to their older counterparts (Minola et al., 2014). Due to the lack of direct access to specific data on the ages of entrepreneurs, and consistently with prior literature (Iacobucci & Perugini, 2021), the share of the young population – those aged 24 to 39 – against the total population is adopted as a proxy for the prevalence of an entrepreneurial culture at the regional level.
- *Higher education* acts as a pivotal catalyst for regional development (Barro, 1991). The presence of a substantial proportion of highly educated individuals within the adult population, aged 25 to 64, induces knowledge spillover effects that benefit neighbouring regions (Annoni et al., 2019).
- *R&D personnel and researchers* are crucial in advancing new knowledge, as demonstrated by the rise in patent registrations. Innovations in firms heavily rely on the creativity of these individuals, positioning them as vital contributors to the knowledge creation process (Henderson, 1997). This proxy ensues from by the proportion of the population employed in R&D compared to the total population (Shefer & Frenkel, 2005).
- *Income level* significantly influence the development of human entrepreneurial capital by facilitating access to educational opportunities and the accumulation of personal savings, which are primary sources of financing for new business ventures (Edmiston, 2008). This indicator is measured by per capita household income (Agiropoulos et al., 2021).
- *Tertiary education*, offered by universities and other tertiary education institutions, plays a crucial role in developing leaders, skilled workers, and informed citizens. The role of universities is increasingly recognised by governments, academics, and policymakers, acting as pivotal drivers of economic growth and societal wealth creation (Dennis, 2011; OECD, 2009; O'Neal & Schoen, 2013). This metric is computed as the percentage of the population with tertiary education qualifications (Leendertse et al., 2022).

- *Employment in science and technology* is a key indicator of regional capital (Mikić et al., 2021), as it drives technological advancements (Berdek & Jones, 1990). The workforce in this sector enhances EE by introducing innovative solutions, boosting industry competitiveness, and providing the skilled human resources necessary for supporting new ventures and attracting investments. Their presence fuels R&D activities, leading to the development of advanced products and services. This metric is represented as the percentage of the population employed in science and technology sectors relative to the total population (Audretsch et al., 2021).

2.4.2. Research setting

The variables chosen inherently come from the foregoing regional landscape. In particular, the focus is on the twenty Italian regions, in accordance with the prevailing geographic research in this field (Boffardi, 2022; Guccio et al., 2019). Specifically, we draw upon the European Union classification where the regional scale is denoted as the NUTS-2 hierarchical level[5].

The choice of Italy as the context for exploring regional EEs ensues from by several compelling factors. Firstly, Italy presents a landscape characterised by distinct economic, cultural, and institutional divergences across its northern, central, and southern regions. This heterogeneity provides a fertile ground for investigating the array of influences that shape EEs, exhibiting a unique mix of traditional industries and innovative sectors (Quatraro, 2010). Secondly, the Italian economy has experienced a series of important transformations, ranging from industrial revolutions (Amatori & Colli, 2013; Bottazzi et al., 2007) to European Union integration (Guiso et al., 2004), evolving into a knowledge-intensive economy (Bonaccorsi et al., 2014; Di Giacinto et al., 2020). Analysing EEs within such a dynamic setting offers critical insights to navigate evolving environments (Brown & Mason, 2017). Thirdly, Italy's rich history of entrepreneurship and business development, especially with respect to SMEs and industrial districts (Becattini, 1979, 1989), provides a historical dimension to the analysis of EE. Fourthly, an examination of EEs across Italian regions offers a comparative lens, highlighting how varying regional conditions influence the success or failure of entrepreneurial efforts. At last, the insights gleaned from the Italian context may

[5] For more details, refer to: https://ec.europa.eu/eurostat/web/nuts/background.

be applied to other EU nations or regions with similar socio-economic frameworks, thereby enhancing the relevance of the study beyond Italy's boundaries.

Our analysis focused on the period from 2009 to 2019. This choice aimed at uncovering the factors contributing to the decline in entrepreneurial activity[6]. Furthermore, by starting the observation period in 2009, the study intentionally avoids the distortive impact of the 2008 financial crisis. Thereby, it ensures that the data reflect the dynamics of post-crisis recovery, rather than the turbulence of the past period. Similarly, by ending the analysis in 2019, it excludes the unprecedented disruptions caused by the pandemic crisis of 2020 (Giones et al., 2020), which could misinterpret the understanding of long-term entrepreneurial trends.

Data were meticulously gathered from various sources, including Eurostat, OECD, and Italian national databases (e.g., Istat, Bank of Italy, Movimprese), as detailed in Table 2.1. The selection of indicators was driven by the relevance to the research goals, alongside the data availability and comparability across different regional contexts. This data collection was summarised into a comprehensive EE index, subsequently disaggregated into three distinct sub-indexes corresponding to foundational pillars of framework, systemic, and human conditions (see Figure 2.1. and Table 2.1.). The forthcoming sections delineate the methodological approach adopted for developing the EE index, providing a transparent and replicable model for future research in this field.

2.4.3. Developing measures by composite index methodology

The indicators listed in Table 2.1. were combined to create the EE index, and the sub-indexes framework, systemic, and human conditions by employing composite index methodology. A standard composite indicator is typically structured as follows (Freudenberg, 2003: 7):

$$I = \sum_{i=1}^{n} w_i X_i$$

where I: composite index, X_i: normalised variable, w_i: weight of the X_i, $\sum_{i=1}^{n} w_i = 1$ and $0 \leq w \leq 1$, i: $1,\ldots, n$.

[6] For further details, consult: https://www.infocamere.it/movimprese.

Given that the variables have different units of measurement, the data were normalised on a scale from zero to 10 using the min-max method to guarantee comparability (OECD, 2008: 85). According to this scale, higher values indicate better performance. Afterwards, the values on the zero to 10 scale were averaged, using equal weighting, to form a composite EE index. In detail, the EE index and the three sub-indexes are calculated as follows:

$$I_r = \Sigma_{j=1}^{J} \Sigma_{m=1}^{M} w_{jm}\{(\mathrm{X}_{jmr} - \mathrm{X}_{Jm}^{min})/ (\mathrm{X}_{Jm}^{max} - \mathrm{X}_{Jm}^{min})\}$$

where r: region; j and m: are indicators and elements subscripts; and min and max: the minimum and maximum values of each indicator across regions.

Drawing upon the configurations proposed by Stam (2015, 2018) and Iacobucci & Perugini (2021), the EE index consists of three components: framework, systemic, and human conditions. This study expanded the range of EE elements, with each component currently comprising seven output indicators, culminating in a comprehensive set of twenty-one indicators for the main EE index.

2.4.4. Weighting Method

Table 2.1. exhibits the data sources, the definition of the variables stemming from the literature, and the weights assigned to the EE index, along with the three sub-indexes and their respective indicators. Despite the existence of various weighting methods, such as statistical models (factor analysis and principal component analysis), an equal weighting approach has been adopted for this conceptual framework. This empirical choice is consistent with prior studies (Peterson, 2020; Radosevic & Yoruk, 2013), and the recommendations provided by the OECD (2008: 31) which argues that: *"(…) most composite indicators rely on equal weighting, i.e., all variables are given the same weight. This essentially implies that all variables are 'worth' the same in the composite, but it could also disguise the absence of a statistical or empirical basis, e.g., when there is insufficient knowledge of causal relationships or a lack of consensus on the alternative. Moreover, if variables are grouped into dimensions (components) and those are further aggregated into the composite, then applying equal weighting to the variables may imply an unequal weighting of the dimension (the dimensions grouping the larger number of variables will have higher weight). This could result in an unbalanced structure in the composite index*". Hence, equal weight was assigned to each indicator to reach a balanced result in the composite index.

2.5. Results

2.5.1. Descriptive statistics

Tables 2.2., 2.3., and 2.4. display the descriptive statistics for regional EEs across the twenty Italian regions from 2009 to 2019.

Table 2.2. Descriptive statistics (normalised values)

Index	Sub-index	EE component	Min	Max	Mean	p50	Std. dev.
EE index			3.70	14.86	9.44	9.90	3.09
	FRAMEWORK CONDITIONS		1.03	5.88	3.99	4.46	1.38
		1. Voice and accountability index	0	1	0.56	0.61	0.24
		2. Government effectiveness index	0	1	0.56	0.62	0.25
		3. Regulatory quality index	0	1	0.53	0.59	0.23
		4. Rule of law index	0	1	0.54	0.56	0.25
		5. Corruption index	0	1	0.73	0.82	0.25
		6.Digital infrastructures	0	1	0.56	0.57	0.24
		7. Physical infrastructures	0	1	0.51	0.60	0.32
	SYSTEMIC CONDITIONS		0.52	4.59	2.21	2.06	0.93
		8. Finance	0	1	0.47	0.42	0.24
		9. New knowledge	0	1	0.18	0.13	0.20
		10. Turnover rate	0	1	0.51	0.52	0.18
		11. GERD	0	1	0.13	0.07	0.21
		12. BERD	0	1	0.28	0.24	0.23
		13. Professional and technology sector	0	1	0.29	0.26	0.19
		14.Information and communication sector	0	1	0.345	0.31	0.22
	HUMAN CONDITIONS		1.44	5.46	3.24	3.38	0.99
		15. Migration flow	0	1	0.62	0.62	0.15
		16. Population structure	0	1	0.55	0.58	0.22
		17. Higher education	0	1	0.39	0.36	0.19
		18. R&D personnel and researchers	0	1	0.37	0.35	0.21
		19. Income level	0	1	0.46	0.55	0.29
		20. Tertiary education	0	1	0.37	0.34	0.20
		21. Employment in science and technology	0	1	0.48	0.54	0.26

Note: N=220

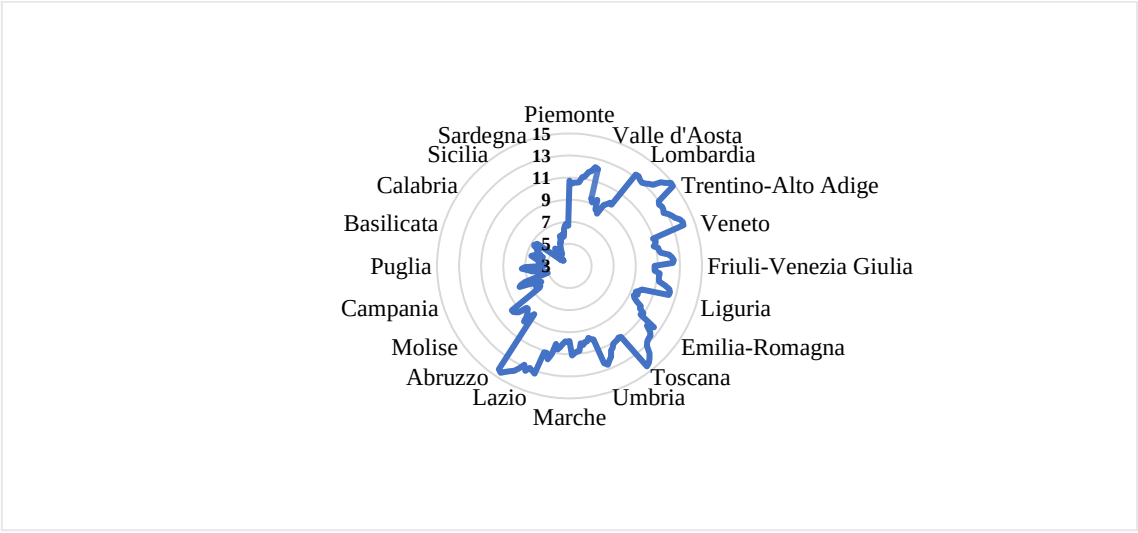
Table 2.2. shows the mean, median, minimum, maximum values, and standard deviations for the components of the regional EEs. The results reveal significant disparities among the EE elements across the Italian regions, with the EE index ranging from 3.70 to

14.86 and a mean of 9.44, denoting strong variability (see Figure 2.2.). Indeed, the region with the highest EE index has a value more than four times that of the region with the lowest score, underscoring substantial regional variations within Italy's entrepreneurial landscape. Regarding the framework conditions, the sub-index exhibits a relatively narrower range from 1.03 to 5.88, suggesting more consistency across regions compared to other factors.

Notably, elements such as the Corruption and Government Effectiveness Index score higher than the Physical Infrastructures component, which indicates a need for improvement across the regions. The systemic conditions present significant variability, with a standard deviation of 0.93 and a mean of 2.21. This suggests there may be large disparities in systemic factors influencing entrepreneurship across different regions.

In particular, new knowledge and GERD are notably low, highlighting potential areas where policymakers could intervene to foster innovation. Human conditions demonstrate a mean of 3.24 with a standard deviation of 0.99, signifying moderate variation across regions. The migration flow component has a relatively high mean, suggesting a positive influence of migration trends on the EE. Conversely, educational components such as Higher Education and Tertiary Education may need increased investment to nurture a livelier entrepreneurial environment.

Figure 2.2. The performance of EE across Italian NUTS-2 regions during 2009-2019 (normalised values)



Source: Authors' elaboration

Figure 2.2. shows the trends of EE index across different Italian regions during the period from 2009 to 2019. The empirical data stimulate several key observations. Primarily,

a growing tendency is clear in most regions, indicating an improvement in the conditions and factors promoting entrepreneurial activities throughout Italy. Additionally, considerable regional variability exists, with areas like Lombardia and Lazio displaying higher EE index values compared to other regions, such as Molise and Calabria. These variations could be ascribed to disparities in resource allocation, infrastructure availability, and the effectiveness of regional entrepreneurship policies. Finally, Northern regions e.g., Lombardia, Emilia-Romagna, and Piemonte boast the highest EE index scores, signaling a robust EE. By contrast, Southern regions and islands, including Calabria, Sicilia, and Sardegna, record lower scores, suggesting a north-south disparity in entrepreneurial activity and support.

Table 2.3 highlights the correlations among the three sub-indexes – framework, systemic, and human conditions. Systemic conditions show a strong and significant correlation with framework conditions, as designated by a correlation coefficient of 0.71. This correlation suggests that systemic components of EE, including financial markets, knowledge creation, and market conditions, are likely well-aligned with framework conditions, such as government policy, the regulatory environment, and infrastructure. When framework conditions are supportive, systemic conditions tend to be positive, manifesting a synergistic relationship. Human conditions show an even stronger correlation with both framework (i.e., 0.85) and systemic conditions (i.e., 0.87), suggesting a close association between human capital factors (e.g., skilled labour availability, educational attainment, and income levels), with both the framework and systemic aspects of the EE. This implies that a supportive regulatory and infrastructural, combined with efficient markets and a robust knowledge ecosystem, are central for nurturing human capital development and attracting the talent essential for a thriving EE. In short, the significant interrelations among all three sub-indexes underscore that they are not isolated factors, but rather interconnected components that jointly influence EE's performance.

Table 2.3. Correlation matrix (EE conditions)

	Framework conditions	Systemic conditions	Human conditions
Framework conditions	1		
Systemic conditions	0.71***	1	
Human conditions	0.85***	0.87***	1

Note: N=220
*p < 0.10; **p < 0.05; ***p < 0.01

Table 2.4. shows the correlation coefficients among the various elements of the EE. The significant correlations observed provide important empirical evidence supporting the interdependence and co-evolution of these elements within the EE model.

As expected, several EE elements, particularly those assessing institutional quality – such as the Voice and Accountability Index, Rule of Law, Corruption Index, Regulatory Quality Index, and Government Effectiveness Index – prove strong positive correlations. This corroborates that effective and high-quality governance is necessary for a robust EE. Both Digital and Physical Infrastructures denote moderate to strong positive correlations with many other components. For instance, the Finance element has a very strong correlation with Physical Infrastructure and a moderate correlation with Digital Infrastructure. The latter, while positively correlated with other factors, exhibits relatively weaker interconnections, implying that despite digital infrastructure having a significant impact, it may not be as central to the EE. Conversely, Physical Infrastructure shows robust correlations with financial components, indicating that well-developed infrastructure considerably influences the financial dimensions of an EE. This suggests that regions with superior infrastructure are likely to have more effective financial systems.

Financial elements are also closely intertwined with institutional quality, underscoring the intricate interplay between financial dynamics, governance structures, and infrastructural development. New Knowledge has weak to moderate correlations with other factors, which may imply that the creation of new knowledge within the EE is affected by a diverse array of elements. GERD and BERD both show positive correlations with components related to innovation, emphasising the pivotal role that R&D investment plays within the EE.

Furthermore, there is a notable strong correlation between the Professional and Technology and the Information and Communication Sectors, reflecting a close nexus between professional services, technology sectors, and information and communication technologies. The Migration Flow is highly correlated with several components, particularly Physical Infrastructure and Employment in Science and Technology, signifying that regions with superior infrastructure and higher employment rates in science and technology sectors tend to attract more migrants. Additionally, Higher and Tertiary Education are strongly interrelated and positively connected with Digital Infrastructures and R&D Personnel, underlining the relevant role of education in reinforcing EE.

2.5.2. Confirmatory Factor Analysis

Following the normalisation through the min-max method, Confirmatory Factor Analysis (CFA) was employed to test the structure of the data (Brown & Moore, 2012; Harrington, 2009). As known, CFA is an appropriate statistical technique to assess the extent to which the assumed factor model is congruent with the observed data. It specifically evaluates how the proposed factorial structure can replicate the observed covariance among a set of variables. In our research, CFA enabled the validation of the indicators for assessing the performance of the regional EEs. A model incorporating all three sub-dimensions of the EE index was framed. This configuration allowed for the alignment of each group of indicators with their respective sub-dimension and provided a mechanism to scrutinise the reliability of the theoretical framework presented.

Specifically, Table 2.5. reports the factor loadings from the CFA for a one-factor solution, where loadings range from -1 to +1 (Brown & Moore, 2012). High positive loadings (from 0.62 to 0.90) for indicators such as Voice and Accountability, Government Effectiveness, and others, confirm their strong association with framework conditions. Although Digital Infrastructure has a lower loading at 0.34, suggesting a weaker connection. By contrast, the Information and Communication Sector stands out with a high loading of 0.98, indicating a strong relation with systemic conditions. Similarly, indicators such as Employment in Science and Technology (0.93) and Higher Education (0.87) reflect their relevance to human conditions. The Population structure indicator suggests an inverse relationship with its latent variable (i.e., human condition). This may indicate that regions with attributes typically favourable to entrepreneurship, such as high levels of education or income, might concurrently have a population structure less inclined towards entrepreneurship – for instance, a higher proportion of older residents. This could lead to a divergence where the demographic composition does not align with other positive entrepreneurial measures.

All factor loadings are significant with a p-value < 0.001, implying that the likelihood of these patterns occurring by random chance is extremely low, thereby underscoring the statistical reliability of the results.

Table 2.4. Correlation matrix (EE components)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	1																				
2	0.44 (***)	1																			
3	0.82 (***)	0.47 (***)	1																		
4	0.87 (***)	0.38 (***)	0.80 (***)	1																	
5	0.74 (***)	0.42 (***)	0.72 (***)	0.71 (***)	1																
6	0.25 (***)	0.38 (***)	0.31 (***)	0.28 (***)	0.12 (*)	1															
7	0.67 (***)	0.74 (***)	0.71 (***)	0.58 (***)	0.59 (***)	0.30 (***)	1														
8	0.67 (***)	0.64 (***)	0.68 (***)	0.56 (***)	0.65 (***)	0.03	0.77 (***)	1													
9	0.00	0.31 (***)	0.15 (**)	-0.16	0.05	0.16	0.29 (***)	0.25 (***)	1												
10	0.18 (***)	0.06	0.09	0.15 (**)	0.05	0.37 (***)	0.12 (*)	0.04	0.15 (**)	1											
11	0.38 (***)	0.21 (***)	0.40 (***)	0.40 (***)	0.23 (***)	0.20 (***)	0.11	0.30 (***)	-0.05	0.22 (***)	1										
12	0.52 (***)	0.61 (***)	0.52 (***)	0.49 (***)	0.47 (***)	0.41 (***)	0.76 (***)	0.44 (***)	0.21 (***)	0.18 (***)	0.24 (***)	1									
13	0.14 (**)	0.15 (**)	0.12 (*)	-0.04	-0.00	0.36 (***)	0.25 (***)	-0.04	0.67 (***)	0.27 (***)	-0.20 (***)	0.23 (***)	1								
14	0.54 (***)	0.52 (***)	0.57 (***)	0.38 (***)	0.46 (***)	0.46 (***)	0.61 (***)	0.49 (***)	0.69 (***)	0.29 (***)	0.27 (***)	0.63 (***)	0.70 (***)	1							
15	0.61 (***)	0.42 (***)	0.65 (***)	0.49 (***)	0.61 (***)	-0.01	0.72 (***)	0.69 (***)	0.29 (***)	0.06	0.22 (***)	0.52 (***)	0.16	0.55 (***)	1						
16	-0.32 (***)	-0.39 (***)	-0.37 (***)	-0.39 (***)	-0.29 (***)	-0.76 (***)	-0.37 (***)	0.05	0.10	-0.17	-0.11 (*)	-0.50 (***)	-0.20 (***)	-0.27 (***)	-0.07	1					
17	0.35 (***)	0.45 (***)	0.45 (***)	0.23 (***)	0.27 (***)	0.69 (***)	0.55 (***)	0.19 (***)	0.40 (***)	0.18 (***)	0.08	0.46 (***)	0.60 (***)	0.60 (***)	0.32 (***)	-0.69 (***)	1				
18	0.44 (***)	0.70 (***)	0.49 (***)	0.36 (***)	0.37 (***)	0.59 (***)	0.72 (***)	0.41 (***)	0.45 (***)	0.27 (***)	0.31 (***)	0.88 (***)	0.41 (***)	0.73 (***)	0.49 (***)	-0.56 (***)	0.66 (***)	1			
19	0.81 (***)	0.61 (***)	0.85 (***)	0.77 (***)	0.72 (***)	0.39 (***)	0.81 (***)	0.68 (***)	0.24 (***)	0.22 (***)	0.41 (***)	0.79 (***)	0.29 (***)	0.77 (***)	0.72 (***)	-0.45 (***)	0.49 (***)	0.73 (***)	1		
20	0.35 (***)	0.45 (***)	0.44 (***)	0.23 (***)	0.26 (***)	0.71 (***)	0.55 (***)	0.18 (***)	0.39 (***)	0.20 (***)	0.06	0.46 (***)	0.60 (***)	0.60 (***)	0.32 (***)	-0.71 (***)	0.99 (***)	0.67 (***)	0.49 (***)	1	
21	0.80 (***)	0.63 (***)	0.83 (***)	0.72 (***)	0.67 (***)	0.45 (***)	0.86 (***)	0.64 (***)	0.24 (***)	0.20 (***)	0.34 (***)	0.81 (***)	0.36 (***)	0.77 (***)	0.71 (***)	-0.54 (***)	0.65 (***)	0.77 (***)	0.95 (***)	0.65 (***)	1

N = 220
*p < 0.10; **p < 0.05; ***p < 0.01

Table 2.5. Confirmatory factor analysis results for main index and subindexes

Sub-index	Indicator	Indicator weight in Sub-index	Indicator weight in EE Index	One factor solution for index (CFA)
FRAMEWORK CONDITIONS				
	1. Voice and accountabilityindex	1/7	1/21	0.90
	2. Government effectivenessindex	1/7	1/21	0.62
	3. Regulatory quality index	1/7	1/21	0.88
	4. Rule of law index	1/7	1/21	0.86
	5. Corruption index	1/7	1/21	0.77
	6. Digital infrastructure	1/7	1/21	0.34
	7. Physical infrastructure	1/7	1/21	0.81
SYSTEMIC CONDITIONS				
	8. Finance	1/7	1/21	0.46
	9. New knowledge	1/7	1/21	0.70
	10. Turnover rate (birth rate-exit rate of firms	1/7	1/21	0.30
	11. Government expenditure in R&S	1/7	1/21	0.20
	12. Business sector expenditure in R&S	1/7	1/21	0.59
	13. Professional and technology sector	1/7	1/21	0.71
	14. Information and communication sector	1/7	1/21	0.98
HUMAN CONDITIONS				
	15. Migration flow	1/7	1/21	0.58
	16. Population structure	1/7	1/21	-0.66
	17. Higher education	1/7	1/21	0.87
	18. R&D personnel and researchers	1/7	1/21	0.81
	19. Income level	1/7	1/21	0.85
	20. Tertiary education	1/7	1/21	0.87
	21. Employment in science and technology	1/7	1/21	0.93

Note: N = 220
All factor loadings are significant at p-value < 0.001

Besides, validity analyses were performed to verify the robust correlations among the identified components (Anderson & Gerbing, 1988). We computed Cronbach's alpha coefficients for each latent dimension and assessed the Kaiser-Meyer-Olkin (KMO) which is the measure of sampling adequacy, as detailed in Table 2.6. All components exhibit Cronbach's alpha values above the 0.70 threshold, denoting acceptable reliability (Nunnally, 1978), and that common factors conceivably influence the components in conceptual framework. This suggests consistent measurement of the same underlying construct by the indicators (OECD, 2008: 71-2). As Table 2.6. demonstrates, the KMO values exceed the critical threshold of 0.50 (Hair et al., 1979), fulfilling the prerequisites for factor analysis and indicating that the data are suitable for such analyses. Moreover, Bartlett's test of sphericity yields highly significant results in each case.

Table 2.6. Reliability and sampling adequacy

Index	Sub-index	Cronbach's alpha	KMO - Bartlett's test of sphericity
EE index		0.927	KMO: 0.837 Chi-square: 7161.624 Sig. level: 0.000
	Framework conditions	0.889	KMO: 0.844 Chi-square: 1143.888 Sig. level: 0.000
	Systemic conditions	0.740	KMO 0.515 Chi-square: 794.206 Sig. level: 0.000
	Human conditions	0.762	KMO: 0.790 Chi-square: 2412.234 Sig. level: 0.000

Note: N = 220
*p < 0.10; **p < 0.05; ***p < 0.01

2.6. Discussion and conclusive remarks

We aim to explore a metric for evaluating regional EEs. Our objective is accomplished by developing an EE index at the NUTS-2 level, examining its variation and persistence across Italian regions during the period 2009-2019. The analysis builds on Stam & van De Ven (2021), who assert that the regional level (NUTS-2) is more suitable than the provincial one. Several underlying motivations drive this choice. Primarily, regional-level data are often more available and reliable than that provincial-level, as suggested by prior research (Leendertse et al., 2022; Mikic et al., 2021; Schrijvers et al., 2023; Xie et al., 2021). Furthermore, the regional level meets the administrative requirements for implementing the EU Cohesion Policy (Terracciano & Graziano, 2016). Therefore, understanding regional EEs might be more directly relevant for policymakers crafting economic development strategies. Lastly, the regional scale facilitates comparative analysis (Audretsch & Belitski, 2021).

The development of the composite EE index represents a significant advance in evaluating regional EE performance (Iacobucci & Perugini, 2021; Leendertse et al., 2022; Stam, 2015; Stam & van De Ven, 2021). Incorporating twenty-one different indicators, the index provides a comprehensive overview of the entrepreneurial environments' strengths and weaknesses across different regions. The rationale for including additional indicators stems from the multifaceted nature of the EE (Acs et al., 2018; Sussan & Acs, 2017), needing a broad spectrum of measures. To capture the multiple dimensions of regional EEs, we integrate the following variables not previously considered (Cavallo et al., 2023; Iacobucci & Perugini, 2021): the Government Effectiveness Index and the

Regulatory Quality Index, as well as Digital Infrastructure within framework conditions; GERD and BERD, along with the Information and Communication Sector into systemic conditions; and Higher and Tertiary Education, R&D personnel and researchers, Income Level, and Employment in Science and Technology within human conditions.

Our study addresses two main research questions. The first one is: *"How can the key variables from the most widely proposed EE indexes be integrated to create a comprehensive EE composite index?"* To this end, we draw upon prior studies in the field of EE (Iacobucci & Perugini, 2021; Perugini, 2023; Stam 2015; Stam, 2018; Stam & van De Ven, 2021), expanding a dataset that attempts to capture the main facets of regional EEs within the Italian setting. A comprehensive array of data was gathered from various European and Italian databases for this purpose. The index's reliability was assessed using normalisation, aggregation techniques, and CFA, which revealed some critical findings.

Addressing the second research question: *"To what extent are the different elements of EEs interdependent within the Italian context?"* we underscore some crucial findings. Firstly, the analysis focused on examining the interconnections among the various conditions and components of the regional EEs. The latter revealed that regional EEs are comprised of intricately interdependent components. For instance, Table 2.3. highlights the correlations between the three sub-indexes related to EE conditions. These findings point out a significant interdependence between the sub-indexes, emphasising the intricate nature of EEs and underscoring the need for a holistic approach to thoroughly understand and improve their dynamics. Table 2.4. shows that components of the EE are strongly correlated with each other. Secondly, the results prove significant disparities in the EE across various Italian regions; while some areas display consistent performance over time, others face more relevant challenges. Figure 2.2. sets out that the trend in the EE index differs considerably among Italian regions in the time span (2009-2019). On one hand, some regions show an upward trend, suggesting an overall improvement in the conditions conducive to entrepreneurial activities. On the other hand, such variability is mostly marked between the Northern and Southern regions, reflecting that differences in EE index scores may reflect unequal distribution of resources, infrastructure availability, or the efficacy of policies tailored to entrepreneurial development.

2.6.1. Theoretical implications

Our empirical findings have prominent theoretical implications that contribute to the ongoing academic debate on regional EEs. By providing a multi-dimensional EE index and investigating its variations across Italian regions, we provide a concrete metric that aligns with the theoretical constructs of regional development (Szerb et al., 2015; Yun et al., 2017), and innovation systems (Radosevic & Yoruk, 2013; Sallos et al., 2017).

Firstly, we deem the regional spatial disaggregation level, in light of recent observations presented by Perugini (2023), which highlight the relative dearth of measures for EEs at the NUTS-2 level (Guzman & Stern, 2020; Stam, 2015; Sternberg et al., 2019).

Secondly, the development of the EE index contributes to the operationalisation of complex theoretical concepts related to entrepreneurship and regional development. This operationalisation is relevant for testing and refining theories as it transforms abstract notions into measurable components. Indeed, this analysis introduces a comprehensive metric for evaluating the three primary conditions that define EEs. Addressing their measurement is a crucial initial step for any analysis of EEs, as underlined by leading scholars in this research domain (Audretsch et al., 2021; Credit et al., 2018). Effective measurement should account for the spatial and temporal dimensions of EEs (Bruns et al., 2017; Sternberg et al., 2019) and employ standardised methods to navigate their heterogeneity and complexity (Shwetzer et al., 2019). By enabling comparative analysis, this methodology improves our understanding of EEs and their impact on entrepreneurial activities, regional economic growth, and *vice versa*.

Finally, the methodology employed to evaluate the reliability of the EE index relies on diverse statistical techniques which brings theoretical implications for the validation of composite indexes in social science research. Therefore, we advocate for the robustness of composite measurements and encourage their application in testing and developing socio-economic theories.

2.6.2. Practical and policy implications

The insights garnered from our analysis present valuable practical implications for policymakers and practitioners. The formulation of EE index offers an instrument for assessing the health of regional EEs, thereby informing strategic decision-making and the distribution of resources.

From a policy perspective, the marked disparity in EE performance (Figure 2.2.) between Italy's Northern and Southern regions underscores the need for tailored regional strategies. The persistence of these differences indicates that regional development is not a self-correcting mechanism, but it is instead shaped by enduring historical and socio-political factors influencing regional economic outcomes. Policymakers could leverage the EE index as a diagnostic tool to identify specific less developed areas requiring targeted support. For instance, the strong association between Physical infrastructure and Finance (see Table 2.3.) underscores the critical role of investment in transportation and logistics as a catalyst for economic expansion, entrepreneurial dynamism, and innovation. Furthermore, in the context of digital transformation, the somewhat marginal impact of digital infrastructures within the Italian EE framework prompts a reassessment of conventional approaches to regional development. The findings suggest that the influence of digitalisation on regional entrepreneurship is nuanced and potentially raised by complementary factors, such as human capital quality and the efficacy of regulatory frameworks.

From an entrepreneurial practice standpoint, it is critical to understand the broader conditions that underpin entrepreneurial activities. Context is frequently deemed as an «exogenous» factor, inadequately integrated into theoretical models, with its influence on entrepreneurship being consistently underappreciated (Welter, 2011). As a result, previous research in the field of entrepreneurship has overlooked the crucial role that context plays in shaping entrepreneurial activity (Stam & van de Ven, 2021). Besides, these scholars advocate for a shift away from considering the setting merely as a control variable or proxy; rather, it deserves an in-depth exploration into how the cultural, social, political, and economic fabric of a region collectively affects EE.

At the micro-level, adopting a systemic perspective holds meaningful implications for individual entrepreneurs. This approach recognises that entrepreneurial endeavours are not isolated occurrences but thus are embedded within a broader network. In this network, an entrepreneur's actions are circumscribed by the available resources and the need to create synergic relationships with other actors to sustain a thriving EE (Shi & Shi, 2022). Consequently, strategic decisions extend beyond the boundaries of individual resource endowments to encompass the wider collaborative networks essential for achieving both individual and collective objectives. These considerations reveal that the demarcations between firm and its surrounding entrepreneurial environment are dynamic,

rather than static (Roundy, & Fayard, 2019). The strategic evolution of these interactions is influenced not only by the companies themselves but is significantly formed by the complex network of interdependencies emerging among the several stakeholders engaged in EE.

2.6.3. Limitations and future research directions

Despite the extensive data collection, some metrics, particularly those concerning Physical (Messina, 2007) and Population structure, were not measured in an entirely satisfactory manner. First of all, an updated index reflecting the potential accessibility of motorways and railways would have been preferable. However, it should be noted that recent studies in the Italian context have deemed these factors as constant (Iacobucci & Perugini, 2020, 2021; Perugini, 2023). Currently, such indexes are available for physical infrastructures. To enhance the scope of the analysis, we also incorporate Digital infrastructure (Table 2.1.). Although these digital metrics evaluate distinct attributes, they concurrently act as indicators of the connectivity levels across various settings. Indeed, studies by Chen et al. (2020) and Schade & Schuhmacher (2022) suggested that digital infrastructure serves as a facilitator for market access, providing direct connections to regional markets and customers. This «digital network» allows for a broader and more varied range of interconnections than what is possible with physical infrastructure alone. Secondly, the negative factor loading of the Population structure indicator suggests a complex and counterintuitive relationship; the characteristics typically associated with entrepreneurial dynamism, such as a younger population, do not align with the actual population structure within the regions investigated. It calls for a more in-depth investigation based on why a younger population structure does not positively correlate with other measures of human conditions in EE.

Furthermore, the equal weighting approach in the index construction simplifies aggregation but may overlook the varying importance of each indicator. While the methodologies used to develop the EE index and analyse the data are rigorous, they might not completely capture these differences, potentially introducing biases.

The study's essentially descriptive approach is a shortcoming; however, it lays the foundations for future comparative analyses across different geographical contexts.

Lastly, while the focus on the Italian context offers in-depth insights, applying the EE index to other regions may require adjustments to account for distinct economic, cultural, and policy environments.

Future research should strive to overcome these limitations by incorporating a wider range of data, exploring causal relationships, expanding the analysis to various contexts and time frames, and employing different methodological approaches to corroborate the robustness of the empirical evidence.

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Chapter 3. Navigating the Regional Entrepreneurial Ecosystem: evidence from the Italian setting[7]

Abstract

Entrepreneurial Ecosystems are essential in fostering the creation of new firms, stimulating economic growth, and generating social value. They contribute to a lively and flourishing society by enhancing collaboration, promoting productive entrepreneurship, and creating a conducive environment for innovative ideas. However, their effectiveness may be hindered by some issues, such as stakeholder fragmentation, regulatory and policy constraints, entrepreneurs' knowledge gaps, and limited access to physical and digital infrastructure. Such a type of study gains prominent relevance in geographical contexts marked by differences. The Italian setting, widely recognised for its discrepancies between the Northern and Southern regions, provides a suitable context to develop this research. Indeed, understanding the variations in the performance of Entrepreneurial Ecosystems within the Italian context is crucial, especially considering the regional disparities in entrepreneurial activity, productive entrepreneurship, and economic development. We aim to uncover these regional imbalances to implement best practices and foster more inclusive growth. To test our hypotheses, we draw upon Embeddedness and Institutional Theories, building a composite EE index along with its sub-indexes: framework, systemic, and human conditions. We employed a dynamic panel data analysis using the Generalised Method of Moments (GMM) over 11 years (2009-2019) for the Italian regions (NUTS-2 hierarchical level). Our empirical evidence highlights significant differences between developed and less developed regions, reflecting the pivotal role of Entrepreneurial Ecosystems in driving regional development. Consequently, our study provides intriguing insights for policymakers, scholars, and practitioners who place particular attention on regional policy issues and the geography of entrepreneurship.

Keywords: Entrepreneurial Ecosystems · Regional economic development · GMM model · Productive entrepreneurship · Regional policy

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3.1. Introduction

Entrepreneurship is the driving force for economic growth and prosperity worldwide. Over the last several years, the concept of Entrepreneurial Ecosystems (henceforth EEs) has gained significant attention in the management field. Some scholars (Autio et al., 2014; Brown & Mason, 2017; Malecki, 2018; Spigel, 2017; Stam, 2015) highlighted the relationship among entrepreneurship and the regional factors embedded within a specific EE.

EEs are portrayed by a complex interplay of actors, institutions, and socio-economic elements, which contribute to catalysing new business formation and driving the creation of regional aggregate value (Kenney, 2000; Nelson, 1993). Adopting this comprehensive perspective is essential, as it encompasses a wide collection of indicators pertinent to entrepreneurial activities at both the individual and regional levels, thereby playing a paramount role in formulating strategies that encourage regional development. Despite existing research in this field at the regional level (Knox & Arshed, 2022; Stam & van de Ven, 2021; Szerb et al., 2019), an ongoing need still persists for crafting additional robust measurement methodologies.

Although assessing entrepreneurship in a macro context is a challenging endeavour, due to its inherent complexities (Audretsch, 2007; Reynolds et al., 2005), it is crucial to carry out an analysis emphasising regional differences. In detail, we pay attention to how elements of EEs influence both intermediate outputs (e.g., entrepreneurial activity and productive entrepreneurship), and overall outcome (namely, regional economic development). The significant differences in entrepreneurial activity, productive entrepreneurship, and regional economic growth across Italy offer a suitable framework for an extensive investigation into the role and influence of EEs. Some regions emerge as hotbeds of entrepreneurial activity, while others lag in gaining similar momentum. Italy, with its rich history and different regional dynamics, presents a compelling backdrop for our study.

By addressing some research gaps identified in the extant literature, our study goes beyond the descriptive focus highlighted by Perugini (2023), delving into how EEs affect variations in new firm creation and economic growth over different regions. Moreover, we answer to Stam & van de Ven's (2021) call for a wider empirical scope by conducting our analysis across various Italian regions over an 11-year period. Our empirical research attempts to understand the influence of different EE components at various levels of the EE structure, as described by Stam (2015).

We explore the following research questions:

1) *"How does EE affect entrepreneurial activity, productive entrepreneurship, and regional economic development?"*
2) *"How does EE differ between developed and less developed regions?"*

Building on Institutional Theory (Bruton & Ahlstrom, 2003; DiMaggio & Powell, 1991; Scott, 2007) and Embeddedness Theory (Granovetter, 1985; Nohria & Eccles, 1992; Jones et al., 1997), we aim to draw attention to regional disparities, by offering insights that can drive the implementation of best practices and promote more inclusive economic development.

Institutional Theory, widely adopted in entrepreneurship research (Eijdenberg et al., 2019; Shane & Foo, 1999), posits that institutions shape the behaviour of individuals and firms through norms, laws, and regulations. This, in turn, plays a critical role in either fostering or hindering entrepreneurial activity in specific areas (Bruton & Ahlstrom, 2003; Scott, 2007). This theoretical construct enables us to explore the relationship between EEs, entrepreneurial activity, and productive entrepreneurship, focusing on how institutions affect the creation of new ventures within regional EEs. Still, Embeddedness Theory allows us to understand how startups and small-medium enterprises (SMEs) operate within specific community. These entities are deeply influenced by social ties, shared values, and their surrounding environment (Dacin et al., 1999), which strongly shape the entrepreneurial process. Therefore, such theoretical lens enriches our comprehension of the dynamics connecting the components of EEs and their contribution to regional development.

Our empirical analysis takes root in a sample of twenty Italian regions at the NUTS-2 level during the period 2009-2019. To test our hypotheses, we conduct a dynamic panel data analysis by using the Generalised Method of Moments (GMM), running twelve GMM regression models with robust standard errors to effectively address potential issues of heteroskedasticity. Furthermore, we investigate the disparities between developed and less developed Italian regions, sorting them according to the EU's Regional Policy and Cohesion Policy standards for 2014-2020. Our findings highlight relevant disparities between these regions, underscoring the critical role of EEs in regional entrepreneurship and economic development. As a result, this study presents valuable insights for policymakers, scholars, and practitioners involved in regional policy and the spatial dynamics of entrepreneurship.

The paper is structured as follows: Section 3.2. delves into the theoretical foundations and hypotheses development. Section 3.3. depicts the empirical analysis, outlining the

sample, measurements of the composite index, variables, and specifications of the regression model. Section 3.4. exhibits our findings. Finally, Section 3.5. discusses the empirical evidence, along with their theoretical, practical, and policy implications, by delineating the limitations of the current study and suggesting insightful avenues for future research in this field.

3.2. Theoretical foundations and hypotheses development

3.2.1. Entrepreneurial Ecosystems

The concept of EEs has been extensively discussed in the extant literature (Autio et al., 2014; Brown & Mason, 2017; Spigel & Harrison, 2018), particularly regarding their significant influence on driving regional growth (Content et al., 2020). This perspective has emerged to offer a systemic understanding of entrepreneurship and highlights how regional performance is shaped by the dynamic interactions among the components of the EE.

Although different scholars have attempted to define this concept (Cohen, 2006; Isenberg, 2011; Spigel, 2017; Spilling, 1996), Stam's definition has gained considerable attention in the academic debate, to which EEs are *"(…) a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship"* (Stam, 2015, p. 1765), in a specific area (Stam & van de Ven, 2021). In this vein, EEs are characterised by a network of interconnected elements, where the vigorous interaction among actors, institutions, and socioeconomic factors might fuel new entrepreneurial ventures within specific regional settings (Acs et al., 2014; Audretsch & Belitski, 2017; Mack & Mayer, 2016; Stam & van de Ven, 2021).

The key milestone is to understand how the interplay among the elements of the EE fosters productive entrepreneurship. The latter, depicted by high-quality entrepreneurial endeavours, such as high-growth firms (HGFs) (Baumol, 1993, 1996), could vary across different regional EEs and significantly affects economic growth (Content et al., 2020). In detail, such productive entrepreneurship is instrumental in generating aggregate value, an outcome profoundly shaped by the culture and community dynamics of a specific context (Spigel & Harrison, 2018; Stam & van de Ven, 2021).

We ground our conceptual model (depicted in Figure 3.1) in two main theoretical frameworks: Institutional Theory (hereon IT) and Embeddedness Theory (henceforth ET). The first (i.e., H1a, H1b, H1c, H1d) and the second set of research hypotheses (i.e., H2a,

H2b, H2c, H2d) draw upon IT. By contrast, the third one (i.e., H3a, H3b, H3c, H3d) is based on the ET.

IT has been notably suitable as a framework for examining a diverse range of research fields, encompassing economics, social issues, policy, and organisational theory (DiMaggio & Powell, 1991). This theoretical perspective investigates the impact of institutions – through norms, laws, and regulations – on the behaviour of individuals and firms. Indeed, many scholars opted for IT to describe how institutional factors influence entrepreneurial activity within specific regions (Bruton & Ahlstrom, 2003; Eijdenberg et al., 2019; Shane & Foo, 1999; Scott, 2007). We concur with the stance presented by Bruton et al. (2010) and endorse their three primary assertions. First, entrepreneurship is substantially affected by the institutional environment, which delineates and restrains entrepreneurial opportunities, in terms of quantity and size of new business formation (Gnyawali & Fogel, 1994). Indeed, factors such as favourable market incentives, government regulations, and the availability of capital can remarkably condition entrepreneurial activity (Aldrich, 1990). Conversely, an inefficient institutional framework may hamper the creation of new firms. Second, entrepreneurs strive to establish legitimacy for their companies (Suchman, 1995). This legitimacy, persistent to the entitlement to conduct entrepreneurial activities, is shaped by both regulatory and cognitive dimensions of the institutional framework. Third, in environments where institutions are poorly developed, entrepreneurs greatly benefit from institutional support to successfully establish and expand their businesses. Drawing upon Institutional Theory to explore the dynamics between EEs and entrepreneurial activity portrays a suitable theoretical foundation for analysing the role of institutions in nurturing new business ventures within an EE. This approach offers insightful perspectives for both researchers and policymakers, helping to shed light on the different elements and interactions that foster or deter entrepreneurial achievements in these environments.

ET, which emerges from various research fields including sociology (Granovetter, 1985), law (Macneil, 1980), and strategy (Nohria & Eccles, 1992; Jones et al., 1997), posits that social structures facilitate access to interfirm networks (Uzzi & Gillespie, 2002). In the realm of management, it emphasises that business activities and behaviours are intertwined with social and institutional structures. Indeed, it is widely acknowledged that startups and SMEs are deeply embedded in local communities, industry networks, and institutional frameworks. Within these contexts, their transactions, economic decisions, access to resources, and potential opportunities are heavily influenced by social ties, shared values, and

the surrounding environment (Dacin et al, 1999; Jack & Anderson, 2002). Notably, the local context sets the conditions for social actions that significantly impact business activities. Embeddedness in a specific environment plays a crucial role in entrepreneurial processes, as it determines access to various settings, or the lack thereof (Welter, 2011; Wigren-Kristoferson et al., 2022). The examination of social networks and institutions shaping economic behaviours and outcomes is highly required. An embedded nature offers a holistic view on how business activities unfold within broader social contexts, such as an EE. In essence, embeddedness explains how entrepreneurs gain access to resources, build relationships, and navigate the complex interplay between economic and social factors. Therefore, insights on how interconnections within an EE can stimulate regional growth might be helpful to confirm such theoretical and conceptual framework.

3.2.2. Entrepreneurial Ecosystems and entrepreneurial activity

The academic debate on entrepreneurship often focuses on how the institutional environment influences entrepreneurial activity (Shane, 2003), as governments implement regional policies to establish specific conditions. Indeed, institutional factors, such as regional norms and regulations, can either facilitate or hinder the creation of new business ventures (Baumol, 1996). Consequently, these elements extensively shape the economic landscapes of regions and nations.

An in-depth exploration of trends in entrepreneurial activity provides substantial insights into the health of a business environment. As such, this metric is commonly used to assess the vibrancy and dynamism of an EE. The latter includes trends in the establishment of new firms and the overall level of entrepreneurial activities within a specific area. Indeed, new firms play a vital role in competitive economic dynamics, contributing significantly to regional economic growth, and creating job opportunities (Qian et al., 2013; Reynolds et al., 1994).

The analysis of the determinants and consequences of entrepreneurship has predominantly focused on its geographical aspects. On one hand, empirical studies have highlighted the positive influence of new firm establishments on regional economic development and competitiveness (Davidsson et al., 1994; Fritsch & Schindele, 2011; Mueller et al., 2008; Van Stel & Suddle, 2008). On the other hand, further research has enriched our understanding of this phenomenon, revealing that territorial dynamics and regional factors

considerably influence new firm creation (Guesnier, 1994; Liu & Qian, 2023; Reynolds et al., 1994).

Indeed, the ongoing emergence of new companies across different regions may be influenced by the varied conditions of EEs, encompassing framework, systemic, and human elements that facilitate entrepreneurial activities. These regional disparities might originate from historical processes that have shaped regional economic structures over time (Fotopoulos, 2014), as well as from geographic factors that create unique regional contexts, thereby impacting the levels of entrepreneurial activity. Specific regional factors may collectively influence the generation, recognition, and exploitation of entrepreneurial opportunities. The key challenge lies in effectively fostering entrepreneurial engagement at the regional level. As such, exploring the geographically contextual factors – including the components of an EE – can provide valuable insights for implementing policies that drive regional entrepreneurial growth and sustain the vitality of the entire EE (Stam, 2015).

In light of the foregoing, we propose that a higher quality of the EE index, including its components – framework, systemic, and human conditions – might positively enhance entrepreneurial activity in a specific setting. Accordingly, we present the following hypotheses (Figure 3.1.):

H1a: *Regions exhibiting a higher EE index positively influence entrepreneurial activity*;

H1b: *Regions exhibiting higher framework conditions positively influence entrepreneurial activity*;

H1c: *Regions exhibiting higher systemic conditions positively influence entrepreneurial activity*;

H1d: *Regions exhibiting higher human conditions positively influence entrepreneurial activity*.

3.2.3. Entrepreneurial Ecosystems and productive entrepreneurship

Notwithstanding evaluating the influence of EEs on entrepreneurial activity is crucial, focusing exclusively on this aspect may provide a partial perspective of the EE's intermediate output. Rather, examining its effect on productive entrepreneurship - measured by the prevalence of HGFs (Baumol, 1996) - enables a more comprehensive assessment that considers both the quality and the potential growth of new business ventures within regional EEs.

According to the OECD's definition, HGFs are characterized as companies experiencing an average annual employee growth rate exceeding 20% over three years. Accordingly, these firms are responsible for a substantial proportion of new jobs created,

especially among firms with at least 10 employees (Stam & Bosma, 2015). Overall, researchers concur that HGFs can be defined as *"(…) companies that exhibit growth at or exceeding a certain rate, quantified through growth over a defined period between a starting and ending year or as annualized growth across a specified number of years"* (Coad et al., 2014, p. 95). Specifically, HGFs play a paramount role in stimulating job creation, driving innovation, and contributing to overall economic dynamism. Recognising their relevant impact on business success, numerous scholars (Coad & Srhoj, 2023; Demir et al., 2017; Henrekson & Johansson, 2010) and policymakers (Grover et al., 2019; Flachenecker et al., 2020) have paid attention to their remarkable capacity for generating considerable firm performance. In this scenario, the presence of HGFs within a region is a key indicator of the effectiveness of its EE. A high-performing EE can foster productive entrepreneurship as an important intermediate output (Stam, 2015; Stam & Spigel, 2018), which, in turn, contributes to the creation of aggregate value.

To trigger this growth, Demir et al. (2017) propose a strategic management framework for HGFs, identifying five key contingent drivers: human capital, strategy, human resource management, innovation, and capabilities. Human capital encompasses the education level of employees, along with the expertise of managers and founders. Effective human resource management (Lepak & Snell, 1999), strategic planning (Feeser & Willard, 1990), and innovation positively correlate with high growth. Finally, managerial capabilities are crucial for capturing the necessary financial resources for a company's growth and gaining a competitive advantage (Barney, 1991).

Building on this conceptualisation, we hypothesise that a higher quality level of the EE index, along with its components – framework, systemic, and human conditions – may positively influence the extent of productive entrepreneurship. Therefore, we propose the following hypotheses (see Figure 3.1):

H2a: *Regions exhibiting a higher EE index positively influence productive entrepreneurship*;

H2b: *Regions exhibiting higher framework conditions positively influence productive entrepreneurship*;

H2c: *Regions exhibiting higher systemic conditions positively influence productive entrepreneurship*;

H2d: *Regions exhibiting higher human conditions positively influence productive entrepreneurship*.

3.2.4. Entrepreneurial Ecosystems and regional economic development

Although the relationship between EEs and regional economic development is a well-established topic in the extant literature (Audretsch & Belitski, 2021; Content et al., 2020), its complexity and multifaceted nature offer intriguing opportunities for new insights. A meticulous definition of regional economic development is crucial for a more comprehensive understanding.

Regional economics is often simplistically defined, being superficially associated with the territorial clustering of business activities, such as industrial districts, especially in the Italian context (Becattini, 1989). However, its scope is far deeper involving both location theory and regional development theory.

Location theory, the more traditional branch that emerged in the early 1900s, focuses on the factors that determine the geographical distribution of business activities across different territories (Capello, 2019). Our study more strictly aligns with regional development theory. This theory examines the capacity of subnational systems — such as regions, provinces, or cities — to foster entrepreneurial activities and create conducive conditions to support long-term growth (Camagni et al., 2009). Furthermore, regional economic development reflects a region's ability to produce goods and services that meet the needs of broader national and international EE. It covers both qualitative and quantitative aspects of a region, such as the entrepreneurial environment and employment opportunities, and involves assessing these factors in comparison with other regions (Malecki, 1991).

Therefore, regional economic development can be defined as the efficient application of economic processes and resources within a specific region, aligning with the values and expectations of both companies and the wider community (Stimson et al., 2006). In this context, a significant correlation exists between the elements within EEs and regional economic development, with these elements serving as key drivers of regional growth (Acs et al., 2017).

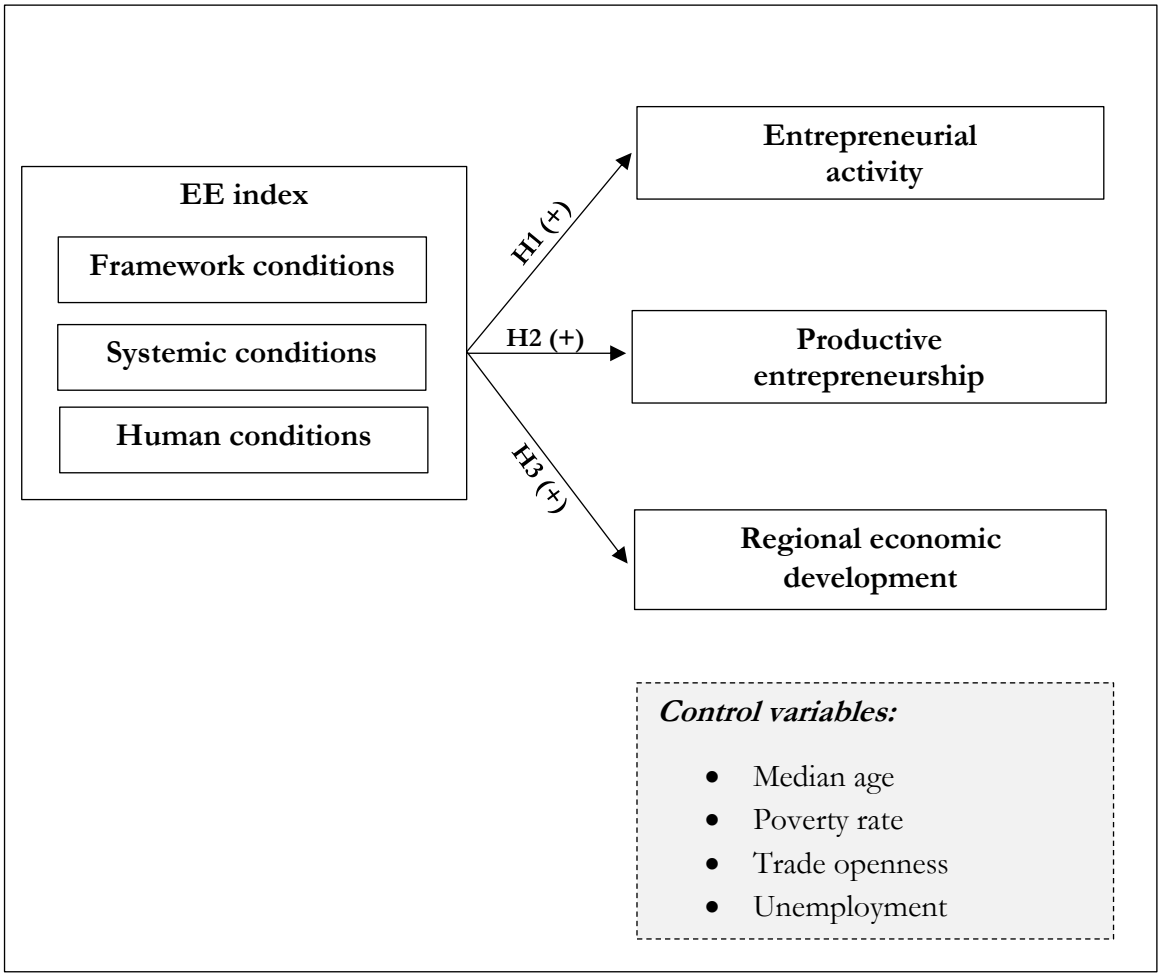
Based on our previous discussions, we assume that a higher quality level of the EE index, alongside its components – framework, systemic, and human conditions – could positively influence regional economic development. Thus, we posit our second set of hypotheses as follows (Figure 3.1.):

> **H3a**: *Regions exhibiting a higher EE index positively influence regional economic development;*
>
> **H3b**: *Regions exhibiting higher framework conditions positively influence regional economic development***;**

H3c: *Regions exhibiting higher systemic conditions positively influence regional economic development***;**

H3d: *Regions exhibiting higher human conditions positively influence regional economic development***.**

Figure 3.1. Research empirical model



Source: Authors' elaboration

3.3. Methodology

3.3.1. Sample

To test our hypotheses, we gathered data for the twenty Italian regions[8] at the NUTS-2 level during the years 2009 to 2019. Data collection was carried out using various sources, including Eurostat, OECD, and other Italian databases (Table 3.1.). The selection of

[8] The classification of the twenty Italian regions is in line with the approaches used in recent geographic studies in this field (Boffardi, 2022; Guccio et al., 2019) and is also consistent with ISTAT's categorisation system.

indicators was based on their relevance to our study, their availability, and the possibility of comparison across regions. This data was subsequently organised into a comprehensive EE index and three sub-indexes: framework, systemic, and human conditions (Figure 3.1. and Table 3.1.).

The choice of the Italian context stems from several factors. First, Italy claims a rich history of entrepreneurship, ranging from traditional craftsmanship to the development of innovative sectors (Bonfanti et al., 2018; Camuffo & Grandinetti, 2011), exhibiting a unique combination of established and emerging industries. Second, Italy presents significant regional disparities in economic growth and entrepreneurial activity (Del Monte et al., 2020). Investigating these regional differences could reveal best practices for addressing regional imbalances and promoting inclusive development. Third, the Italian experience may offer valuable knowledge for less developed regions and serve as a reference point to identify strengths and opportunities. Finally, the analysis of the Italian context is insightful for implementing targeted policy interventions, identifying areas requiring improvement, and providing support for new business ventures.

Table 3.1. Components of the Entrepreneurial Ecosystem Index

EE Conditions: EE index and Sub-indexes	Indicator	Indicator Definition	Source	Year	Indicator weight in Sub-index	Indicator weight in EE Index
EE index						
FRAMEWORK CONDITIONS	1. Voice and accountability index	Index reflecting the degree of citizen participation in public elections, engagement in civic and social associations, the number of social cooperatives, performance on INVALSI tests, and cultural vibrancy as measured by the number of books published	Italian of Society and Industrial Economics Policy (SIEPI)	2009-2019	1/7	1/21
	2. Government effectiveness index	Index measuring the availability of economic and social structures in Italian regions, along with the effectiveness of regional	Italian of Society and Industrial Economics Policy (SIEPI)	2009-2019	1/7	1/21

		governments in implementing policies, such as waste management, and environmental protection				
	3. Regulatory quality index	Index refers to the economy's openness, the firms mortality rate, and business density	Italian of Society and Industrial Economics Policy (SIEPI)	2009-2019	1/7	1/21
	4. Rule of law index	Index comprising data on crimes against individuals or property, magistrate productivity, trial times, tax evasion and the shadow economy	Italian of Society and Industrial Economics Policy (SIEPI)	2009-2019	1/7	1/21
	5. Corruption index	Index of crimes against the Public Administration, as well as the frequency of local governments being overruled by federal authorities, and the Golden-Picci Index	Italian of Society and Industrial Economics Policy (SIEPI)	2009-2019	1/7	1/21
	6. Digital infrastructures	Percentage of households with Internet access at home	Eurostat	2009-2019	1/7	1/21
	7. Physical infrastructures	Motorway and railway potential accessibility index	Messina (2007)	2007	1/7	1/21
SYSTEMIC CONDITIONS	8. Finance	The share of loans issued to households and firms relative to the Value Added	Bank of Italy and Istat	2009-2019	1/7	1/21
	9. New knowledge	Share of research institutions and experimental stations for research (expressed as a percentage)	Istat	2009-2019	1/7	1/21
	10. Turnover rate (birth rate-	Net turnover rate of firms	Istat	2009-2019	1/7	1/21

	exit rate of firms)	(expressed as a percentage)				
	11. Government expenditure on R&D	Share of R&D expenditure in GDP (GERD)	Eurostat	2009-2019	1/7	1/21
	12. Business sector expenditure on R&D	R&D expenditure per capita (BERD)	Eurostat	2009-2019	1/7	1/21
	13. Professional and technology sector	Share of professional, scientific and technical activities; administrative and support service activities (percentage in total active enterprises)	Eurostat	2009-2019	1/7	1/21
	14. Information and communication sector	Share of information and communication firms (percentage in total active enterprises)	Eurostat	2009-2019	1/7	1/21
HUMAN CONDITIONS	15. Migration flow	Difference population between immigrants and emigrants over resident population (expressed as a percentage)	Istat	2009-2019	1/7	1/21
	16. Population structure	Share of the population in the 24 to 39 years old age group	Istat	2009-2019	1/7	1/21
	17. Higher education	Percentage of higher educated in the adult population (from 25 to 64 years old age)	Istat	2009-2019	1/7	1/21
	18. R&D personnel and researchers	People employed in R&D over the total population (percentage)	Eurostat	2009-2019	1/7	1/21
	19. Income level	Household income level per capita	Eurostat	2009-2019	1/7	1/21
	20. Tertiary education	People with tertiary education over the total	Eurostat	2009-2019	1/7	1/21

		population				
	21. Employment in science and technology	People employed in science and technology over the total population (percentage)	Eurostat	2009-2019	1/7	1/21

Source: Our elaboration based on Iacobucci & Perugini (2021)

We divided the sample into two distinct subsamples to conduct a detailed analysis of regional differences: a) developed regions, and b) transitioning and less developed regions. This classification followed the guidelines of the EU Regional Policy and Cohesion Policy for 2014-2020[9], which are fully consistent with the timeframe of our study.

Initially, we found the critical GDP per capita threshold for a trustworthy categorisation of the regions. This process involved the comparison with the GDP per capita of each Italian region to the EU-27 average, following the guidelines of the EU Regional Policy and Cohesion Policy for 2014-2020. Then, we used Eurostat data on the EU-27 average GDP per capita for 2020 to classify the regions. Regions with a GDP per capita exceeding 90% of the EU-27 average are categorised as developed, while those falling below this threshold are classified as transitioning or less developed regions. As highlighted in Table B1(see Appendix B), Southern Italy is recognised as one of the less developed areas within the EU. This designation reflects various institutional challenges, such as inadequate infrastructure and limited support services for businesses, as well as socio-economic and human disparities when compared to the more developed central and northern regions of Italy.

3.3.2. Crafting Measures via Composite Index Methodology

In our study, we constructed the EE index and its three sub-indexes - framework, systemic, and human conditions - by aggregating various indicators (see Table 3.1.) using a composite index methodology[10]. A typical composite indicator is generally structured as follows (Freudenberg, 2003: 7):

[9] For additional information, please refer to: https://ec.europa.eu/regional_policy/20212027_en#:~:text=EU%20Cohesion%20Policy%20contributes%0to,the%20green%20and%20digital%20transition.

[10] Composite indexes are frequently used in economic and business statistics to evaluate and compare the relative progress of countries or regions in various policy areas, including competitiveness, innovation, and entrepreneurship. While some researchers reveal concerns about their susceptibility to manipulation (Grupp &

$$I = \sum_{i=1}^{n} w_i X_i$$

where I represents the composite index; X_i denotes normalised variable; w_i are their respective weight (with $\sum_{i=1}^{n} w_i = 1$ and $0 \leq w \leq 1$), and i ranges from 1,…, n.

To ensure comparability across different measurement units, we normalised the data on a 0–10 scale using the min-max method, as recommended by the OECD (2008: 85). Higher values on this scale indicate superior performance. The EE index and its sub-indexes were derived by averaging these normalised values, with each component receiving equal weighting (Table 3.1.). Although there are various methods for assigning weights, such as factor analysis and principal component analysis, our study adopts the equal weighting approach. This approach is in line with the OECD's (2008: 31) recommendation, which suggests equal weighting in cases where knowledge about causal relationships is limited or when there is no consensus on alternative methods. In this way, each variable contributes equally to the composite index, preventing any potential imbalances that might result from assigning unequal weights to dimensions, particularly when they encompass varying numbers of variables. Specifically, the index for each region (I_r) was computed as follows:

$$I_r = \Sigma_{j=1}^{J} \Sigma_{m=1}^{M} w_{jm}\{(\mathrm{X}_{jmr} - \mathrm{X}_{jm}^{min})/ (\mathrm{X}_{jm}^{max} - \mathrm{X}_{jm}^{min})\}$$

where r signifies region, j and m are indicators and elements subscripts; min and max denote the minimum and maximum values of each indicator across regions.

Building on the frameworks proposed by Stam (2015) and Iacobucci & Perugini (2021), our EE index encompasses three key components: framework, systemic, and human conditions. We expanded the scope of EE elements, with each component comprising seven indicators. This enlargement resulted in a total of twenty-one indicators for the overall EE index.

Furthermore, we carried out many robustness and reliability tests (see Table B2 in Appendix B). First, we computed Cronbach's alpha coefficient for each latent dimension (Table B2 – Appendix B) to corroborate the strong correlation among the identified components (Anderson & Gerbing, 1988). The adequacy of each index, as reflected in its

Mogee, 2004), others argue that, when applied correctly and within a solid theoretical framework, these indexes can be extremely valuable tools (Archibugi et al., 2009).

Cronbach's alpha values, exceeds the 0.70 threshold, indicating acceptable reliability (Nunnally, 1978). This suggests that the indicators are influenced by common factors, consistent with our conceptual model and that they consistently measure the same underlying construct (OECD, 2008: 71–2). Second, we performed the Confirmatory Factor Analysis (CFA) (Table B2 - Appendix B). The indicators for each component and the main indexes are grouped into factor aggregates, thus demonstrating the validity of our constructs. Third, we calculated the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. The KMO values exceed the critical threshold of 0.50 (Table B2 – Appendix B) (Hair et al., 1979), meeting the prerequisites for factor analysis and demonstrating the appropriateness of our data for such analyses. Finally, Bartlett's test of sphericity shows highly significant results in each case.

3.3.3. Description of the variables

Dependent variables

- ***Regional economic development*** has been measured in various ways in previous literature. Some regional studies use employment growth or income level as indicators (Fritsch & Mueller, 2008; Glaeser et al., 2010), while others employ Gross Value Added (GVA) (Agarwal et al., 2010; Content et al., 2020). Following the suggestion of Audretsch & Belitski (2021), we used GDP per capita (Table 3.2.). Utilising such a metric allows to standardise each region's economic performance, rather than merely considering the value at constant prices. This approach enables meaningful comparative analysis between regions, accounting for variations in population size. The label is *GDP_pc*.
- ***Entrepreneurial activity***, as defined by the Global Entrepreneurship Monitor (GEM), emerges from the interplay between an individual's ability to recognise an opportunity and its motivation and skills to seize it, combined with the specific conditions in the environment. Hence, entrepreneurial activity is not merely the result of individual effort but is deeply influenced by the surrounding context where the entrepreneurial venture occurs. In our study, entrepreneurial activity refers to the rate of new business per capita in each region (Qian et al., 2013). We use the per capita measurement due to its usefulness in facilitating meaningful comparisons between regions with different population sizes (Table 3.2.). This approach is

especially valuable in evaluating the impact of an EE on entrepreneurial activity, as the metric of new firms per capita offers a nuanced perspective. It helps us understand how entrepreneurship is influenced by, and in turn influences, the economic and social dynamics within a specific region. The label is *new_firms_pc*.

- ***Productive entrepreneurship*** was measured as the number of HGFs on total active enterprises with at least 10 employees, aligning with approaches used in previous studies (Henrekson & Johansson, 2010; OECD, 2011; Stam & Bosma 2015; Stam & van de Ven, 2021). This approach captures the presence of HGFs within the regional business environment. The label is *HGF_share*.

Explanatory variables

EE index represents the primary independent variable in our analysis. We developed this index at the NUTS-2 regional level, aligning with the framework suggested by Stam & van de Ven (2021). Although this approach differs from the perspective of Iacobucci & Perugini (2021), we deem that the regional level is more suitable for capturing the unique attributes of an EE. The regional level offers a broader scope than the provincial, particularly considering policy implications. Legislative and policy decisions at the regional level tend to have more extensive impacts, affecting multiple provinces within a region. This wider outlook enables a comprehensive evaluation of how regional policies, resources, and institutions collectively shape entrepreneurial activity, productive entrepreneurship, and regional economic development. Conversely, focusing merely on the provincial level might overlook the prevailing synergies and interdependencies across provinces within a huge regional context.

Despite the limitations imposed by data availability, we attempted to select variables that effectively represent the key characteristics and dimensions of an EE, consistent with recommendations from existing literature (Stam, 2015; Stam & Van de Ven, 2021).

Therefore, we moved the current body of knowledge forward on the EE index by involving further items that might capture the broadness of a regional EE. As a result, our selection is more exhaustive, since it consists of 21 indicators regarding the time frame "2009-2019" (see Table 3.1.). The label is *ee_index*.

The geographical distribution of the EE index is depicted in Figure 3.2. using quintile-based interpolation. This visualisation stems from the average EE index score for the period 2009-2019, reflecting the regional performance of EEs. Regions with darker shades,

predominantly in Northern Italy, indicate higher EE index values. The map strongly highlights regional disparities, with Central Italy representing transitional areas. Southern Italy, marked by lower EE index scores, emphasises the relevance of this study for policymakers and practitioners in understanding and addressing the regional level.

Figure 3.2. Performance of the EE index across Italian NUTS-2 Regions (2009-2019)

EE INDEX RANGE	REGIONS *(From worst to best performance)*
0.00 – 6.50	Calabria, Sicilia, Puglia, Sardegna, Campania, Basilicata
6.50 – 9.50	Molise, Abruzzo, Veneto, Valle d'Aosta
> 10.00	Liguria, Umbria, Marche, Piemonte, Friuli-Venezia Giulia, Toscana, Trentino-Alto Adige, Emilia-Romagna, Lazio, Lombardia

Source: Authors' elaboration from Datawrapper (https://www.datawrapper.de/)

To gain deeper insights into how different facets of the EE influence our dependent variables, we classified the explanatory variables in three conditions, representing a unique domain of EE. These dimensions are outlined below:

- ***Framework conditions.*** This sub-index comprises variables numbered from 1 to 7 (refer to Table 3.1.) and relates to the base level of the EE, combined with the others through a logical interrelationship. The elements within the framework conditions delineate the institutional environment underpinning the EE (Stam & Van de Ven, 2021). The label is *fram_cond*.
- ***Systemic conditions.*** This dimension encompasses variables marked 8 to 14 (Table 3.1.) and is defined as the core of the system (Stam, 2015, p. 5). Such systemic perspective allows for a more comprehensive examination of entrepreneurship regarding the interactions between multiple stakeholders and various contextual factors (Erina et al., 2017; Roundy et al., 2018). The label is *syst_cond*
- ***Human conditions.*** This sub-index includes variables numbered 15 to 21 (Table 3.1.) and pertains to the human capital characteristics that define an EE. In particular,

this dimension can either support or hinder the development of new business creation, making it a crucial component of any EE (Florida et al., 2008). The label is *hum_cond*.

Table 3.2. Description of the variables

Name	Label	Description	Related literature	Data source	Year
Dependent variables					
1)Regional economic development	*GDP_pc*	GDP per capita	(Audretsch & Belitski, 2021)	Eurostat	2009-2019
2)Entrepreneurial activity	*new_firms_pc*	New firms registered per capita	(Stam, 2015)	Movimprese	2009-2019
3)Productive entrepreneurship	*HGF_share*	Share of high growth firms measured in employment: number of high growth enterprises divided by the number of active enterprises with at least 10 employees - percentage	(Harima, 2020; Spigel & Harrison, 2018; Stam & van de Ven, 2021)	Eurostat	2011-2019
Independent variables					
1)EE index	*ee_index*	Entrepreneurial Ecosystem index	(Iacobucci & Perugini, 2020, 2021; Stam, 2018; Stam & Van de Ven, 2021)	Various sources (see Table 3.1.)	2009-2019
2)Framework conditions	*fram_cond*	The foundational institutional framework supporting the EE	Audretsch & Belitski, 2017; Stam, 2015	Various sources (see Table 3.1.)	2009-2019
3)Systemic conditions	*syst_cond*	Resource endowments defininig a specific context	Malecki, 2018; Miles & Morrison, 2020)	Various sources (see Table 3.1.)	2009-2019
4)Human conditions	*hum_cond*	Human capital features affecting the EE	Iacobucci & Perugini, 2021; Perugini, 2023	Various sources (see Table 3.1.)	2009-2019
Control variables					
1)Median age	*median_age*	Indicator of the median age of the population	(Audretsch & Belitski, 2021)	Eurostat	2009-2019
2)Unemployment	*unemployment*	People per square kilometre living in a specific area	(Bruns et al., 2017; Content et al., 2020)	Eurostat	2009-2019
3)Trade openness	*trade_openness*	(Import+Export)/GDP	(Iacobucci & Perugini, 2021; Yoruk et al., 2023)	Istat	2009-2019
4)Risk of poverty rate	*risk_poverty_rate*	The percentage of individuals with a disposable income (post-social transfers) falling below the poverty threshold, defined as 60% of the national average income, adjusted for equivalence and considering disposable income after social transfers.	(Santos et al., 2022)	Eurostat	2009-2019

Control variables

Consistently with prior research, our analysis deems several control variables to account for key socioeconomic factors at the NUTS-2 level, which may influence regional economic development, entrepreneurial activity, and productive entrepreneurship. Notably, they include trade openness (Iacobucci & Perugini, 2021; Yoruk et al., 2023), median population age (Audretsch & Belitski, 2021), unemployment rate (Bruns et al., 2017; Content et al., 2020), and the percentage of people at risk of poverty (Santos et al., 2022).

3.3.4. Regression model specification

Dynamic panel data analysis was used to test our hypotheses. The dynamic GMM, developed by Arellano & Bover (1995) and Blundell & Bond (1998), was applied for several reasons. Firstly, our time span (*t*) is relatively small, and fixed-effects estimation is not suitable (Baltagi, 2005). Secondly, the dynamic specification was employed, since the level of GDP per capita exhibits considerable stability over time (Roodman, 2009a). By contrast, a static specification might yield biased estimates by failing to consider how previous values might influence the current level of the dependent variable. Therefore, our model incorporates the first lag of the dependent variable as a covariate. Due to its setting, unobservable individual effects are correlated with the prior value of the dependent variable, making standard estimators inconsistent. Furthermore, this method allowed us to tackle the potential endogeneity of the explanatory variables using internal instrumental variables. While we expect the dependent variables to be influenced by the level of the EE index, there is also a potential issue of reverse causality, where the outcomes might in turn affect the components of the EE (Bruns et al., 2017). To account for this possible issue, we conducted GMM estimation to address the endogeneity concern (Arellano & Bond, 1991; Blundell & Bond, 1998). The models are formulated as follows:

$$New\_firms\_pc_{r,t} = \rho New\_firms\_pc_{r,t-1} + \beta_1 EE\_index_{r,t} + \beta_3 Control\_variables_{r,t} + \varepsilon_{r,t} \quad (1)$$

$$HG\_firms_{r,t} = \rho HG\_firms_{r,t-1} + \beta_1 EE\_index_{r,t} + \beta_3 Control\_variables_{r,t} + \varepsilon_{r,t} \quad (2)$$

$$GDP\_pc_{r,t} = \rho GDP\_pc_{r,t-1} + \beta_1 EE\_index_{r,t} + \beta_3 Control\_variables_{r,t} + \varepsilon_{r,t} \quad (3)$$

where r and t indicate regions and years, β the estimating coefficients, and ε the error term.

We employed STATA's *xtabond2* command for running various regression models (Roodman, 2009b). Given that the number of regions in our panel data is not substantially larger than the number of years, we opted for a one-step GMM estimation. In cases of smaller samples, the standard errors of coefficients in two-step GMM estimation might be biased downwards, as outlined by Bond et al. (2001) and Windmeijer (2005). To ensure the robustness of our analysis, we conducted two diagnostic tests: the Arellano-Bond test for second-order serial correlation and the Sargan test for overidentifying restrictions, which relates to the reliability of the instrumental variables in our one-step system GMM diagnostics (Arellano & Bond, 1991). In this regard, the results of these tests are reported in Section 3.4.

3.4. Results

3.4.1. Descriptive statistics

Table 3.3. shows the descriptive statistics for the full sample and the two subsamples. The table provides a comprehensive range of statistics, including mean (Mean), median (p50), standard deviation (Std. Dev), minimum (Min), and maximum (Max) values, enabling for a detailed understanding of the distribution and variation of each variable across regions.

With reference to the dependent variables, entrepreneurial activity (i.e., *new_firms_pc*) appears similar in both developed and less developed regions. However, significant differences emerge in productive entrepreneurship (i.e., *HGF_share*), which shows a higher mean in less developed regions (mean of *HGF_share* = 10.55). This could imply a greater proportion of rapidly growing firms in the areas above mentioned. Moreover, regional economic development (i.e., *GDP_pc*) is remarkably higher in developed regions, reflecting a disparity in economic wealth.

Examining the independent variables, the higher mean EE index score in developed regions (mean of *GDP_pc* = 31,248) indicates a stronger EE compared to less developed regions (mean of *GDP_pc* = 18,887). This implies that developed regions hold more favourable institutional environments for entrepreneurship (i.e., *fram_cond*), as well as major resource availability (i.e., *syst_cond*), and human capital (i.e., *hum_cond*).

Regarding the control variables, less developed regions show higher *unemployment* rates, which might influence entrepreneurial activities and regional development. In developed regions, the median age is slightly higher, indicating demographic differences. The *risk_poverty_rate* is elevated in less developed areas, pointing to socio-economic challenges. Furthermore, developed regions demonstrate notably higher *trade_openness*, suggesting a

greater integration in international networks. Overall, Table 3.3. highlights significant disparities between developed and less developed regions in Italy concerning entrepreneurial activity and regional economic development. These initial findings are crucial for understanding regional differences and driving policymakers towards fostering balanced economic growth.

Table 3.4. highlights Pearson correlation coefficients between independent and control variables, conducted to identify potential multicollinearity issues. The results indicate no statistically significant concerns, except for the correlation among *risk_poverty_rate* and *unemployment*. This suggests that these variables may capture overlapping aspects of regional economic circumstances. Despite this correlation, each variable contributes distinct and nuanced insights into the socio-economic landscape. The unemployment rate indicates the labour market efficacy, reflecting workforce engagement and economic productivity. Conversely, poverty rates provide a broader view of overall economic well-being, encapsulating factors such as income inequality, social security, and living costs. The inclusion of both variables aligns with previous research emphasising their individual and collective importance in exploring regional economic conditions (Danson et al., 2021; Laffineur et al., 2017). For instance, in low GDP per capita regions, high entrepreneurship rates often originate from limited labour opportunities, positioning self-employment as a pathway out of poverty (Torres & Eminet, 2004). In contrast, regions with higher GDP per capita offer more conducive environments for business ownership due to better financial, human, and technological resources (Wennekers et al., 2005, 2010).

Therefore, the inclusion of both poverty and unemployment rates in the model facilitates a comprehensive understanding of the regional economic environment. It enables multi-dimensional analysis, considering both employment dynamics and wider socio-economic conditions, critical for developing meaningful policy recommendations. To substantiate these findings, we also conducted Variance Inflation Factor (VIF) tests. The resulting values suggest that multicollinearity is not a severe concern in this model, as they are far from the critical threshold of 10 (Hair et al., 2010).

Table 3.3. Descriptive statistics

	Full sample					Developed regions					Less developed regions				
	Mean	p50	Std. Dev	Min	Max	Mean	p50	Std. Dev	Min	Max	Mean	p50	Std. Dev	Min	Max
Dependent variables															
new_firms_pc	0.01 (220)	0.001 (220)	0.00 (220)	0.00 (220)	0.01 (220)	0.01 (143)	0.01 (143)	0.01 (143)	0.00 (143)	0.01 (143)	0.02 (77)	0.01 (77)	0.00 (77)	0.01 (77)	0.01 (77)
HGF_share	9.18 (180)	8.79 (180)	2.31 (180)	5.24 (180)	16.50 (180)	8.45 (117)	8.00 (117)	1.90 (117)	5.24 (117)	12.10 (117)	10.55 (63)	9.79 (63)	2.40 (63)	6.54 (63)	16.50 (63)
GDP_pc	26,922 (220)	27,600 (220)	7157 (220)	16,300 (220)	43,900 (220)	31,248 (143)	30,800 (143)	4,843 (143)	22,600 (143)	43,900 (143)	18,887 (77)	18,600 (77)	1,771 (77)	16,300 (77)	23,300 (77)
Independent variables															
ee_index	9.378 (220)	9.88 (220)	2.99 (220)	3.67 (220)	14.84 (220)	11.30 (143)	10.99 (143)	1.62 (143)	8.35 (143)	14.84 (143)	5.82 (77)	18,600 (77)	1.03 (77)	3.70 (77)	8.13 (77)
fram_cond	3.99 (220)	4.46 (220)	1.38 (220)	1.02 (220)	5.88 (220)	4.91 (143)	4.89 (143)	0.55 (143)	3.64 (143)	5.88 (143)	2.27 (77)	2.38 (77)	0.58 (77)	1.03 (77)	3.06 (77)
syst_cond	2.14 (220)	2.03 (220)	0.85 (220)	0.51 (220)	4.59 (220)	2.54 (143)	2.33 (143)	0.77 (143)	1.06 (143)	4.59 (143)	1.44 (77)	1.43 (77)	0.41 (77)	0.51 (77)	2.65 (77)
hum_cond	3.24 (220)	3.38 (220)	0.99 (220)	1.44 (220)	5.46 (220)	3.85 (143)	3.69 (143)	0.62 (143)	2.67 (143)	5.46 (143)	2.11 (77)	2.05 (77)	0.35 (77)	1.44 (77)	3.25 (77)
Controls variables															
unemployment	11.04 (220)	9.73 (220)	5.10 (220)	3.23 (220)	23.68 (220)	8.00 (143)	7.92 (143)	2.25 (143)	3.23 (143)	12.90 (143)	16.69 (77)	15.60 (77)	3.99 (77)	8.48 (77)	23.68 (77)
median_age	45.22 (220)	45.30 (220)	2.19 (220)	39.10 (220)	51.00 (220)	45.98 (143)	45.90 (143)	1.84 (143)	41.55 (143)	51.00 (143)	43.82 (77)	43.80 (77)	2.12 (77)	39.10 (77)	48.30 (77)
risk_poverty_rate	19.28 (220)	14.60 (220)	10.20 (220)	6.10 (220)	44.60 (220)	12.66 (143)	11.80 (143)	3.80 (143)	6.10 (143)	25.80 (143)	31.56 (77)	30.90 (77)	6.09 (77)	18.30 (77)	44.60 (77)
trade_openness	36.16 (220)	33.59 (220)	17.00 (220)	2.67 (220)	68.77 (220)	45.05 (143)	43.56 (143)	14.74 (143)	15.39 (143)	68.77 (143)	23.35 (77)	21.44 (77)	13.08 (77)	2.67 (77)	56.53 (77)

Note: No. of observations in parentheses.

Table 3.4. Correlation matrix, 2009-2019

	VIF	1	2	3	4	5
1.ee_index	3.75	1.00				
2.median_age	1.48	0.44***	1.00			
3.risk_poverty_rate	6.51	-0.83***	-0.51***	1.00		
4.unemployment	4.67	-0.78***	-0.34***	0.87***	1.00	
5. trade_openness	1.76	0.64***	0.41***	-0.59***	-0.53***	1.00

N = 220
*p < 0.10; **p < 0.05; ***p < 0.01

3.4.2. Empirical findings

The results of the GMM regression analysis are set out in Tables 3.5. to 3.13. At the outset, our quantitative analysis focuses on the relationships between the independent variables (i.e., *ee_index*, *fram_cond*, *syst_cond*, *hum_cond*) and entrepreneurial activity. This includes an examination of the full sample and distinct sub-samples for developed and less developed regions. Afterward, we broaden our analysis to encompass other dependent variables, such as productive entrepreneurship and regional economic development.

EE index and entrepreneurial activity

Table 3.5. shows the results of the panel data estimations using the GMM model for the full sample. The dependent variable is the rate of new firm creation per capita (*new_firms_pc*) over the period 2009-2019. In essence, the EE index does not demonstrate a significant direct effect on the creation of new ventures within the full sample. However, a deeper examination of the sub-index components reveals nuanced effects. Framework conditions exert a significant negative influence on new firm creation ($\beta = -12.52$; $p < 0.01$), indicating that certain institutional or infrastructural elements might act as barriers to entrepreneurial activities. Conversely, human conditions exhibit a positive impact ($\beta = 6.19$; $p < 0.05$), underlining the pivotal role of human capital in encouraging the establishment of new businesses. Control variables do not yield statistically significant results, except for *median_age*, which has a negative influence across all models. This effect is particularly significant in Model 2 ($p < 0.01$). To delve deeper into insights, we carried out a similar analysis in the sub-samples of developed (Table 3.6.) and less developed regions (Table 3.7.). Notably, in Models 1(*ee_index* on *new_firms_pc*; $\beta = 1.38$; $p < 0.1$), 3 (*syst_cond* on *new_firms_pc*; $\beta = 3.94$; $p < 0.05$), and 4 (*hum_cond* on *new_firms_pc*; $\beta = 6.58$; $p < 0.01$) there are positive associations with entrepreneurial activity. Aligned with the results in the full sample, *fram_cond*

reveal a negative relationship ($\beta = -11.72$; $p < 0.01$). By contrast, in Table 3.7. *fram_cond* were not statistically significant, while the *ee_index* ($\beta = 19.30$; $p < 0.01$), *syst_cond* ($\beta = 27.10$; $p < 0.01$), and *hum_cond* ($\beta = 67.37$; $p < 0.01$) demonstrate a greater statistical significance compared to the prior models estimated. Referring to control variables, *unemployment* consistently exhibits a significant negative impact across all models (Table 3.6.), suggesting that higher unemployment rates in developed regions may hinder new business creation. Trade openness shows a negative effect in some models (Table 3.6.), which might indicate that increased global integration affects new firm formation in complex ways. Interestingly, the *risk_poverty_rate* appears to have a consistently positive effect (Table 3.6.), implying that in developed regions, areas with higher poverty risk may show more entrepreneurial activity, potentially as a means of economic self-reliance. In contrast to the findings in developed regions, in less developed regions demonstrates a different pattern of influence on entrepreneurial activity (Table 3.7.). This suggests that in these regions, higher poverty rates are associated with decreased entrepreneurial activity.

The reliability of the empirical models is corroborated by several key metrics. The *Wald Chi2* statistics for all models show a statistical significance at the $p < 0.01$ level. Furthermore, the *Mean VIF* for each model is below the critical threshold of 10 (Hair et al., 1979). Therefore, the multicollinearity is not a severe issue. Additionally, we performed two diagnostic tests: the Arellano–Bond test for second-order correlation in the first differenced residuals and the Sargan test for over-identifying restrictions. The purpose of the first test is to ensure that our one-step GMM estimator does not present serial correlation problems. Consequently, *AR(2) p-values* suggest the absence of second-order autocorrelation, thereby validating the assumptions underpinning the GMM model. The results of *Sargan* test, with acceptable *p-values*, indicate that the instruments employed in the model are well-founded and that there are no significant concerns inherent to the proliferation of instruments. Such factors collectively confirm the trust worthiness of our findings.

Table 3.5. Panel data estimations with GMM model – entrepreneurial activity (*Full sample*)

Y = new_firms_pc **(2009-2019)**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
ee_index	0.75		-	-
	(1.60)			
fram_cond	-	**-12.52*** **	-	-
		(4.85)		
syst_cond	-	-	4.09	-
			(2.81)	
hum_cond	-	-	-	**6.19** **
				(3.13)
median_age	**-2.47** **	**-2.33*** **	**-2.35***	**-2.62** **
	(1.18)	(0.89)	(1.23)	(1.17)
unemployment	-1.10	-1.59	-0.89	-1.02
	(0.95)	(0.98)	(0.92)	(0.87)
trade_openness	-0.18	-0.23	-0.16	-0.21
	(0.17)	(0.19)	(0.16)	(0.16)
risk_poverty_rate	-0.17***	-0.70	-0.28	-0.45
	(0.46)	(0.46)	(0.47)	(0.44)
depeloped_regions	-10.47	9.06	-11.76	**-12.97***
	(8.36)	(10.32)	(7.81)	(7.72)
No. Of Observations	200	200	200	200
No. Of groups	20	20	20	20
Wald chi2	**820.55*** **	**959.00*** **	**776.81*** **	**714.00*** **
AR(2) *p value*	0.253	0.240	0.239	0.254
Sargan	0.109	0.036	0.163	0.053
Mean VIF	3.34	4.52	2.78	3.12

Note: Heteroskedasticity-robust standard errors in parentheses; The values in bold highlight the significance of the variables of interest; The values in models have been multiplied x100,000.
*p < 0.10; **p < 0.05; ***p < 0.01

Table 3.6. Panel data estimations with GMM model – entrepreneurial activity (*Developed regions*)

Y = new_firms_pc **(2009-2019)**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
ee_index	**1.38*** (0.75)	-	-	-
fram_cond	-	**-11.72***** (3.60)	-	-
syst_cond	-	-	**3.94**** (1.70)	-
hum_cond	-	-	-	**6.58***** (1.74)
median_age	0.49 (1.21)	-1.53 (1.22)	0.17 (1.29)	-0.86 (1.21)
unemployment	**-3.02***** (0.97)	**-3.41***** (0.98)	**-3.18***** (0.88)	**-2.67***** (0.84)
trade_openness	**-0.24***** (0.11)	-0.64 (0.17)	**-0.29***** (0.98)	**-0.31***** (0.95)
risk_poverty_rate	**1.59***** (0.32)	**1.14**** (0.53)	**1.44***** (0.42)	**1.47***** (0.39)
No. Of Observations	130	130	130	130
No. Of groups	13	13	13	13
Wald chi2	**3171.07*****	**5948.28*****	**3045.15*****	**3395.96*****
AR(2) *p value*	0.589	0.472	0.543	0.603
Sargan	0.458	0.416	0.413	0.459
Mean VIF	1.76	2.00	1.75	1.70

Note: Heteroskedasticity-robust standard errors in parentheses; The values in bold highlight the significance of the variables of interest; The values in models have been multiplied x100,000.
*p < 0.10; **p < 0.05; ***p < 0.01

Table 3.7. Panel data estimations with GMM model – entrepreneurial activity (*Less developed regions*)

Y = new_firms_pc **(2009-2019)**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
ee_index	**19.30***** (3.32)	-	-	-
framework_conditions	- 12.88 (13.22)	-	-	
systemic conditions	-	-	**27.10***** (7.46)	-
human_conditions	-	-	-	**67.37***** (18.46)
median_age	-11.00 (1.67)	-7.44*** (2.34)	**-7.30***** (2.18)	**-12.39***** (2.32)
unemployment	-1.49 (1.97)	-1.67 (1.89)	-2.30 (1.92)	-1.20 (1.69)
trade_openness	-0.28 (0.38)	-0.13 (0.44)	-0.25 (0.36)	0.80 (0.38)
risk_poverty_rate	**-1.07***** (0.41)	-0.90 (0.64)	**-1.64***** (0.51)	**-1.30**** (0.57)
No. Of Observations	70	70	70	70
No. Of groups	7	7	7	7
Wald chi2	**7678.40***	**195.99***	**6488.55***	**4974.42***
AR(2) *p value*	0.210	0.389	0.248	0.284
Sargan	0.198	0.389	0.250	0.240
Mean VIF	1.74	1.74	1.43	1.83

Note: Heteroskedasticity-robust standard errors in parentheses; The values in bold highlight the significance of the variables of interest; The values in models have been multiplied x100,000.
*p < 0.10; **p < 0.05; ***p < 0.01

EE index and productive entrepreneurship

Table 3.8. presents the results of the panel data estimations using the GMM model for the entire sample. The dependent variable is the share of HGFs (*HGF_share*) over the period 2011-2019. We selected this specific period based on the data availability from Eurostat, which provides information on the prevalence of HGFs among active businesses during these years. In this context, the EE index emerges as a significant and positive driver of productive entrepreneurship ($\beta = 0.26$; $p < 0.01$). This finding underscores that a well-structured and supportive EE is conducive to the growth and development of HGFs. Although framework conditions are not statistically significant, both systemic ($\beta = 0.67$; $p < 0.01$) and human conditions ($\beta = 0.46$; $p < 0.05$) displayed a pronounced positive influence on the share of HGFs. This emphasises the critical role that systemic structures and human resources play in nurturing productive entrepreneurship. Interestingly, the median age of the workforce consistently emerged as a significant variable across all models, indicating that a more experienced workforce might contribute positively to the prevalence of HGFs.

In the full-sample analysis (Table 3.8.), a distinction is made between developed and less-developed regions using a dummy variable *depeloped_regions* (1 for developed regions; 0 for less-developed regions). This differentiation highlights varied impacts across different models, indicating that the factors influencing HGFs in developed regions might vary from those in less-developed areas. This could be attributed to differences in market dynamics, resource availability, or the level of institutional support.

Tables 3.9. and 3.10. delve deeper into these relationships, focusing separately on developed and less developed regions. These analyses corroborate the findings from the full sample and highlight some distinct patterns in less-developed regions. For instance, in these areas, framework conditions (*Model 2* in Table 3.10.) do not significantly influence the development of HGFs. Conversely, in developed regions, framework conditions positively affect productive entrepreneurship ($\beta = 0.70$; $p < 0.01$).

The validity tests demonstrate the robustness and reliability of the empirical evidence, albeit there are some areas requiring careful interpretation. The *Wald chi2 values* show significant statistical significance across all models. The *AR(2) p-values* indicate an absence of significant second-order autocorrelation, reinforcing the temporal stability of the models. However, the results of the *Sargan* test are somewhat mixed, with some potential challenges in instrument validity. Despite these concerns, the *Mean VIF* values indicate that multicollinearity is not an issue within these models.

Table 3.8. Panel data estimations with GMM model – productive entrepreneurship (*Full sample*)

Y = HGF_share **(2011-2019)**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
ee_index	**0.26***** (0.07)		-	-
fram_cond	- (0.33)	0.52	-	-
syst_cond	-	-	**0.67***** (0.18)	-
hum_cond	-	-	-	**0.46**** (0.18)
median_age	**0.21***** (0.06)	**0.18***** (0.05)	**0.25***** (0.05)	**0.17***** (0.06)
unemployment	-0.05 (0.06)	-0.04 (0.05)	-0.09 (0.06)	-0.08 (0.06)
trade_openness	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	**0.01**** (0.01)
risk_poverty_rate	**0.10***** (0.03)	**0.11***** (0.04)	-0.28** (0.47)	**0.08**** (0.03)
depeloped_regions	**-1.14*** (0.63)	-0.77 (0.53)	**-1.56***** (0.60)	**-1.15**** (0.55)
No. Of Observations	160	160	160	160
No. Of groups	20	20	20	20
Wald chi2	**3150.90 *** **	**4161.26*****	**2259.08*****	**3526.61*****
AR(2) ***p value***	0.035	0.018	0.054	0.032
Sargan	0.000	0.000	0.000	0.000
Mean VIF	4.64	6.47	3.95	4.26

Note: Heteroskedasticity-robust standard errors in parentheses; The values in bold highlight the significance of the variables of interest.
*p < 0.10; **p < 0.05; ***p < 0.01

Table 3.9. Panel data estimations with GMM model – productive entrepreneurship (*Developed regions*)

Y = HGF_share **(2011-2019)**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
ee_index	**0.21***** (0.06)	-	-	-
fram_cond	-	**0.70***** (0.23)	-	-
syst cond	-	-	**0.47***** (0.14)	-
hum_cond	**-**	**-**	**-**	**0.31***** (0.12)
median_age	**0.25**** (0.11)	**0.23**** (0.09)	**0.27**** (0.11)	**0.21*** (0.12)
unemployment	**-0.22*** (0.12)	-0.19 (0.12)	**-0.25**** (0.12)	**-0.27**** (0.12)
trade_openness	-0.00 (0.01)	-0.00 (0.00)	0.00 (0.01)	**0.17**** (0.07)
risk_poverty_rate	**0.16**** (0.07)	**0.19***** (0.07)	**0.15**** (0.07)	**1.47***** (0.39)
No. Of Observations	104	104	104	104
No. Of groups	13	13	13	13
Wald chi2	**574.21*****	**547.74*****	**505.58*****	**3395.96*****
AR(2) ***p value***	0.110	0.079	0.125	0.127
Sargan	0.000	0.000	0.000	0.000
Mean VIF	2.07	2.43	2.01	1.99

Note: Heteroskedasticity-robust standard errors in parentheses; The values in bold highlight the significance of the variables of interest.
*p < 0.10; **p < 0.05; ***p < 0.01

Table 3.10. Panel data estimations with GMM model – productive entrepreneurship (*Less developed regions*)

Y = HGF_share **(2011-2019)**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
ee_index	**0.37***** (0.14)	-	-	-
fram_cond	-	-0.13 (0.48)	-	-
syst_cond	-	-	**1.06***** (0.36)	-
hum_cond	-	-	-	**0.99***** (0.38)
median_age	**0.25**** (0.11)	**-0.26*** (0.14)	**0.31***** (0.12)	**0.20***** (0.08)
unemployment	**0.11*** (0.06)	0.03 (0.06)	0.07 (0.06)	0.10 (0.06)
trade_openness	0.02 (0.02)	0.02 (0.02)	0.02 (0.02)	0.03 (0.02)
risk_poverty_rate	0.05 (0.03)	0.04 (0.04)	0.04 (0.03)	0.04 (0.04)
No. Of Observations	56	70	70	70
No. Of groups	7	7	7	7
Wald chi2	**6147.15*****	**3200000*****	**4310.39*****	**2440.40*****
AR(2) ***p value***	0.095	0.196	0.152	0.116
Sargan	0.077	0.031	0.081	0.096
Mean VIF	1.99	2.15	1.89	1.94

Note: Heteroskedasticity-robust standard errors in parentheses; The values in bold highlight the significance of the variables of interest.
*p < 0.10; **p < 0.05; ***p < 0.01

EE index and regional economic development

Table 3.11. displays the results of a GMM analysis for the full sample, focusing on the dependent variable GDP per capita (*GDP_pc*) from 2009 to 2019. The EE index exhibits a positive association with regional economic development ($\beta = 68.65$; $p < 0.05$), indicating that higher performance in the EE index leads to increased GDP per capita. Within the sub-conditions of the EE index, only *syst_cond* exhibits a statistically significant positive influence ($\beta = 175.19$; $p < 0.10$). In contrast, framework and human conditions do not exert a significant effect on this relationship in the full sample analysis. The *median_age* consistently shows a positive relationship with *GDP_pc* across all models. Unemployment is negatively associated with GDP per capita in all models, reflecting the negative economic influence of high unemployment rates. Trade openness is statistically significant solely in Model 4, where it shows a positive effect ($\beta = 6.22$; $p < 0.05$). This suggests that economies with greater openness may experience enhanced GDP per capita. In the full-sample analysis (Table 3.11.), the use of a dummy variable differentiates between developed and less-developed regions. The findings indicate no significant impact of *depeloped_regions* on *GDP_pc*, suggesting a similar relationship between the EE and overall outcomes across both developed and less-developed regions.

Tables 3.12. and 3.13 show the analysis of GMM model estimations for GDP per capita in developed and less developed regions. In developed areas (Table 3.12.), the *ee_index* exerts a significant positive influence on *GDP_pc* ($\beta = 92.52$; $p < 0.01$), with framework conditions playing a particularly crucial role ($\beta = 329.87$; $p < 0.01$). In less developed regions (Table 3.13.), the *ee_index* shows an even more pronounced positive impact on *GDP_pc* ($\beta = 244.43$; $p < 0.01$), with systemic ($\beta = 521.64$; $p < 0.01$) and human conditions having a strong influence ($\beta = 350.54$; $p < 0.05$).

The empirical models' robustness is confirmed through various important estimations. The *Wald chi2 values* exhibit high statistical significance for all models. Additionally, the *Mean VIF* values remain low, indicating that multicollinearity is not a significant concern within these models. Furthermore, the *AR(2) p-values* are consistently above the 0.05 threshold, suggesting the absence of significant autocorrelation issues at the second lag. However, the *Sargan* test values, especially for the full sample and developed regions, raise some potential challenges regarding instrument validity, though this issue appears more favourable in the less developed regions.

Table 3.11. Panel data estimations with GMM model – regional economic development (*Full sample*)

Y = GDP_pc **(2009-2019)**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
ee_index	**68.65**** (34.02)		-	-
fram_cond	-	163.96 (99.69)	-	-
syst_cond	-	-	**175.19*** (89.86)	-
hum_cond	-	-	-	32.21 (52.06)
median_age	**62.23***** (17.06)	**62.16***** (14.64)	**69.59***** (15.98)	**64.01***** (17.04)
unemployment	**-47.01**** (21.30)	**-43.83**** (19.49)	**-50.03**** (20.90)	**-45.10**** (20.09)
trade_openness	4.26 (3.57)	4.67 (3.54)	4.33 (3.62)	**6.22**** (2.70)
risk_poverty_rate	**27.70***** (9.10)	**36.37***** (9.31)	22.19** (9.72)	**28.39***** (9.61)
depeloped_regions	-278.12 (183.99)	-266.42 (247.07)	**-209.72** (153.19)	-134.81 (140.99)
No. Of Observations	200	200	200	200
No. Of groups	20	20	20	20
Wald chi2	**45159.84*****	**41924.59*****	**54985.46*****	**40161.52*****
AR(2) ***p value***	0.788	0.736	0.932	0.767
Sargan	0.000	0.000	0.000	0.000
Mean VIF	4.85	5.59	4.14	4.36

Note: Heteroskedasticity-robust standard errors in parentheses; The values in bold highlight the significance of the variables of interest.
*p < 0.10; **p < 0.05; ***p < 0.01

Table 3.12. Panel data estimations with GMM model – regional economic development (*Developed regions*)

Y = GDP_pc **(2009-2019)**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
ee_index	**92.52***** (26.15)	-	-	-
fram_cond	-	**329.87***** (97.38)	-	-
syst_cond	-	-	**0.04**** (0.02)	-
hum_cond	**-**	**-**	**-**	30.75 (33.07)
median_age	**106.90***** (21.25)	**109.40***** (16.21)	-0.00 (0.01)	**100.89***** (23.70)
unemployment	**-165.56***** (37.36)	**-157.32***** (28.21)	**-0.04***** (0.01)	**-162.60***** (38.62)
trade_openness	-0.41 (3.05)	-0.83 (2.59)	**-0.00***** (0.00)	**4.57**** (2.33)
risk_poverty_rate	**49.70***** (13.81)	**72.23***** (10.94)	**0.01***** (0.00)	**60.45***** (12.34)
No. Of Observations	130	130	130	130
No. Of groups	13	13	13	13
Wald chi2	**22925.57*****	**77255.64*****	**3023.48**	**42378.97*****
AR(2) ***p value***	0.441	0.626	0.545	0.417
Sargan	0.006	0.069	0.007	0.003
Mean VIF	2.30	2.08	1.75	2.08

Note: Heteroskedasticity-robust standard errors in parentheses; The values in bold highlight the significance of the variables of interest.
*p < 0.10; **p < 0.05; ***p < 0.01

Table 3.13. Panel data estimations with GMM model – regional economic development (*Less developed regions*)

Y = GDP_pc **(2011-2019)**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
ee_index	**244.43***** (62.25)	-	-	-
fram_cond	-	**186.71**** (89.93)	-	-
syst_cond	-	-	**521.64***** (91.09)	-
hum_cond	-	-	-	**350.54**** (170.16)
median_age	**152.65***** (30.58)	**153.70***** (53.44)	**168.29***** (20.98)	**149.53***** (38.23)
unemployment	**-54.27***** (16.84)	**-45.55*** (24.33)	**-58.71***** (15.99)	**-45.02**** (21.73)
trade_openness	0.02 (0.02)	12.07 (6.75)	**11.32***** (3.82)	**14.52**** (5.75)
risk_poverty_rate	12.43 (11.96)	16.80 (14.21)	1.89 (11.69)	10.69 (14.66)
No. Of Observations	70	70	70	70
No. Of groups	7	7	7	7
Wald chi2	**303404.22*****	**2406.66*****	**4310.39*****	**44894.71*****
AR(2) ***p value***	0.582	0.694	0.427	0.701
Sargan	0.422	0.262	0.816	0.164
Mean VIF	2.83	2.90	2.51	2.70

Note: Heteroskedasticity-robust standard errors in parentheses; The values in bold highlight the significance of the variables of interest.
*p < 0.10; **p < 0.05; ***p < 0.01

3.5. Discussion and conclusive remarks

The current study aims to investigate the influence of the EE index on some dependent variables, such as regional economic development, entrepreneurial activity, and productive entrepreneurship across the twenty Italian NUTS-2 regions. The EE index, including its components, such as framework, systemic, and human conditions, provides a thorough evaluation over EE's health and its capacity to nurture entrepreneurial activities. These components are crucial, since they can influence productive entrepreneurship and entrepreneurial activity, which are the intermediate outputs, contributing to overall value creation (Stam, 2015). The variability in these elements can lead to different regional performances in EEs and condition the set up of new ventures and, consequently, regional economic development (Audretsch & Belitski, 2021). the findings are consistent with previous research (Stam, 2015; Stam & van de Ven, 2021) and empathise the relevance of cultivating robust EEs to foster entrepreneurship within regions. Still, our empirical evidence sheds light on intricate interplay among these factors, by offering significant contributions to both academic research and the formulation of regional policies.

In addressing the following research questions: 1) *"How does EE affect entrepreneurial activity, productive entrepreneurship, and regional economic development?"* 2) *"How does EE differ between developed and less developed regions?"*, our study reveals intriguing insights.

Firstly, the EE index and its components – framework, systemic, and human conditions – significantly influences entrepreneurial activity, productive entrepreneurship, and regional economic development. In detail, human conditions show a positive correlation with entrepreneurial activity, suggesting that regions featured by with stronger human capital and supportive conditions are more likely to experience higher entrepreneurial activity levels. The presence of HGFs, a key measure of productive entrepreneurship, points out a positive association with the EE index, systemic, and human conditions. This underlines the critical role of a conducive EE in both supporting the creation of new firms and promoting their expansion and success. Furthermore, the EE index and systemic conditions are positively correlated with regional economic development, measured by GDP per capita, suggesting that a robust EE is instrumental in enhancing a region's economic prosperity.

Secondly, the influence of EE unveils a considerable variation between developed and less developed regions. In the former, the EE's effect on entrepreneurial activity and

productive entrepreneurship is mainly positive. On one hand, framework conditions negatively affect entrepreneurial activity. Therefore, in more advanced regions, stringent regulatory frameworks might hinder new business ventures. On the other hand, in less developed regions, the overall EE index and its systemic and human components exert a strong positive influence on both entrepreneurial activity and regional economic development. However, framework conditions do not significantly sway productive entrepreneurship, indicating that in these areas, the reinforcement of systemic and human conditions is crucial for fostering entrepreneurship and stimulating economic growth.

The findings shed light on the intricate interplay within EEs and their varying effects on different aspects of regional performance. Some elements of EE and their influence on entrepreneurial activity, productive entrepreneurship, and regional economic development heavily depend on the growth stage of the region. Developed regions tend to benefit more from systemic and human conditions, while less developed regions aim to base on the overall EE index and its components to stimulate entrepreneurial activity.

3.5.1. Theoretical implications

The analyses offer fruitful insights into the current debate on Embeddedness and Institutional theories. In detail, Embeddedness Theory highlights the relevance of social networks in business activities (Granovetter, 1985; Nohria & Eccles, 1992; Jones et al., 1997). The findings reveal a relationship between human conditions within EE and entrepreneurial activity, as outlined in hypothesis *H1d*. In particular, regions endowed with stronger human capital, typically characterised by robust social networks and community ties, are more likely to exhibit higher levels of entrepreneurial activity. Therefore, the empirical evidence confirm that entrepreneurship thrives in socially cohesive environments where entrepreneurs are deeply embedded in supportive social structures. Furthermore, the differences emerged between developed and less developed regions, in terms of EE impact, can be observed through the lens of Embeddedness Theory. In less developed regions, where formal institutions may be relatively weaker, the role of informal networks and social embeddedness increasingly becomes crucial in driving entrepreneurial activity and economic development. This stresses the significance of context-specific social structures in determining economic outcomes.

Focusing on the second theoretical framework, as known, institutional theory postulates that institutions influence the behaviour of individuals and organisations

through norms, laws, and regulations (Bruton & Ahlstrom, 2003; DiMaggio & Powell, 1991; Scott, 2007). Such theory suggests that the efficacy of institutions in providing support, resources, and stability plays a crucial role in fostering economic growth. In such a context, the empirical study suggests that the different impacts of framework conditions on entrepreneurial activity highlight the prominence of formal institutions, such as regulatory frameworks, in shaping economic behaviour, in line with the tenets of the institutional theory. In developed regions, the stringent regulations might hamper entrepreneurial initiatives, implying a potential misalignment between formal institutions and the demands of entrepreneurs. Therefore, the finding highlights the critical need for regulatory environments that are both adaptive and supportive to encourage entrepreneurship. With reference to the systemic conditions within the EE, in both developed and less developed regions, the institutional support mechanisms are vital for economic advancement. Less developed regions more significantly benefit from improvements in systemic and human conditions. Hence, such regions are at a different stage in their institutional development. A need for region-specific institutional strategies to foster economic development emerges.

3.5.2. Practical and policy implications

The empirical evidence provides meaningful implications for practitioners within EEs and offers valuable guidance for policymakers. The insights serve as a roadmap for developing strategies that are both effective and tailored to the unique needs of various regions. Drawing upon our findings, policymakers and practitioners can make informed decisions that nurture robust EEs, thereby catalysing economic growth and enhancing regional prosperity. Indeed, the EE composite index serves as a trustworthy tool for assessing the performance and effectiveness of the regional EEs. Therefore, the policymakers might identify strengths and weaknesses in the regional entrepreneurial environments, to design targeted interventions and reinforce entrepreneurship along with economic growth.

A greater attention has been paid to the relevance of region-specific policy formulation. In developed regions, the focus should be on decreasing regulatory constraints and encouraging innovation, as overly stringent framework conditions might inhibit entrepreneurial activity. By contrast, less developed regions might benefit from policies cultivating a supportive entrepreneurial culture and improving access to

resources. The varying effects of systemic conditions on economic outcomes underline the need for customised support mechanisms. For instance, in developed regions, resources might be more efficiently allocated to enhancing current infrastructure and innovation systems. Conversely, less developed regions might require more strategic support to establish and strengthen these systems. Moreover, the findings highlight the critical need for inclusivity and sustainability in growth strategies. The understanding of the distinct dynamics in each regional EE allows policymakers to develop strategies meant to promote equal and long-run economic development.

Furthermore, the stakeholder engagement in local communities is pivotal. The significant role of human conditions in fostering entrepreneurship highlights the relevance of policies encouraging networking, mentorship, and skill development, which can heavily influence the entrepreneurial landscape. At last, given the dynamic nature of EEs, continuous monitoring and assessment of regional policies and their impacts are essential. The EE index can act as a benchmarking tool and enable policymakers to track progress, make data-driven adjustments to their strategies, as well as ensure ongoing relevance and effectiveness.

3.5.3. Limitations and future research directions

Despite our study might provide stimulating insights into the Italian EE, some limitations need to be highlighted. Firstly, the research is geographically constrained to the twenty Italian NUTS-2 regions. This focus offers a detailed understanding of the Italian context but potentially limits the generalisability of the findings to the regions located in other countries, which might have different socio-economic and cultural dynamics. Nonetheless, this limitation also presents an opportunity for future research to replicate this analysis in different settings, conceivably broadening the magnitude of the results.

Secondly, even though the variables used to construct the EE index provide a comprehensive overview of the regional EEs, this approach may overlook certain latent or unobserved variables that could significantly condition the dynamics of EEs. The potential influence of these unconsidered factors remains an area for further exploration.

Thirdly, the study was focused on specific outcomes, such as entrepreneurial activity and regional economic development, neglecting other relevant aspects, such as social entrepreneurship and sustainability issues. Instead, such fields deserve a deeper

understanding in future research. Addressing the aspects above mentioned might provide a more nuanced exploration of the multifaceted nature of EEs and their broader effects on environment and society at large.

Lastly, our study covers a specific period (i.e., 2009-2019), that might not fully encapsulate enduring trends or changes in EE occurring beyond these years. Indeed, the landscape of entrepreneurship can evolve significantly over time, shaped by a multitude of factors, such as technological progress, variations in policy landscapes, and global economic fluctuations.

Building on our empirical evidence, future research avenues emerge and offer opportunities to deepen EEs and their influence on regional development. Future research should delve into a detailed examination of the individual indicators that comprise the EE index, both stand-alone and overall, to understand their respective and combined effects on intermediate and overall outcomes. Such a nuanced analysis might significantly address the understanding on how different elements within EE contribute to regional economic growth.

Additionally, broadening the scope of the research to incorporate a more extensive dataset, covering various countries, or extending over different time frames, would yield more thorough and diverse insights. The integration of further variables might affect the relationship between EEs and the dependent variables, such as innovation rates, social entrepreneurship, or environmental sustainability, and provide a more nuanced understanding of the underlying dynamics.

Furthermore, the analysis over the influence of EEs on firm's performance might provide a meso-level perspective meant to test how EEs condition corporate financial and non-financial aspects within a region. Such analysis intends to look into direct effects of EEs on firm's success.

Finally, the continuous advancement of technology and its increasing role in entrepreneurship might stimulate future research on how technological innovation sways, and it is affected by EEs. This implies the analysis of digital transformation, hi-tech startups, and innovation hubs within EEs. In so doing, scholars might significantly contribute to the academic debate on EEs while providing practical insights for policymakers and practitioners involved in fostering entrepreneurship and regional economic development.

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Conclusive remarks

Main findings, key contributions, and future research directions

The thesis aims to conduct an insightful journey to unravel the intricacies and dynamics of EEs along with their pivotal role in regional development. By employing a comprehensive and mixed-method research approach, such study sheds light on the complex layers and key attributes that define EEs, moving beyond conventional analyses to a deeper understanding of their influence on entrepreneurial endeavors.

In the first Chapter, titled «*Fostering Regional Growth: A wider overview of Entrepreneurial Ecosystems through an integrated methodological approach*», a systematic literature review was carried out by a bibliometric analysis of 118 peer-reviewed articles published on EEs and regional development over twenty-six years (i.e., from 1996 to 2022). The field of EE has shown an increasing trend, especially over the last seven years (i.e., since 2015), as a consequence of various initiatives developed by the European Union to spur entrepreneurship, such as the European Commission's plan called «*Entrepreneurship 2020 Action Plan - Reigniting the entrepreneurial spirit in Europe*» (European Commission, 2013). The methodology includes bibliographic coupling (van Eck and Waltman, 2010) and supports the exploration of the epistemological structure of EEs. This approach led to the identification of three major clusters that encompass the theoretical and practical implications of EEs. The findings not only underscore the crucial role of EEs in fostering socio-economic development, but also highlight the key drivers for cultivating effective and resilient entrepreneurial environments. In detail, the red cluster underlines the relevance of policymakers to create an environment that bolsters regional economic development (Acs et al., 2017; Mack & Mayer, 2016; Spigel & Harrison, 2018); the green cluster comprises many studies on the role of innovative firms to address evolutionary dynamics within EEs (Audretsch & Belitski, 2021; Cunha et al., 2020; Roundy, 2019); then, the blue cluster focuses on the role of universities to promote entrepreneurship culture within EEs (Hayter et al., 2018; Spilling, 1996; Wagner et al., 2021). At last, the chapter outlines future research avenues suggesting specific topics and methodologies that demand an in-depth examination, such as the enlargement of quantitative studies, the understanding of the EEs evolution over time, and the holistic analysis of ecosystems. Furthermore, the research highlights the significance of strategic choices for entrepreneurs and the role of policymakers in shaping the entrepreneurial environment,

stressing the need for context-sensitive policies and support mechanisms. The empirical evidence fuels the EE research domain, by responding to earlier calls for more comprehensive exploration (Cavallo et al., 2019). The limitations ensue from the adoption of the bibliometric analysis. Therefore, future research routes should include a wider range of documentary sources, by paving the way for further advancement of the extant body of knowledge on EEs and regional development.

The second chapter, entitled «*Evaluating Performance Indicators within Regional Entrepreneurial Ecosystems*», focuses on the creation of the EE index at the NUTS-2 level and highlights its variation and persistence across Italian regions from 2009 to 2019. The choice of the regional rather than the provincial level takes root in the greater availability and reliability of data (Leendertse et al., 2022; Mikic et al., 2021; Schrijvers et al., 2023; Xie et al., 2021), as well as in the consistency with European Union Cohesion Policy requirements (Terracciano & Graziano, 2016). The EE index integrates several variables to fully capture the manifold dimensions of regional EEs. Twenty-one indicators were employed so much to attain a significant advancement in the evaluation of regional EE performance compared to prior literature (Iacobucci & Perugini, 2021; Leendertse et al., 2022; Stam, 2015; Stam & van De Ven, 2021). The dataset was gathered from European and Italian databases (e.g., Eurostat, Bank of Italy, Istat, etc.) and covers the Italian regions over the period "2009 – 2019". The composite index methodology and Confirmatory Factor Analysis (CFA) were used to address the research goals. This kind of methodological approach allows the data normalisation on the same scale and concurrently assesses their reliability. The findings prove the interdependence of different EE elements within the Italian context, revealing meaningful disparities across regions. Hence, the theoretical implications feed the academic debate on regional EEs. In detail, the development of the EE index operationalises complex theoretical concepts and converts abstract notions into measurable components, enabling comparative analysis. From a practical perspective, the EE index serves as a tool for policymakers to appraise the health of regional EEs and inform strategic decision-making. The study stresses the need for targeted regional strategies, in light of the disparities between Northern and Southern Italy, as well as it underscores the relevance to consider the broader conditions that underpin entrepreneurial activities and the dynamic interactions within EEs. However, some limitations should be deemed, such as the metrics pertinent to the infrastructure and the population configuration which need further refinement to

improve their reliability. While the focus on Italy provides in-depth insights, the use of the index to other geographical settings might require adjustments to meet regional-specific features. Future research avenues should incorporate a wider range of data, explore causal relationships, enlarge the analysis to different contexts and time frames, and employ additional methodological approaches to strengthen the empirical evidence.

The third chapter, named «*Navigating the Regional Entrepreneurial Ecosystem: evidence from the Italian setting*», deals with the influence of EE index on entrepreneurial activity, productive entrepreneurship, and regional economic development over Italian NUTS-2 regions from 2009 to 2019. The EE index's components, including framework, systemic, and human conditions to evaluate their support for regional entrepreneurship and economic development are considered. The analysis proves that such conditions heavily affect productive entrepreneurship and entrepreneurial activity, which in turn contribute to aggregate value creation. The main results comprise a positive correlation between human conditions and entrepreneurial activity, suggesting that regions with strong human capital tend to experience higher levels of entrepreneurship. Still, productive entrepreneurship is positively correlated with the EE index, underscoring the relevance of supportive EEs in fostering firms' growth. The study also suggests that systemic conditions and EE index positively condition regional economic development. Moreover, the differences between developed and less developed regions emerged. Indeed, stringent framework conditions in developed areas might hinder entrepreneurship, whereas in less developed regions, systemic and human conditions are key drivers of economic development and entrepreneurial activity. Nevertheless, the research exhibits some limitations, such as its geographical focus on the Italian context, the possible oversight of certain variables, and the exclusion of facets regarding social entrepreneurship. Future research routes might increase the scope to include different countries or timeframes, explore the influence of EEs on firms' performance and technological innovation.

The concluding sections of each chapter thoroughly explore the key findings, the theoretical and practical implications, and the limitations. The thesis lays an insightful ground for understanding the pivotal role of EEs in shaping entrepreneurial activity, productive entrepreneurship, and regional economic development. Critical dimensions were investigated and the consequent results provided inspiring insights for both academics and practitioners involved in the dynamics and the broader regional economic effects exerted by EEs.

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Appendix A

Table A1. Papers in order of normalised citations

Papers	Research methods	Main Findings	Theoretical Frameworks
RED CLUSTER			
Leendertse, J.; Schrijvers, M.; Stam, E. (2022)	Empirical	The physical infrastructure, finance, institutions and talent have a core position in EEs. They provide comparable metrics that are useful to calculate an index that approximates the quality of EEs.	Knowledge Spillover Theory of Entrepreneurship
Szerb, L.; Lafuente, E.; Horváth, K.; Páger, B. (2019)	Empirical	The quantity-based entrepreneurship (Kirznerian) is not supported by the findings obtained, due to the fact is more significant the quality entrepreneurship (Schumpeterian). Indeed, Kirznerian entrepreneurship negatively impacts on regional performance, while Schumpeterian entrepreneurship has a positive influence.	Knowledge Spillover Theory of Entrepreneurship
Cunha, C; Kastenholz, E.; Carneiro, M.J. (2020)	Case study	Rural entrepreneurial businesses contribute in raising the sustainability of the territories. Their distinctiveness to cooperate with stakeholders in the surrounding environment sparks generally positive outcomes. Such features promote networks that improve the socioeconomic conditions of the local community.	Stakeholder Theory
Muñoz, P. (2019)	Abductive research	The observed importance of regional marks underlines the critical role of physical place in rural entrepreneurship, which somewhat describes the significance of attracting customers to the local setting, rather than straining to enter outer markets.	Institutional Theory; Knowledge Spillover Theory of Entrepreneurship
Roundy, P.T.; Fayard, D. (2019)	Exploratory research	Developing EEs involves both tangible (e.i. attracting financial and human capital, reinforcing technological infrastructure, creating support organizations), and intangible resources (narratives on EEs).	Theory of Entrepeneurship
Spigel, B.; Vinodrai, T. (2021)	Case study	Skilled workers are one of the critical resources for entrepreneurial broadening. The latter are orientated towards high-growth entrepreneurial ventures, rather than spurring new waves of entrepreneurship.	Knowledge-based Theory
Pugh, R.; Soetanto, D.; Jack, S.L.; Hamilton, E. (2021)	Case study	The integrated learning model and its university commitment activities may develop the regional EE.	Entrepreneurial Learning Theory
Mas, J. M.; Gómez, A. (2021)	Empirical	Although sizeable countries with the highest Human Development Index, they do not have a higher level of digital development.	Theory of Action Collective
Spigel, B.; Kitagawa, F.; Mason, C. (2020)	Conceptual paper	A larger cognition of ecosystem thinking is essential, including a variety of actors involved, institutional settings, and the dissimilar nature of interactions between actors and networks.	Embeddedness Theory
Knox, S.; Arshed, N. (2021)	Case study	Several stakeholders shape and disrupt networks within the EE. Effectiveness coordination defines new helpful plans to promote entrepreneurship.	Stakeholder Theory
Carayannis, E. G.; Grigoroudis, E.; Wurth, B. (2021)	Literature review	Stakeholders and boundaries, dynamic systems, comparability and evaluation, and policy and interventions have a connection function between operational research scholars and practitioners.	Stakeholder Theory

Ryan, P.; Giblin, M.; Buciuni, G.; Kogler, D.F. (2021)	Case study	New venture spinouts have created knowledge of technological heterogeneity, which is able to generate a resilient EE.	Evolutionary Economic Geography Theory
Harima, A.; Harima, J.; Freiling, J. (2021)	Explorative qualitative study	Finding resources through transnational entrepreneurs helps to contrast resource scarcity, at the regional level.	Institutional theory
Scheidgen, K. (2021)	Case study	EEs are charactherized by heterogeneous structures and several levels of integration. These properties highly affect the possibility to procure resources within EE.	Structuration Theory
Roundy, P.T.; Bayer, M.A. (2019)	Conceptual paper	It is observed a positive association among resource dependence of a native EE and its application of bridging and buffering activities.	Resource Dependence Theory
Cavallo, A.; Ghezzi, A.; Rossi-Lamastra, C. (2021)	Empirical	Innovative start-ups are inclined to locate within Italian industrial districts. This proximity may advocate constructive collaboration.	Knowledge Spillover Theory of Entrepreneurship
Daniel, L. J.; de Villiers Scheepers, M. J.; Miles, M. P.; de Klerk, S. (2022)	Case study	Dynamic and interlocked social systems contribute to entrepreneurial economic development. There is a link between the theory of complex adaptive systems and EEs.	Theory of Complex Adaptive Systems
Rocha, H.; Audretsch, D.B. (2022)	Conceptual paper	Although EEs, regional clusters, and industrial districts concepts are intended as synonyms, their main difference consists in the pivotal point being the entrepreneur, rather that the firm.	Knowledge Spillover Theory of Entrepreneurship
Santos, D. (2021)	Case study	Stakeholder engagement has had a key role in enhancing urban competitiveness. The knowledge-based start-ups have significant spill-over effects, which are perks in increasing the number of other firms in the same territory.	Stakeholder Theory
Walsh, J.; Winsor, B. (2019)	Case study	Socio-cultural factors may influence the growth of EEs. There are specific weaknesses of social capital that cause obstacles in developing.	Social Capital Theory
Galvão, A.R.; Mascarenhas, C.; Marques, C.S.E.; Braga, V.; Ferreira, M. (2020)	Empirical	Including local actors, such as higher education institutions and business associations, enable the building of a social network in a rural setting.	Community Interaction Field Theory
Roundy. P.T. (2019a)	Abductive research	EEs come out through a narrative that allows entrepreneurs to make an understangin of the new business activities and the evolution of the region.	Evolutionary Theory
Villegas-Mateos, A.; Vázquez-Maguirre, M. (2020)	Empirical	Social entrepreneurship is perceived more encouragingly by the specialists placed in the low vulnerability region, rather than high-vulnerability regions.	Knowledge Spillover Theory of Entrepreneurship
Levenda, A.M.; Tretter, E. (2020)	Case study	Dissemination and combination of entrepreneurship into urban governance has molded how town act as a ground of governance by administrating social and cultural life.	Institutional Theory
Belitski, M.; Cherkas, N.; Khlystova, O.	Empirical	Entrepreneurship culture, formal networks, debt and equity financing are crucial determinants of productive entrepreneurship.	Not specified

Dal Bello, U.; Marques, C. S.; Sacramento, O.; Galvão, A. R. (2021)	Multiple-case studies	Territorial development is driven by entrepreneurship, which is supported through enabling factors, such as the presence of components of attractiveness to business activities and institutional supports.	Institutional Theory
Szerb, L.; Ortega-Argilés, R.; Acs, Z.J.; Komlósi, É. (2020)	Empirical	An isolated industry specialization may not have successful if the EE is not optimized first, given that it is not able to raise high-growth firms.	Knowledge Spillover Theory of Entrepreneurship
Cao, G.-H.; Zhang, J. (2022)	Empirical	By introducing some gimmicks, EE can achieve sustainable development, in the Chinese provinces, such as staying shy away from an overly low human capital return, too-low poor-conditions-led transaction productivity and a too-low human capital stock-driven technology.	Transaction Cost Theory
Sitaridis, I.; Kitsios, F.	Multi-Criteria Decision Making (MCDM)	Greek EE is underperforming compared to EE in EU countries.	Knowledge Spillover Theory of Entrepreneurship
Roundy. P.T. (2019b)	Comparative-case study	Small cities are characterized by community dynamics that promote and hinder entrepreneurial activity.	Evolutionary Theory
Schmutzler, J.; Andonova, V; Perez-Lopez, J. (2021)	Mixed-method	The entrepreneurial businesses in a country depend not merely on the existing residents, but also the transnational links of the diaspora. They generate an interconnected system through global entrepreneurial hubs and resources available for local entrepreneurs.	Social Capital Theory
Nordling, N. (2019)	Exploratory research	Public policies may encourage EEs through embedded actors in the regional setting. However, matching the requirements to the resources in the EE is crucial, since the evolving nature of EE.	Evolutionary Theory
Yang, J.; Zhang, M. (2021)	Empirical	There is a positive relationship between the furtherance of innovation and entrepreneurship in the EE. Although the innovation may display its effects in the long run.	Institutional Theory
Spigel, B. (2018)	Conceptual paper	The study distinguishes between "top-down" and "bottom-up" for analyzing EEs.	Not specified
Meshram, S.A.; Rawani, A.M. (2019)	Literature review	The principal role of policymakers is to comprehend the critical differences between the actors and factors of regional context to develop successful EEs.	Institutional Theory
Spicer, J.; Zhong, M. (2022)	Multiple-case studies	Productive firms like worker cooperatives have been less successful in the Toronto ecosystem than in Montréal.	Not specified
Cao, G.-H.; Zhang, J. (2021)	Empirical	The capacities such as promoting innovation and self-reinforcing are drivers to fostering a sustainable developing system. Nonetheless, not enough human capital endowment could be an earnest hurdle.	Transaction Cost Theory; Knowledge Spillover Theory of Entrepreneurship
Morrison, E.; Barrett, J.D.; Fadden, J.B. (2019)	Case study	The five propositions of the reflective theory of development for entrepreneurial ecosystems are critical components to address practitioners and policymakers keen on developing EEs. Universities depict platforms upon which the EEs can broaden.	Reflective Theory of Development
Roundy. P.T. (2018)	Conceptual paper	In small-town EEs, there is a triple influence of customers: local market force, customers' capacities to access the EE, and customers' choices.	Consumer Theory

von Bloh, J. (2021)	Mixed-method	The regional economic development agencies have a possible negative effect on EEs bottom-up growth and the capability to become self-sustained.	Theory of Planned Behaviour; Stakeholder Theory
Bramwell, A. (2021)	Case study	The intermediary organizations are responsible for coordinating networks and bargaining power upper-level funding to implement programs characteristic of the local setting, but they do not have the paucity of force to affect agendas. The determining element is the straightforward linkage to a commonly accepted urban development agenda.	Knowledge-based Theory
Gamidullaeva, L.A.; Agamagomedova, S. (2019)	Empirical	EEs are considered a driver of regional sustainable development.	Not specified
Meutia, I.F.; Yulianti, D.; Djausal, G.P.; Sujadmiko, B. (2021)	Empirical	The raising of entrepreneurship in a rural context is plausible through legal policies, strategic programs, business opportunities, social capital, competitive and dynamic resources, networks and partnerships.	Dynamic Capabilities Theory
Schmutzler, J.; Pugh, R.; Tsvetkova, A. (2022)	Conceptual paper	By blending the concepts of EEs with the innovation systems, it is plausible to gain a greater comprehension of economic development, innovation, and entrepreneurship.	Evolutionary Theory
Komlósi, È.; Sebestyén, T.; Tóth-Pajor, Á.; Bedő, Z. (2022)	fuzzy-set Qualitative Comparative Analysis	Access to entrepreneurial resources, such as information and knowledge is simplified by social networks inside EE. Accordingly, the efficiency of networking defines several features of EE.	Institutional Theory
GREEN CLUSTER			
Spigel, B.; Harrison, R. (2018)	Conceptual paper	A process-based view enhances the perception of how EEs grow and change over time. It is still critical to understand in which way the resources fluctuate into EEs since they are vital for keeping a sustainable competitive advantage.	Resource Dependence Theory
Mack, E.; Mayer, H. (2016)	Case study	Evolutionary dynamics are prominent ways to evaluate the impact of history, culture, and institutional context on EE. Stakeholders fulfill a significant role in keeping or pushing EEs.	Evolutionary Theory
McAdam, M.; Harrison, R.T.; Leitch, C.M. (2019)	Case study	EEs both have roles in the social and business environment. They are responsible for nurturing and restraining entrepreneurship. Moreover, gender capital is transmutable in social capital and economic capital.	Theory of Embodied Practice
Stam E. (2015)	Literature review	The system approach emphasizes the role of the entrepreneur to raise EE and hold it in good health, which has to be nourished by the stakeholders to the EE.	Knowledge Spillover Theory of Entrepreneurship; Stakeholder theory
Audretsch, D.B.; Belitski, M. (2021)	Empirical	Regions with a broader stock of creative industries bring fertile entrepreneurship, which develops faster and has a positive spillover on regional economic development.	Knowledge Spillover Theory of Entrepreneurship
Zhao, X.; Shang, Y.; Song, M. (2020)	Empirical	The results show that an increase in the advancement of industrial structure determines a raising in ecological efficiency.	Not specified
Brush, C.G. (2014)	Conceptual paper	University-based EEs are a crucial source of providing structures, resources, and knowledge to expand entrepreneurial communities. An innovative entrepreneurship education ecosystem contributes to reinforce networks with regional stakeholders.	Stakeholder Theory; Resource Dependence Theory

Bandera, C. (2019)	Empirical	Collaborating with universities, industries, and government organizations may create perks for start-ups.	Knowledge Spillover Theory of Entrepreneurship
Godley, A.; Morawetz, N.; Soga, L. (2021)	Case study	Entrepreneurial actors, entrepreneurial resource providers, entrepreneurial connectors and entrepreneurial orientation are strongly correlated and they can influence each other.	Complementarity Theory
Fiorentino, S. (2019b)	Case study	Despite cities being the driving force of the current innovation tendency, they are truly influenced by the socio-political context.	Embeddedness Theory
Qian, H. (2018)	Case study	Entrepreneurial absorptive capacity is a prominent driving strength for knowledge-based business activities, and high-tech and cultural diversity participate in creating dynamic regional systems of entrepreneurship.	Knowledge Spillover Theory of Entrepreneurship
Corradini, C. (2020)	Empirical	A social trust may promote the current information and knowledge interchange over geographic proximity embedded institutions, firms and people raising entrepreneurial processes.	Institutional Theory; Knowledge Spillover Theory of Entrepreneurship
Stam, E. (2018)	Empirical	The prevalence of high-growth firms correlates to the EE index, however, not to individual elements of the EE.	Knowledge Spillover Theory of Entrepreneurship
Khan, M.R. (2013)	Empirical	They emphasized the strategic role of institutions and companies to streamline and trigger entrepreneurship development.	Not specified
Roth, S.; Kaivo-Oja, J.; Hirschmann, T. (2013)	Case study	Crowdsourcing projects may activate regional development, since they allow knowledge transfer, exploiting the strength of regional ties.	Institutional Theory
Martínez-Fierro, S.; Biedma-Ferrer, J.M.; Ruiz-Navarro, J. (2020)	Empirical	EEs are affected by the economic development of the country and high-growth entrepreneurship. The latter have particular spillovers on government programs, knowledge transfer, and access to the national market.	Knowledge Spillover Theory of Entrepreneurship
Roundy, P.T. (2017a)	Conceptual paper	Small cities might adopt different strategies to be successful and to create lively entrepreneurial communities, for instance, establishing educational institutions, unconventional technologies, and attracting high-skilled workers.	Resource Dependence Theory
Roundy, P.T. (2017b)	Conceptual paper	Heterogeneous resources in EE, such as the infrastructures, entrepreneurial culture, and educational opportunities impact the effectiveness of social entrepreneurs. The last may affect the EE through the attraction of a specific group of stakeholders.	Resource-based View
Lopes, J.; Franco, M. (2019)	Literature review	Regional development networks are acquiring bearing at the regional level. There are four kinds of regional networks: smart specialization strategies; regional innovation strategies; regional development and entrepreneurship networks, and ecosystems of entrepreneurship and innovation.	Knowledge Spillover Theory of Entrepreneurship
Sleuwaegen, L.; Ramboer, S. (2020)	Empirical	The human capital existing in the region has a robust effect on the proliferation of high-growth firms.	Knowledge Spillover Theory of Entrepreneurship
Lyons, T.S.; Lyons, J.S.; Jolley, G.J. (2020)	Literature review	There are two frameworks for understanding the minimum skills required for prosperous entrepreneurship: entrepreneurship skill-building and readiness inventory for successful entrepreneurship.	Entrepreneurship Skill Building Framework
Stam, E.; Bosma, N. (2014)	Conceptual chapter	They provide an extensive overview of current academic insight about regional determinants for entrepreneurship and how it conveys to regional development.	Knowledge Based Theory

Motoyama, Y.; Knowlton, K. (2016)	Case study	Government sponsorship promotes coordination between entrepreneurs and supports local EEs.	Resource dependence theory; New institutional theory
Oh, J.; Clayton, P.; Feldman, M. (2022)	Empirical	Accelerators are established by several kinds of entities such as local governments, non-profit organizations, universities, etc., and foster support companies over time in the EEs.	Not specified
Yamamura, S.; Lassalle, P. (2020)	Case study	The cooperation between proximate institutional actors may support a valid entrepreneurial setting, as a pillar of the competitive advantage in regional development.	Knowledge Spillover Theory of Entrepreneurship
Schrock, G.; Wolf-Powers, L. (2019)	Case study	They assert that local government actors often strive to build network capability and curb opportunism.	Not specified
Yang, S.; Kher, R.; Lyons, T.S. (2018)	Literature review	Incubation and accelerator practices facilitate early-stage entrepreneurs in the greater handling of EE.	Business Life Cycle Theory
Singh, A.K.; Kumar, S.; Sharma, A.K.; Sinha, S. (2022)	Empirical	The study focuses on several indexes for mapping the sustainable development within the EE.	Not specified
Feldman, M.P.; Lowe, N.J. (2018)	Conceptual paper	An efficient policy is characterized by adaptations in response to mutating circumstances, to adjust to a novel environment. The complexity of EEs requires new reconfigurations of policy and planning.	Evolutionary Theory
Erina, I.; Shatrevich, V.; Gaile-Sarkane, E. (2017)	Empirical	The role of universities is prominent in entrepreneurial development, in fact, university R&D expenditure can advance innovations and it improves the collusion between all components of the triple helix relationship.	Stakeholder Theory
Lowe, N.J.; Feldman, M.P. (2017)	Conceptual paper	The processes of institutional change are activated by endogenous endeavours driven by the economic actors.	Evolutionary Theory
Xu, Z.; Maas, G. (2019)	Conceptual paper	They inspect the two ecosystem concepts which are connected to the surrounding environment: entrepreneurial and innovative. By analyzing the differences they found that the two ecosystems are not mutually exclusive.	Not specified
Sheriff, M.; Muffatto, M. (2015)	Multiple-case studies	The outcomes from each country confirm that merely the entrepreneurship environment is able to account for the differences in entrepreneurial economic growth and the cross-countries matching.	Theory of Complex Adaptive Systems; Insitutional Theory
Stough, R.R. (2016)	Case study	In the promotion of entrepreneurship, China is strongly engaged in the public sector role, while the U.S.A are characterized by less government intervention. European countries are oriented to provide sturdy policy support.	Endogenous Growth Theory; Knowledge Spillover Theory of Entrepreneurship
Feldman, M.; Lowe, N. (2015)	Empirical	They create a transferable framework for investigating regional dynamics in other setting.	Institutional Theory
Markley, D.M.; Lyons, T.S.; Macke, D.W. (2015)	Case study	Building entrepreneurial communities require any characteristics: the community has to entertain and promote an EE, and entrepreneurs have to rise themselves and their businesses in the protection of community economic development.	Community Interaction Field Theory

Fernández, M.T.F.; Santos, J.L.; Jiménez, F.J.B. (2019)	Case study	In Spanish regions, there is a positive relationship between the regional entrepreneurship and development index (REDI) and the major performance of the business incubators and accelerators.	Knowledge-based Theory
Freitas, C.; Kitson, M. (2018)	Empirical	Firms placed in remote islands perceive to work in a not plenty encouraging EE, as compared to the firms in core regions. Such sense causes the surrounding environmental might dishearten new firm formation.	Resource Dependence Theory
Rice, M.D.; Kalafsky, R.V. (2020)	Case study	Government support does not always the better resolution to improve local communities. In most cases, a unique combination of nonlocal connections, local cultural resources, and social networks are greater solutions.	Embeddedness Theory
Fiorentino, S. (2019a)	Empirical	There are three types of co-working spaces: a "social incubator" with an educational function; a "start-up incubator" that financially and technically supports entrepreneurs; a "real estate incubator" which is substantially a business product.	Institutional Theory
Assenza, P. (2016)	Conceptual paper	Stakeholder involvement enables the procurement of enough resources in the local setting, and at the same time, it guarantees the burgeoning of high-growth entrepreneurial ventures.	Stakeholder theory
Naseef, M.; Jyothi, P. (2019)	Case study	EE approach may be used as a mechanism for regional industrial development. The entrenched idea that in the cooperative context one cannot be competitive and cannot focus on innovation must be overcome.	Knowledge Spillover Theory of Entrepreneurship
Meek, S.R.; Tietz, M.A. (2022)	Empirical	Regional entrepreneurial activity positively influences objective institutional performance and, at the same time, negatively affects subjective performance.	Institutional Theory
BLUE CLUSTER			
Acs, Z.J.; Stam, E.; Audretsch, D.B.; O'Connor, A. (2017)	Conceptual paper	The distinctive aspect of EE is the attention to value creation by entrepreneurs. The most identifiable yardstick is the occurrence and number of high-impact "unicorn" firms, in a specific regional geography.	Knowledge Spillover Theory of Entrepreneurship
Wagner, M.; Schaltegger, S.; Hansen, E.G.; Fichter, K. (2021)	Case study	Universities are progressively assuming a societal role in regional development. They back knowledge spillovers to enhance EEs. In the same vein, they advocate stakeholder engagement in central governance processes at the regional level.	Knowledge Spillover Theory of Entrepreneurship
Hayter, C.S.; Nelson, A.J.; Zayed, S.; O'Connor, A.C. (2018)	Literature review	Concerning academic entrepreneurship, the ecosystem approach has not been completely exploited to address policy decisions. Several existing studies are generally descriptive in type and they do not investigate the synergy of ecosystem properties.	Knowledge Spillover Theory of Entrepreneurship
Nicholls-Nixon, C.L.; Valliere, D.; Gedeon, S.A.; Wise, S. (2021)	Case study	The dynamic relationship between university business incubators and universities in the regional context is conditioned by the rising requirement for resource access to back increase and development.	Knowledge Spillover Theory of Entrepreneurship
Lamine, W.; Mian, S.; Fayolle, A.; Wright, M.; Klofsten, M.; Etzkowitz, H. (2018)	Empirical	In the South African context, the radicated nature of the reputationally directed work organizations obstructs university-industry interaction.	Knowledge Spillover Theory of Entrepreneurship
Ferreira, J. J., Fernandes, C. I., Veiga, P. M.; Caputo, A. (2022)	Empirical	Entrepreneurial attitudes have a positive influence on both the digital and environmental transition. Entrepreneurial skills positively affected such twin transitions. Entrepreneurial aspirations have a positive effect on the environmental transition, however, they have not registered any sway on the digital transitions.	Theory of Planned Behaviour

Spilling O.R. (1996)	Empirical	The recommendation is that on the side of regional development, there is an entrepreneurial system. Such system is complicated, it comprises several actors who play different roles, and it is encouraged and bounded by a wide amount of environmental factors.	Knowledge-based Theory
Harrison, R.T.; Leitch, C. (2010)	Case study	University spin-offs, with some remarkable considerations, do not depict a significant source of entrepreneurial dynamism in regional development and do not hence perform as a main element in an EE.	Knowledge-based Theory
Belitski, M.; Heron, K. (2017)	Literature review	Entrepreneurship education ecosystems promote start-ups proliferation through knowledge provided by universities. These are significant sources of knowledge spillover and regional development.	Knowledge Spillover Theory of Entrepreneurship
Bakry, D. S.; Daim, T.; Dabic, M.; Yesilada, B.; (2022)	Hierarchical Decision Model (HDM)	They generate a framework for entrepreneurial and innovation ecosystem strategies to raise the adoption of innovation in sustainable entrepreneurship.	Not specified
O'connor, A.; Stam, E.; Sussan, F.; Audretsch, D.B. (2018)	Conceptual chapter	They state that technological progress offers great value in creating opportunities in some territories.	Not specified
Costa, J.; Pita, M. (2020)	Empirical	They discover different patterns of entrepreneurial propensity. The results show that Qatari women are less prone to begin a newco. For women, age represents a deterrent factor, conversely to men. Both genders seem to be unconstrained by the fear of failure, however, the self-perception of skills has a prominent influence on women.	Gender Entrepreneurship Theory
Pittz, T.G.; White, R.; Zoller, T. (2019)	Empirical	The aggregation of dealmakers is positively connected to knowledge spillovers in a regional EE. Major interconnection between dealmakers is positively associated with industry connectivity in a regional EE	Knowledge Spillover Theory of Entrepreneurship
Mehtap, S.; Pellegrini, M.M.; Caputo, A.; Welsh, D.H.B. (2017)	Empirical	A strong supportive education system might decrease the perception of potential barriers to entrepreneurship.	Theory of Planned Behavior
Van Weele, M.; Van Rijnsoever, F.J.; Eveleens, C.P.; Steinz, H.; Van Stijn, N.; Groen, M. (2018)	Empirical	The existing business incubators do not entirely exploit their potential, since they do not address institutional challenges, but they merely provide temporary solutions to protect start-ups from adverse institutions.	Institutional Theory
Guindalini, C.; Verreynne, M.-L.; Kastelle, T. (2021)	Systematic literature review	They arrange the entrepreneurial path as follows: idea origin; the value proposition for stakeholders; development of an innovative business model; and implementation of the strategy that stimulates the real impact.	Resource-based View; Knowledge Spillover Theory of Entrepreneurship
Schaeffer, V.; Matt, M. (2016)	Case study	University promotes the evolution of non-mature EEs towards a greater sustainable model. Developing precise components, such as local technology transfer offices and business incubators is decisive in this transformation process.	Knowledge Spillover Theory of Entrepreneurship
Mason, C.; Anderson, M.; Kessl, T.; Hruskova, M. (2020)	Case study	The university start-up plans have a positive influence on student and graduate start-ups. The financial support is merely a part of a wide bundle. To be constructive, these plans need to contribute in terms of suggestions and consultations and create a collaboration with stakeholders and connect them to resources in the external EE.	Resource Dependence

			Theory; Stakeholder Theory
Ierapetritis, D.G. (2019)	Conceptual paper	Universities are recognized as a knowledge-concentrated institutions that bring up human capital flourishing, innovation and entrepreneurship. Therefore, they are crucial entities to boost regional EEs, given that they are accountable for know-how, entrepreneurial thinking and culture transfer.	Knowledge Spillover Theory of Entrepreneurship
Yun, J.J.; Won, D.; Park, K.; Yang, J.; Zhao, X. (2017)	Empirical	Platform business models advocate regional development through the focus on multitudinous areas, a network of several firms, and clever economy-based firms driving regional development.	Open Innovation Theory
Elnadi, M.; Gheith, M.H.; Farag, T. (2020)	Empirical	Access to physical infrastructure and social factors are the main elements that can positively influence the students' entrepreneurial intention.	Theory of Planned Behaviour
Schillo, R. S. (2018)	Empirical	This study examines research-based spin-off companies as agents in EEs. The outcomes demonstrate that only half of the firms point out sales growth aims.	Resource-based View
Wang, Q. (2021)	Empirical	University-led entrepreneurship programs enhance the level of human, social and financial capital since the business owners can increase their capabilities to better perceive themselves and the environment neighboring.	Knowledge Spillover Theory of Entrepreneurship
Huang-Saad, A.; Duval-Couetil, N.; Park, J. (2018)	Empirical	Universities bestow infrastructures, new technologies and human capital educated and they disseminate the culture of innovation.	Knowledge Spillover Theory of Entrepreneurship
O'connor, A.; Reed, G. (2018)	Multiple-case studies	The results underline five specific roles for universities: Regional Governance; Human Capital Development; Intellectual Resources; Network Facilitator; and, Entrepreneurial Node.	Institutional Theory
Fishman, E.A.; O'shea, R.P.; Allen, T.J. (2014)	Conceptual chapter	MIT EE has been very successful in promoting the entrepreneurial path to technology transfer and is endorsed as one of the world's leading entrepreneurship universities.	Not specified
Choi, J.-I.; Lee, W.-C. (2021)	Case study	There are four key components for creating of entrepreneurship education in developing countries: human resources, programs, domestic and international networks, and plans to reinforce entrepreneurship education.	Resource-based View
Ribeiro, A.T.V.B.; Yamashiro, C.S.; Feldmann, P.R.; Plonski, G.A. (2022)	Multiple-case studies	They found that universities may stimulate the entrepreneurial spirit, from the idea stage to IPO.	Not specified
Yang, P.; Liu, X., Hu, Y.; Gao, Y. (2022)	fuzzy-set Qualitative Comparative Analysis (fsQCA)	EE may well describe employment and innovation in the regional setting. Their research investigates how the elements within the EE reach out to support regional development.	Resource-based View

Appendix B

Table B1. Classification of Italian regions according to the EU Cohesion Policy 2014-2020

Region code ISTAT	Year	Macro-area	Region (NUTS-2)	GDP per capita on EU-27 average (%)
01	2009	North-west	***Piemonte***	114.41
01	2010			113.65
01	2011			114.09
01	2012			111.11
01	2013			111.84
01	2014			112.53
01	2015			110.89
01	2016			111.33
01	2017			112.46
01	2018			113.61
01	2019			113.73
02	2009	North-west	***Valle d'Aosta***	146.25
02	2010			149.80
02	2011			150.02
02	2012			152.13
02	2013			145.65
02	2014			142.74
02	2015			140.60
02	2016			137.45
02	2017			139.43
02	2018			138.67
02	2019			138.32
03	2009	North-west	***Lombardia***	142.15
03	2010			144.58
03	2011			144.49
03	2012			142.17
03	2013			140.46
03	2014			140.39
03	2015			140.22
03	2016			141.61
03	2017			141.65
03	2018			142.65
03	2019			141.53
04	2009	North-east	***Trentino-Alto Adige***	150.14
04	2010			150.40
04	2011			151.40
04	2012			155.12
04	2013			157.22
04	2014			155.33
04	2015			153.12
04	2016			152.78
04	2017			152.53
04	2018			155.32
04	2019			156.51
05	2009	North-east	***Veneto***	118.39
05	2010			118.07
05	2011			119.62
05	2012			118.28
05	2013			118.52
05	2014			118.36
05	2015			118.64
05	2016			120.79
05	2017			120.99

05	2018			120.93
05	2019			121.21
06	2009	North-east	***Friuli-Venezia Giulia***	112.66
06	2010			114.46
06	2011			114.88
06	2012			112.31
06	2013			113.73
06	2014			112.86
06	2015			114.02
06	2016			113.97
06	2017			113.61
06	2018			115.13
06	2019			116.22
07	2009	North-west	***Liguria***	119.21
07	2010			116.47
07	2011			116.86
07	2012			115.89
07	2013			115.32
07	2014			116.40
07	2015			116.33
07	2016			117.00
07	2017			117.30
07	2018			116.22
07	2019			116.93
08	2009	North-east	***Emilia-Romagna***	127.82
08	2010			127.31
08	2011			129.49
08	2012			128.24
08	2013			128.89
08	2014			129.37
08	2015			129.04
08	2016			130.63
08	2017			130.95
08	2018			131.06
08	2019			130.12
09	2009	Center	***Toscana***	115.12
09	2010			113.65
09	2011			114.49
09	2012			114.70
09	2013			113.73
09	2014			114.43
09	2015			113.25
09	2016			114.35
09	2017			113.98
09	2018			114.77
09	2019			117.65
10	2009	Center	***Umbria***	101.19
10	2010			100.40
10	2011			99.49
10	2012			97.57
10	2013			95.77
10	2014			93.20
10	2015			93.99
10	2016			93.15
10	2017			93.32
10	2018			94.86
10	2019			94.47
11	2009	Center	***Marche***	104.47
11	2010			102.41
11	2011			102.25
11	2012			100.76
11	2013			99.76

11	2014			100.67
11	2015			99.77
11	2016			100.34
11	2017			100.33
11	2018			100.29
11	2019			100.89
12	2009	Center	***Lazio***	138.47
12	2010			136.14
12	2011			135.41
12	2012			131.82
12	2013			128.89
12	2014			127.02
12	2015			124.42
12	2016			126.85
12	2017			125.41
12	2018			124.91
12	2019			124.78
13	2009	South	***Abruzzo***	92.59
13	2010			93.17
13	2011			95.54
13	2012			96.38
13	2013			94.97
13	2014			93.59
13	2015			92.84
13	2016			92.01
13	2017			92.22
13	2018			91.60
13	2019			91.27
14	2009	South	***Molise***	86.85
14	2010			85.14
14	2011			84.09
14	2012			82.44
14	2013			77.41
14	2014			75.89
14	2015			75.89
14	2016			75.73
14	2017			75.99
14	2018			76.39
14	2019			77.72
15	2009	South	***Campania***	73.33
15	2010			71.08
15	2011			69.88
15	2012			70.09
15	2013			68.90
15	2014			68.42
15	2015			68.95
15	2016			68.91
15	2017			68.98
15	2018			68.79
15	2019			69.16
16	2009	South	***Puglia***	69.23
16	2010			68.67
16	2011			69.09
16	2012			70.09
16	2013			68.64
16	2014			68.42
16	2015			68.57
16	2016			69.29
16	2017			68.61
16	2018			69.15
16	2019			69.52
17	2009	South	***Basilicata***	79.48

17	2010			77.11
17	2011			78.56
17	2012			79.25
17	2013			81.80
17	2014			77.86
17	2015			83.20
17	2016			82.17
17	2017			81.15
17	2018			84.36
17	2019			82.71
18	2009	South	***Calabria***	68.41
18	2010			67.07
18	2011			66.72
18	2012			66.11
18	2013			65.44
18	2014			64.10
18	2015			63.56
18	2016			63.61
18	2017			63.81
18	2018			62.64
18	2019			62.75
19	2009	Island	***Sicilia***	71.69
19	2010			70.28
19	2011			68.69
19	2012			69.30
19	2013			68.24
19	2014			66.06
19	2015			66.26
19	2016			65.88
19	2017			65.66
19	2018			65.17
19	2019			65.24
20	2009	Island	***Sardegna***	81.11
20	2010			79.52
20	2011			79.35
20	2012			80.45
20	2013			78.21
20	2014			77.47
20	2015			78.97
20	2016			77.24
20	2017			77.09
20	2018			77.12
20	2019			78.07

Developed regions

GDP per capita > 90% EU-27 average

Lombardia**;** Trentino-Alto Adige**;** Veneto**;** Friuli-Venezia Giulia**;** Liguria**;** Emilia-Romagna**;** Toscana**;** Umbria**;** Marche**;** Lazio**;** Abruzzo

Less developed regions

GDP per capita < 90% EU-27 average

Molise; Campania; Puglia; Basilicata; Calabria; Sicilia; Sardegna

Table B2. Robustness and reliability tests

Index	Sub-index	Indicator	One factor solution for index (CFA)	KMO (Bartlett's sphericity sig.)	Cronbach's alpha
EE index				0.837 (0.000)	0.927
	FRAMEWORK CONDITIONS			0.844 (0.000)	0.889
		1. Voice and accountabilityindex	0.90		
		2. Government effectivenessindex	0.62		
		3. Regulatory quality index	0.88		
		4. Rule of law index	0.86		
		5. Corruption index	0.77		
		6. Digital infrastructure	0.34		
		7. Physical infrastructure	0.81		0.740
	SYSTEMIC CONDITIONS			0.515 (0.000)	
		8. Finance	0.46		
		9. New knowledge	0.70		
		10. Turnover rate (birth rate-exit rate of firms)	0.30		
		11. Government expenditure in R&S	0.20		
		12. Business sector expenditure in R&S	0.59		
		13. Professional and technology sector	0.71		0.762
		14. Information and communication sector	0.98		
	HUMAN CONDITIONS			0.790 (0.000)	
		15. Migration flow	0.58		
		16. Population structure	-0.66		
		17. Higher education	0.87		
		18. R&D personnel and researchers	0.81		
		19. Income level	0.85		
		20. Tertiary education	0.87		
		21. Employment in science and technology	0.93		