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The impact of different Entrepreneurial Support Organizations on Entrepreneurial Ecosystems development: an empirical study

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Abstract

The literature on Entrepreneurial Ecosystems has increasingly raised a conceptual interest of studying Entrepreneurial Support Organizations (ESOs), recognizing the importance of their role in spurring ecosystem development. However, the specific outcomes these various types of organizations provide for the territories involved remain underexplored. The ESO element has often been treated as a monolithic block, yet it encompasses diverse entities that may have different influences and impacts on the entrepreneurial environment. This thesis work seeks to address this gap in the Entrepreneurial Ecosystem literature by first creating an updated and comprehensive mapping of incubation and acceleration activities, focusing the analysis on Italy, the Netherlands, and Ireland. Subsequently, by conducting regional correlation analyses and Qualitative Comparative Analysis (QCA), this study compares various statistics obtained from the research with entrepreneurial output data. Findings suggest that ESOs with specific characteristics are consistently present in regions characterized by high values in terms of entrepreneurial outputs, thereby hosting more active and dynamic Entrepreneurial Ecosystems. This thesis, although limited to just three countries, lays the foundation for more extensive research and offers valuable insights for policymakers aiming to promote the emergence of Entrepreneurial Ecosystems in their regions, suggesting that targeted policy interventions on specific factors could positively impact the overall ecosystem health.

Keywords: Entrepreneurial Ecosystems, Entrepreneurial Support Organizations, Incubators, Accelerators, Qualitative Comparative Analysis

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1. Introduction

Recent years have witnessed an increasing focus on entrepreneurship as a catalyst for economic and social development (Zahra and Wright, 2016). This attention stems from the realization that entrepreneurship significantly contributes to job creation, innovation, and the overall dynamism of the environment. The attention of policymakers is particularly focused on the implementation of strategies aimed at expediting the development of High Growth Potential Firms (HGPFs), recognizing the potential positive impact they can have on local economies (Brown and Mawson, 2019). In this scenario, the concept of the Entrepreneurial Ecosystem (EE), which investigates the factors facilitating the emergence of HGPFs in regions from a complex systems perspective, has gained importance in both academic literature and policymaking (Malecki, 2018; Stam, 2015; Stam and Spigel, 2016; Stam and van de Ven, 2021).

An EE can be defined as a "system of actors and factors that collaboratively enable productive entrepreneurship to flourish in a particular region" (Stam and van de Ven, 2021). The EE framework categorizes factors into Resource Endowments, critical for the development of new entrepreneurial activities, and Institutional Arrangements, which can either facilitate or impede the development and circulation of these resources.

Efforts aimed at investigating the relative importance of different factors within this framework for EEs development have proliferated in the literature. While examples of dynamic and successful ecosystems, such as Silicon Valley, London, or Shenzhen, are frequently cited in relation to the rise and expansion of HGPFs, studies indicate that simply increasing the number of these firms does not necessarily result in more vibrant economies (Mazzucato, 2014; Colombelli et al., 2016). Nevertheless, much of the research and policymaking regarding EEs has predominantly focused on identifying the specific combinations of factors beneficial for the generation of more potentially high-growth firms. Actually, the hallmark of these “regional hotbeds” is their ability to favor HGPFs growth (Brown and Mason, 2017; Brown and Mawson, 2019). The capacity of entrepreneurs to access resources within an ecosystem stands out as a more effective measure of that ecosystem's potential for growth (Shi and Shi, 2022; Spigel and Harrison, 2018). The idea that resources can circulate without restrictions and that equal access is available to all is highly idealistic. This perspective underlines the need for governmental intervention to ensure equitable opportunities (Sipola et al., 2016).

In this context, the role of Entrepreneurial Support Organizations (ESOs) is crucial. ESOs, including incubators and accelerators, act as intermediaries to foster entrepreneurial activities, particularly in the early stages of HGPFs (Bergman and McMullen, 2023; Ratinho et al., 2020). Despite mixed outcomes at the firm level (Bergman and McMullen, 2022), ESOs significantly contribute to EE development by promoting resource sharing, managing resource exchanges, and reducing information disparities (Cohen et al., 2019; Edler and Yeow, 2016; van Rijnsoever, 2020, 2022; Ng et al, 2023). Moreover, they play a pivotal role in evolving and coordinating EEs, fostering a shared vision, and enhancing the flow and dynamism of resources within the ecosystem (Goswami et al., 2018; Feld and Hathaway, 2021; Pustovrh et al., 2020; Shi and Shi, 2022). It is important to note that the various entities falling under the definition of Entrepreneurial Support Organizations (ESOs), such as incubators and accelerators, can themselves be classified into different categories based on aspects like strategic focus or organizational legal nature, and hence the sponsors behind them. While the literature often considers the ESO element as a single block, without disaggregating the various sub-elements, research suggests that some models may be more effective than others in addressing specific challenges. Despite this, the EEs literature on whether different typologies of ESOs are more effective in facilitating ecosystem growth remains largely unexplored.

This thesis, although limited to three countries (Italy, the Netherlands, and Ireland), seeks to bridge this gap. Initially by developing an updated and comprehensive database, in order to create a current mapping of the incubation and acceleration activities in the three aforementioned states. Subsequently, it investigates and elaborates on two fundamental aspects:

The first aspect concerns the correlation between the entrepreneurial output of a region and its corresponding density of incubators/accelerators per million inhabitants. By exploiting the created database, results from previous studies will be reprocessed, and the analysis will be expanded to include a breakdown of these organizations based on certain characteristics (organizational legal nature and area of focus). This will provide a much more detailed overview of the phenomenon in question and clarify certain dynamics more explicitly.

The second aspect examines the role these organizations play within the ecosystem. Our dataset will be enriched with data regarding other EEs enabling factors collected from a previous study's dataset, and a Qualitative Comparative Analysis (QCA) will be conducted to determine which configurations of factors are present in regions characterized by high entrepreneurial output values. It will be shown that organizations belonging to a specific category are present in the configuration of conditions associated with more dynamic ecosystems.

Considering the systemic effect that ESOs might unleash on the development of EEs (van Rijnsoever, 2020), these findings contribute valuably to the EE literature by providing empirical evidence on how certain subcategories of incubators and accelerators are more prevalent in regional ecosystems characterized by a certain entrepreneurial dynamism, and suggesting that focusing on this aspect, along with other EEs enabling factors, could be beneficial for the development of the overall ecosystem and all the positive aspects deriving from this.

The thesis is structured as follows: Chapter 2 synthesizes the existing literature on Entrepreneurial Ecosystems and Entrepreneurial Support Organizations to give the reader a detailed overview of what has been discussed so far. Chapter 3 presents the construction procedure followed to set up the database, while Chapter 4 offers a descriptive and qualitative analysis of the collected data. Chapter 5 addresses the empirical analysis conducted, including both correlation analysis and QCA, explaining the methodologies adopted and results obtained. Chapter 6 discusses the work's implications and presents the conclusions.

2. Literature review

In this chapter a more detailed overview on the concept of entrepreneurial ecosystems will be provided, along with the state of empirical research regarding the relationship between entrepreneurship and economic development, and efforts to develop frameworks representing the latter. Subsequently, an analysis of the role of entrepreneurial support organizations (ESO) in this context will be carried out to shed light on the motivations for focusing on these entities. This discussion will then proceed to explore their various types, strategic focus, sponsors, and the support mechanisms they offer.

2.1 Entrepreneurial Ecosystems

Entrepreneurial ecosystems can be defined as “systems of actors and factors that, by working together, enable productive entrepreneurship to emerge in a particular region” (Stam and van de Ven, 2021). The entrepreneurial ecosystem approach has gained popularity due to the gradual shift from managerial economies to entrepreneurial economies (Thurik et al., 2013). In the latter, entrepreneurship is considered a primary catalyst of economic development (Schumpeter, 1934).

The field of study concerning entrepreneurship and its impact on regional economic development is typically divided into two principal areas. The first domain, focusing on economic growth, examines the overall influence of entrepreneurial activities on economic expansion. The second domain, known as the geography of entrepreneurship, investigates the reasons behind the geographical diversity of entrepreneurial endeavors.

In the following sections, this thesis will provide significant insights regarding both these perspectives. Moreover, a novel tool intended to merge these two approaches will be thoroughly evaluated. The latter is designed to assess the relationship between entrepreneurship and the development of regional economies, by tracing the systemic nature of entrepreneurial economies and the degree to which economic systems are able to produce entrepreneurship (Brown and Mason, 2014; Stam 2015). It serves as a useful instrument for understanding and modeling the dynamics of this phenomenon, allowing to synthesize and integrate a great amount of data to measure the (changing) nature, outputs and outcomes of regional economies (Leendertse et al, 2021). The above-mentioned qualities have thus the potential to provide policy makers with an actionable framework.

2.1.1 Entrepreneurship and economic growth

The significance of entrepreneurship in fostering economic development has been a subject of scholars for decades, tracing back to the works of Schumpeter (1934), Leibenstein (1968), and Baumol (1990). The economic growth literature revolves around the extent and manner in which entrepreneurship contributes to the latter. Although there is not a unanimous agreement on the positive impact of entrepreneurship, the majority of evidence suggests the positive (causal) influence of entrepreneurship on economic growth (Audretsch et al., 2006; Bosma et al., 2018; Carree and Thurik, 2010; Fritsch, 2013). The primary causal factors are identified as the generation and spread of innovations and the competition introduced by entrepreneurs (Bosma et al., 2018).

The influence and magnitude of the impact of entrepreneurship on economic growth vary based on the entrepreneurial context and type. Entrepreneurship characterized by ambition, opportunity-seeking, and growth orientation is more likely to spur economic growth compared to self-employment or necessity-driven entrepreneurship (Bosma et al., 2018, 2011; Fritsch, 2013; Stam et al., 2011; Stam and Van Stel, 2011). Moreover, entrepreneurship tends to be most effective in environments with inclusive and growth-promoting institutions, characterized by supportive legal and regulatory frameworks, accessible financial resources, comprehensive educational systems, encouraging social and cultural norms, and well-established infrastructure and technological advancements. (Bosma et al., 2018; Sobel, 2008).

Furthermore, it is crucial to acknowledge that entrepreneurship is inherently a localized phenomenon (Feldman, 2001). This local aspect leads to significant regional variations in entrepreneurial activity, with its underlying causes deeply embedded in spatial and regional factors. The exploration of these spatial disparities in entrepreneurship (Alvedalen and Boschma, 2017; Guzman and Stern, 2015) reveals the complex relationship between regional characteristics and entrepreneurial activities. Understanding these regional differences and their root causes is essential in developing policies that effectively leverage entrepreneurship for regional and overall economic growth.

2.1.2 The geography of entrepreneurship

The research on the geographical dimensions of entrepreneurship offers extensive insights into the diverse factors that influence its prevalence across regions (Bosma et al., 2011; Stam, 2010; Stam and Spigel, 2018). The origins of Entrepreneurial Ecosystems (EEs) can be traced to literature on regional development, encompassing clusters, industrial districts, and regional innovation systems, particularly the concept of business ecosystems (ACS et al., 2017a; Cavallo et al., 2018). However, while previous literature primarily focused on innovation, employment, and economic growth, EEs offer a perspective on how systemic conditions affect entrepreneurial actors' capacity to create value (Acs et al., 2014; Stam, 2015). The empirical literature in this field identifies ten main elements that affect the prevalence of entrepreneurship (Stam, 2015; Stam and Van de Ven, 2021).

The initial element, *formal institutions*, establishes essential conditions for economic activities (Granovetter, 1992) and the productive utilization of resources (Acemoglu et al., 2005). These institutions not only facilitate economic actions but also shape the approach and societal impacts of entrepreneurship (Baumol, 1990). A second factor, informal institutions, particularly a *culture* that values entrepreneurship, significantly affects its prevalence (Fritsch and Wyrwich, 2014). Entrepreneurial *networks*, as a third aspect, create a conduit for information, aiding in the effective allocation of knowledge, labor, and capital (Malecki, 1997).

The fourth element, a well-developed *physical infrastructure*, which includes traditional and digital infrastructure, is crucial for enabling economic interactions and entrepreneurship (Audretsch et al., 2015). Access to *finance*, particularly from investors with entrepreneurial expertise, is a fifth vital component for funding long-term entrepreneurial projects (Kerr and Nanda, 2009). The sixth element, *leadership*, is essential in steering and maintaining a robust entrepreneurial ecosystem, with visible leaders dedicated to their region (Feldman, 2014; Feldman and Zoller, 2012). The commitment and community spirit of regional leaders often mirror regional norms (Olberding, 2002).

The presence of a diverse and skilled labor force, or '*talent*', is arguably the most critical condition for entrepreneurship, marking the seventh element (Acs and Armington, 2004; Glaeser et al., 2010; Lee et al., 2004; Qian et al., 2013). Eighth, entrepreneurial opportunities frequently emerge from *knowledge* within both public and private sectors (Audretsch and Lehmann, 2005). The ninth factor is the financial capacity of the population to purchase goods and services, essential for the existence of entrepreneurship. The presence of such *demand* is a crucial part of the entrepreneurial ecosystem, with regional income and purchasing power being both a consequence and a catalyst of entrepreneurship, highlighting feedback effects in entrepreneurial ecosystems (Berkowitz and DeJong, 2005).

Finally, the tenth element involves the supply of support services by various *intermediaries*, which can considerably lower barriers for new entrepreneurial projects and shorten the time to market for innovations (Clayton et al., 2018; Howells, 2006; Zhang and Li, 2010). The aforementioned elements are summarized in Table 2.1.

Table 2.1 Entrepreneurial ecosystem elements and output

Element	Definition
Formal institutions	The rules of the game in society
Culture	The degree to which entrepreneurship is valued in a region
Networks	The social context of actors, especially the degree to which they are socially connected
Physical infrastructure	Transportation infrastructure and digital infrastructure

Finance	The presence of financial means to invest in activities that do not yet deliver financial means
Leadership	The presence of actors taking a leadership role in the ecosystem
Talent	The skills, knowledge and experience possessed by individuals
Knowledge	Investments in (scientific and technological) knowledge creation
Demand	The presence of financial means in the population to purchase goods and services
Intermediaries	The supply and accessibility of intermediate business services
Productive entrepreneurship	Any entrepreneurial activity that contributes (in)directly to net output of the economy or to the capacity to produce additional output

2.1.3 The Entrepreneurial Ecosystem framework

To fully understand the long-term growth of economies and the significant role of entrepreneurship, we need to merge the ideas from economic growth and the geography of entrepreneurship. Entrepreneurship serves two roles here: it is the end result in the geography of entrepreneurship approach, and at the same time, it is the input variable in the economic growth literature approach (Leendertse et al., 2021). The situation gets more complex as entrepreneurship and economic growth start influencing the basic elements of where entrepreneurship thrives. For example, we see serial entrepreneurs becoming active investors and focal nodes for the creation of entrepreneurial networks (Feldman and Zoller, 2016). Also, as the economy grows, there is a rise in customer demand, more investment in new knowledge, and potential issues related to overcrowding in business hubs. This interconnection highlights how entrepreneurship intertwines with economic development and geographical factors in the business world.

A viable approach to navigate through these theoretical complexities requires the adoption of complex systems methodologies (Arthur, 2013; Hidalgo and Hausmann, 2009; Ostrom, 2010; Simon, 1962). This is done to create a comprehensive system-based view of how entrepreneurial economies evolve (Feld and Hathaway, 2020; Roundy et al., 2018; Stam and Van de Ven, 2021).

This has led to the creation of the integrative model of entrepreneurial ecosystems by Stam and Van de Ven (2021), which stands as the most up-to-date and inclusive framework (Figure 2.1). This model incorporates resource endowment elements and institutional arrangements, which represent, respectively, resources that are deemed critical for the development of new entrepreneurial activities and factors that can facilitate or hinder the development and circulation of such resources (Van de Ven, 1993).

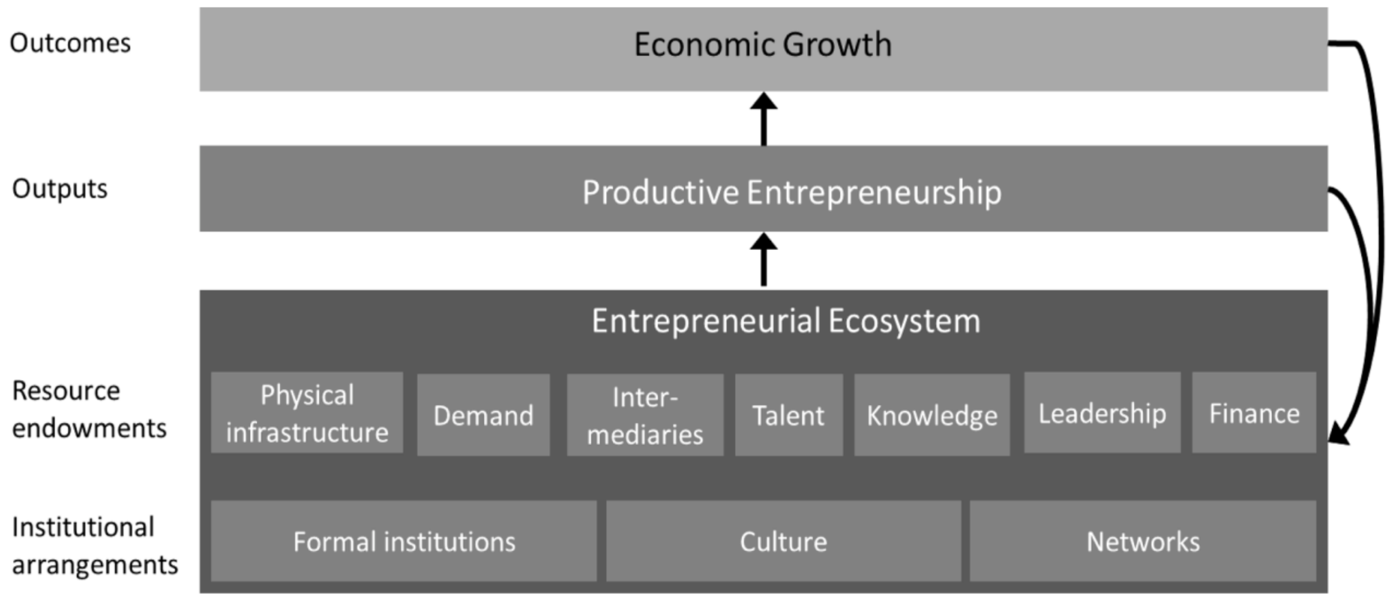

Figure 2.1 Elements, outputs and outcomes of an entrepreneurial ecosystem

The framework relies upon three principal mechanisms: the interdependence and coevolution of elements within the system, the upward influence of the ecosystem on entrepreneurial activity, and the reciprocal downward impact of entrepreneurial outcomes on the ecosystem's quality (Stam and Van de Ven, 2021).

Specifically, the first mechanism states that the entrepreneurial ecosystem elements are mutually interdependent and coevolve in a territory.

The second construct focuses on how the context, measured with the collection of entrepreneurial ecosystem elements in a region, causes productive entrepreneurship that builds upon these elements. This process is known as upward causation, referring to the way in which the overall structure (The ten observable entrepreneurial ecosystem elements) affects individual agency (the levels of entrepreneurial activity in a territory).

The third and last mechanism highlights how productive entrepreneurship subsequently affects the entrepreneurial ecosystem, a process labelled as downward causation: agency affecting structure. Examples from the literature are successful entrepreneurs becoming venture capitalists, role models, leaders and network developers in the region (Bosma et al. 2012; Garnsey and Heffernan 2005; Mason and Harrison 2006), which we interpret as positive feedback effects of entrepreneurs on the finance, culture, leadership and network elements of entrepreneurial ecosystems.

Following this detailed overview of entrepreneurial ecosystems, which has enabled a better understanding of the complex dynamics governing them and the diverse players involved, attention will now be turned to one of the elements previously described, namely *intermediaries*. More specifically, attention will be directed towards the subcategory that is most intimately linked with entrepreneurship and represents the primary focus of this thesis, namely, Entrepreneurial Support Organizations (ESOs). Before delving into an in-depth examination of ESOs, the subsequent paragraph will outline their role within the ecosystem, to underscore the importance of concentrating on this aspect.

2.1.4 The role of ESOs in Entrepreneurial Ecosystems

Policymakers are focusing their efforts more than ever on crafting strategies that catalyze the development of High Growth Potential Firms (HGPFs), recognizing the profound impact these enterprises can have on regional economic landscapes. These impacts include job creation, the stimulation of innovation, and overarching economic growth, which are crucial for boosting competitiveness and prosperity in both local and national markets (Brown and Mawson, 2019). In this vein, the concept of the Entrepreneurial Ecosystem (EE) has emerged as a pivotal framework in academic and policy-making circles. This framework scrutinizes the components that facilitate the emergence of HGPFs across different regions through a complex systems perspective, drawing significant scholarly and practical attention (Malecki, 2018; Stam, 2015; Stam and Spigel, 2016; Stam and van de Ven, 2021).

Recent research endeavors have intensified to unpack the significance of the various elements constituting the EE model discussed previously. Although vibrant and successful ecosystems like Silicon Valley, London, and Shenzhen are often associated with the growth and scaling of HGPFs, evidence suggests that the simple existence of these ecosystems is not a silver bullet for fostering dynamic economies (Mazzucato, 2014; Colombelli et al., 2016). Nevertheless, the bulk of studies and policy measures concerning EEs have predominantly aimed at identifying the optimal combination of elements that nurture an increased number of high-growth firms (Audretsch et al., 2020; Brown and Mason, 2019).

A lack of research into the causal mechanisms driving EEs' evolution (Alvedalen and Boschma, 2017; Motoyama and Watkins, 2014) may account for why many EE-focused policies fail to generate supportive environments for HGPFs (Brown and Mawson, 2019; Lerner, 2010). However, Schrijvers et al. (2023) and Leendertse et al. (2022) are notable for directly examining the factors prevalent in regions where HGPFs successfully scale, observing that unicorns—firms valued at over one billion dollars—thrive primarily within mature EEs. Adopting a process-oriented approach, Spigel and Harrison (2018) delve into the evolutionary dynamics shaping high-performance regions, with Spigel's study (2017) highlighting how the synergy between supportive EE elements and stakeholders bolsters the competitiveness of new ventures in places like Calgary and Waterloo, Canada. Each region exhibits unique mechanisms that foster strong ecosystems: Calgary benefits from a central industry that attracts talent and capital, creating a vibrant network of innovative startups and backers. Conversely, Waterloo's ecosystem is fueled by a culture that celebrates risk and technological entrepreneurship, as demonstrated by local success stories like Blackberry, fostering robust social networks that reinforce the region's entrepreneurial spirit (Spigel, 2017).

Furthermore, Spigel and Harrison (2018) underline the critical role of network access and mentorship in EE development, arguing that the potential of an ecosystem hinges on entrepreneurs' ability to tap into local resources. Successful ecosystems are characterized by dense, trust-based social networks that facilitate entrepreneurs' access to resources (Feld, 2020), highlighting the importance of enabling resource mobility within EEs for their continued growth (Shi and Shi, 2022; Spigel and Harrison, 2018). Yet, assuming uniform access and fluid resource exchange among all entrepreneurs is overly optimistic. Therefore, providing relational support to HGPFs (Mason and Brown, 2014) and boosting resource fluidity (Shi and Shi, 2022) are identified as vital strategies for policymakers aiming to foster EEs.

The emergence of entities dedicated to nurturing entrepreneurship plays a key role in the comprehensive growth of EEs (van Rijnsoever, 2020; 2022). Entrepreneurial Support Organizations (ESOs) are established with the primary aim of encouraging entrepreneurial ventures by offering structured support, especially during the nascent and vulnerable phases of HGPFs' lifecycles (Bergman and McMullen, 2023; Ratinho et al., 2020). Despite the advent of various types of ESOs, such as science parks, incubators, and accelerators, both public and private, they essentially serve as intermediaries, assisting entrepreneurs in navigating the challenges of startup and expansion phases and in connecting with vital networks (Clayton et al., 2018; Howells, 2006; Zhang and Li, 2010).

While the impact of ESOs on the survival and growth of HGPFs shows mixed results at the firm level (Bergman and McMullen, 2022), it's broadly acknowledged that they significantly enhance EE development by promoting the exchange of resources and information among ecosystem stakeholders (Cohen et al., 2019; Edler and Yeow, 2016; Eveleens et al., 2017; van Weele et al., 2017; van Rijnsoever, 2020, 2022). ESOs, acting as intermediaries, facilitate the ecosystem's development through various means (Goswami et al, 2018; Pustovrh et al, 2020; van Rijnsoever, 2020, 2022) by managing resource exchanges (Ng et al, 2023) and reducing informational asymmetries that hinder the formation of valuable connections among different actors (McEvily and Zaheer, 1999), thereby integrating knowledge, financial, and business networks (Spigel, 2023; van Rijnsoever, 2022).

Moreover, ESOs play a crucial role in evolving and coordinating EEs, molding participants' interests and motivations. They foster a shared vision and the formation of local, trust-based communities, influencing the relationships and actions of actors (Ng et al, 2023; Goswami et al, 2018; Feld and Hathaway, 2021; Tjong et al., 2015). Additionally, ESOs act as catalysts by promoting the emergence of key players, attracting new local investors, and stimulating investment in local HGPFs (Fehder et al., 2014). They are instrumental in facilitating resource flow within and beyond the ecosystem, thereby enhancing resource dynamism and availability (Pustovrh et al., 2020; Shi and Shi, 2022).

Falling under the umbrella of ESOs are entities such as incubators, science parks, accelerators, venture builders, and co-working spaces. These can further be categorized based on strategic focus or organizational legal nature, along with the sponsors backing them. Although the literature often views the ESO component as a monolith without distinguishing between its various sub-elements, research indicates that certain models may be more effective in addressing specific challenges. Despite this, EEs literature does not delve into whether different ESO typologies are more effective in facilitating ecosystem growth.

The following sections will examine deeper the various aspects and typologies of these organizations to fully understand them before seeking analytical evidence to support the assertions made above.

2.2 Entrepreneurial Support Organizations

The current state of the art on ESOs outcomes in Entrepreneurial Ecosystems (EEs) encompasses a broad array of conceptual studies. These studies offer detailed analyses of ESOs characteristics (Audretsch et al., 2019), resources (Sardeshmukh et al., 2019), and strategies (Theodoraki, 2020). More precisely, as discussed before, ESOs play a pivotal role in the entrepreneurial dynamics of EEs, as they stimulate innovation through the creation of relationships among their participants (Cloitre et al., 2022; Stam and Van de Ven, 2021; Theodoraki, 2020). By acting as intermediaries, ESOs facilitate the exchange of resources, reduce information asymmetries, and connect various stakeholders within the ecosystem, including knowledge institutions, financial entities, and business networks. This interconnectedness is vital for fostering a collaborative environment that supports entrepreneurial ventures (Ng et al, 2023; van Rijnsoever, 2022).

Bergman and McMullen (2022:3) define ESOs as *"an organization whose primary purpose is to support individuals and collectives, through (in)direct and (im)material assistance, as they seek to initiate and progress through the stages of the entrepreneurial process*". Therefore, ESOs encompass a large panel of organizations, including incubators, science parks, accelerators, venture builders, and co-working spaces (Bergman and McMullen, 2022).

In the following paragraphs, various existing types of these entities will be examined, along with their admission regimes and the support mechanisms they are capable of offering. This examination will further elucidate the important role of ESOs in enhancing the developmental trajectories of EEs by promoting resource and information sharing among different ecosystem stakeholders (Cohen et al., 2019; Edler and Yeow, 2016; Eveleens et al., 2017; van Weele et al., 2017; van Rijnsoever, 2020, 2022). Through their multifaceted support mechanisms, ESOs not only aid in overcoming the initial hurdles faced by HGPFs but also in creating a conducive environment for their sustained growth and the overall vitality of the entrepreneurial ecosystem.

2.2.1 ESOs support mechanisms

After their acceptance, ESOs provide startups with diverse forms of support (Amezcua et al., 2013; Bruneel et al., 2012; Cohen et al., 2019; van Weele et al., 2017). Van Rijnsoever (2020) outlines three principal mechanisms of support that contribute to the broader benefits within the entrepreneurial ecosystem (EE).

The first mechanism is field building. This involves ESOs actively connecting their tenant startups with external peers, as described by Amezcua et al. (2013). Such efforts increase the opportunities for interaction between supported and non-supported startups, primarily through structured introductions or networking events.

The second mechanism, as identified by Patton et al. (2009) and Van Rijnsoever et al. (2017), is VC networking. Here, ESOs act as intermediaries, facilitating connections between startups and venture capitalists (VCs). This networking often takes the form of events, direct introductions, or referrals, aiming to enhance the frequency of interactions between startups and VCs.

The third is business learning, which allows the startup to improve its ideas and management qualities. Business learning lets startup entrepreneurs acquire new knowledge, reflect on their business ideas and practices (Bruneel et al., 2012; van Weele and Van Rijnsoever, 2017), and develop new capabilities (van Rijnsoever and Eveleens, 2021). Overall, they prevent startups from being content too early with many businesses' decisions (Cohen et al., 2018). ESOs promote learning through professional consulting services, coaching, and mentoring (Cohen et al., 2019; Rotger et al., 2012; van Weele et al., 2017). This aspect of learning not only refines startups' business models, making them more appealing to VCs, but also guides them in managing their dual objectives of generating social/environmental value and profit, especially when it comes to sustainable development startups (SDSs).

2.2.2 Typologies of ESOs

Historically, research on ESOs has focused on various types of organizations performing analogous functions (Bergman and McMullen, 2021). A significant portion of this literature revolves around incubators, entities designed to assist startups (Bergek and Norrman, 2008; Bruneel et al., 2012). The optimal functioning of these incubators has been a topic of extensive academic debate for years (Amezcua et al., 2013; Bruneel et al., 2012; Eveleens et al., 2017). Over time, incubators, along with other support programs, have evolved, experimenting with different forms and levels of support, which has led to the development of various types of incubators (Galbraith et al., 2019; Grimaldi and Grandi, 2005). These incubators have undergone three generational changes (Aerts et al., 2007; Bruneel et al., 2012).

The first generation, prevalent in the 1980s, was primarily focused on economies of scale, offering shared office space and facilities (Bruneel et al., 2012). Although still relevant, modern incubators have shifted their emphasis towards providing intangible resources. Recognizing the lack of entrepreneurial experience in founders of technology-based startups in the 1990s, incubators expanded their services to include entrepreneurial coaching and training to foster business learning (Bruneel et al., 2012). This second generation also began offering funding in exchange for equity. The third generation, emerging in the late 1990s, concentrated on providing startups with network access, facilitating external resource acquisition, and granting legitimacy to startups (Bøllingtoft and Ulhøi, 2005b; Bruneel et al., 2012; Hansen et al., 2000). This generation acts as intermediaries in regional entrepreneurial ecosystems, promoting networking among startups, VCs, and other stakeholders (van Rijnsoever, 2020). These intermediaries, as network brokers, play a crucial role in forming regional economic clusters (Smedlund, 2006), fostering innovations (Howells, 2006), developing entrepreneurial ecosystems (Goswami et al., 2018; Stam, 2015), and accelerating sustainability transitions (Kivimaa et al., 2019).

Beyond incubators, other ESO types exist, performing similar functions in an EE but under different designations (Aernoudt, 2004; Clayton et al., 2018). Prominent among these are accelerator programs, focused on nurturing "early-stage, growth-driven companies through education, mentorship, and financing in a fixed-period, cohort-based setting" (Hathaway, 2017). Accelerators usually operate over three to six months, in contrast to the longer support period offered by incubators (Cohen, 2013). However, accelerator programs vary widely in terms of sponsorship, purpose, and support programs (Cohen et al., 2019). Another significant category is Technology Transfer Offices (TTOs), responsible for commercializing technologies from universities or other knowledge institutions. TTOs facilitate this by securing intellectual property rights and aiding in the creation of academic spin-off firms and preliminary investments, connecting these firms with other actors in the EE, such as VCs (Algieri et al., 2013; Gubitta et al., 2015). Although TTOs primarily target technology-based startups, their functions are akin to other ESOs. A fourth example of ESOs includes co-working spaces, which offer shared office environments (Spinuzzi, 2012). These spaces are convenient and flexible for budding entrepreneurs, providing limited startup support but fostering community building and networking among occupants, similar to some ESO functions in an EE (Clayton et al., 2018; van Weele et al., 2018a). A fifth and emerging form of startup support is venture builders, also known as tech studios or startup factories. Current scientific research on this model is limited, but it essentially involves companies that aim to generate business ideas and assemble professional teams to turn promising concepts into successful ventures (Diallo, 2015; KarSin, 2019).

These entities collectively represent the diverse manifestations of the ESO phenomenon (Bergman and McMullen, 2021). Hence, the term *entrepreneurial support organizations* is used as an umbrella term encompassing all such initiatives in this field.

To conclude this detailed overview about ESOs we have to analyze their strategic focus and the sponsors behind them. Understanding these two aspects is essential for figuring out what makes EEs work well. The deliberate selection processes and strategic orientations of ESOs directly influence the nurturing and growth of startups, determining which innovations flourish. Meanwhile, the array of sponsors behind these ESOs—from corporate entities and educational institutions to government bodies and non-profits—play a pivotal role in providing the necessary resources, networks, and legitimacy. Delving into these aspects helps identify how targeted support and strategic alignment between ESOs and their sponsors can foster high-growth potential firms.

2.2.3 ESO strategic focus

ESOs play a crucial role in providing startups with access to financial support networks (van Rijnsoever, 2020). Prior to this, however, they must undertake the selective process of determining which startups are eligible for their support (Bergek and Norrman, 2008; Hackett and Dilts, 2004). Typically, the selection criteria used by ESOs revolve around the entrepreneur or team's qualifications (Aerts et al., 2007; Bergek and Norrman, 2008) and the viability of the startup's business concept. Additionally, the startup's commitment to sustainable development is increasingly becoming an explicit criterion for selection. However, the primary criterion for selection remains the competitive scope that characterizes the ESO.

In line with Porter's (1986) framework, Carayannis and von Zedtwitz (2005) identified four distinct competitive scopes to categorize incubators -ESOs in a broader sense- based on their strategic objectives, which in turn shape their outcomes. This includes: a *vertical scope*, referring to ESOs focusing on early-stage startups while differentiating from business angels through institutionalized coaching and other startup services; a *segment scope*, where ESOs specifically target a predefined audience, like university-affiliated ESOs supporting students, or corporate ESOs aiding their employees; a *geographical scope*, for ESOs having territory-grounded development strategies; and an *industry scope*, where ESOs focus their efforts to one specific industry.

These competitive scopes are instrumental for researchers to distinguish between different ESOs, as they lead to varied strategic objectives among the ESOs and their sponsors: "This differentiation is more than just a superficial academic distinction. It fundamentally affects the design of the incubator's business model and the execution of the incubator's business plan. The opening spectrum of competitive focus and strategic objectives has led to the archetyping of incubator forms, offering different benefits to different clientele." (Carayannis and von Zedtwitz, 2005:13). These strategic objectives may align or diverge, especially under the increasing institutional pressure from policymakers to promote entrepreneurial activities that are more in harmony with societal and environmental responsibilities.

2.2.4 ESO sponsors

ESO sponsors are best described as institutions that offer financial or in-kind support to ESOs themselves, encompassing elements such as office space, professional services, mentors, and endorsement (Cohen et al., 2019). These sponsors typically include a variety of organizations such as corporations, universities, non-profits, and government entities (Carayannis and Von Zedtwitz, 2005). In their detailed analysis, Bergman and McMullen (2022) further elaborate that ESO sponsors can be primarily categorized into four groups: corporate, university, non-profit, and government institutions. These sponsors engage with ESOs for gaining competitive, efficiency, and sustainability benefits (Bergman and McMullen, 2022). Moreover, they classify six distinct types of ESO sponsors: corporations, entrepreneurs, governments, financial institutions, non-profit organizations, and universities.

There are different motivations behind the above-mentioned sponsors. *Corporations* often sponsor ESOs to foster innovation that complements their existing operations or to explore new business opportunities. Through this engagement, they gain early access to innovative products, technologies, and entrepreneurial talent. It also serves as a platform for corporate social responsibility (CSR) initiatives, enhancing their brand image and community relations. *Universities* typically engage with ESOs to bridge the gap between academic research and market application. This involvement enriches the educational experience by providing students with real-world entrepreneurial exposure and opportunities for research commercialization. Additionally, it strengthens the university's reputation in innovation and entrepreneurship. *Non-profit organizations* sponsor ESOs primarily to promote social welfare, economic development, and job creation in specific communities or sectors. Their involvement often focuses on supporting underserved or marginalized groups, aligning with their broader mission of societal improvement. *Government entities* sponsor ESOs to stimulate economic growth, foster innovation, and create jobs. Their support is often part of broader economic development policies aimed at building a vibrant entrepreneurial ecosystem, diversifying the economy, and enhancing the country's global competitiveness. *Financial institutions* are motivated by the potential for financial returns through investments in promising startups. They also engage with ESOs to identify emerging market trends and to expand their network within the entrepreneurial community. To conclude, *individual entrepreneurs and mentors* often engage with ESOs to give back to the entrepreneurial community, sharing their knowledge, experience, and networks. This involvement also allows them to stay connected with the latest industry trends and potential investment opportunities.

The involvement of these entities in the entrepreneurial ecosystem (EE) is indispensable for the development and success of startups and entrepreneurs. Such sponsors provide essential financial, technical, or social support to startups. Their role is critical in fostering an environment conducive to innovation and entrepreneurship within the EE.

3. Data collection and methodology

As stated in the introduction, the first objective of this thesis was to develop an updated national mapping of incubation and acceleration activities, specifically focusing on Italy, the Netherlands, and Ireland. Having access to a complete and reliable dataset is crucial throughout the subsequent analysis phase. For this reason, the construction of the database represents the cornerstone of this research. This chapter is thus dedicated solely to this aspect.

It will be explained how the research parameters were defined, the initial data available for each country, the subsequent steps in the database development, and finally, the database itself will be shown, to better understand the results of the preceding steps.

3.1 Setting of research parameters

Prior to initiating the database construction process, research parameters were explicitly defined. Among the various types of Entrepreneurial Support Organizations (ESOs) listed in Chapter 2.2.2, only incubators and accelerators were selected for consideration[1]. This decision limited the search for such entities, making it a manageable effort for an individual researcher, and more importantly, the narrowed scope ensured a higher precision in the outcomes.

For each organization, multiple attributes were gathered in addition to mere names, providing a broader overview and enhanced characterization. Specifically, data was collected regarding the state and region where the organization is located, the year of foundation, the organizational legal nature, the type of organization and the area of focus. As mentioned earlier, the collection of these elements makes the database much

[1] Entrepreneurial training courses, such as those offered by university faculty, have not been included, as they are primarily educational and not actual organizations. Additionally, awards or calls for startups that do not provide direct incubation paths, or that fully outsource incubation to organizations previously examined, have been excluded.

more comprehensive, and will later allow in the subsequent phase to understand which combinations of these characteristics have the most impact on the entrepreneurial ecosystems. Let us now specifically analyze the various characteristics under examination.

The *year of foundation* is self-explaining, simply indicating the year the organization began its operations. For some of them, it was not possible to obtain this information, but the number is negligible compared to the total.

As for the *organizational legal nature,* the following classification has been made: public organizations, managed exclusively by public administrations or bodies, often through the creation of "in-house" companies; public/private organizations, whose corporate structure includes both public and private entities; private organizations, namely organizations managed exclusively by private entities.

The voice *type of organization* discriminates between incubators and accelerators. In Italy only, some incubators are classified as certified. This identifies those that are registered in the special section of the Registro delle Imprese, referred to as certified incubators.

The element *area of focus* distinguished between generalist organizations, which accept startups from any sector, and vertical organizations, focused on a specific sector or industry. In the latter case, the area of interest was also indicated.

Lastly, it is time to explain the geographical characterization. As stated before, and as will be visible in the database overview, the *state* and *region* of belonging have been indicated for each organization. The reasons behind a regional-level classification are essentially two: the first one is because entrepreneurship is largely a regional event (Feldman, 2001), and there is substantial variation in entrepreneurship between regions within countries (Sternberg, 2009; Fritsch and Wyrwich, 2014). The level of the (city-)region is generally seen as the more adequate level from a policy (Katz and Bradly, 2013; Spigel, 2020) and entrepreneurship practice (Feld, 2012; Feldman, 2001) point of view. The regional level in Europe is best defined through the NUTS 2 classification, in which the population for a single unit is roughly between 800,000 and 3 million people (European Commission, 2018).

The second reason for adopting a regional approach is due to the entrepreneurial output element, that will be largely used in the following chapter for the correlation analyses. This factor is indeed taken from the Leendertse et al. (2021) research paper, where, for each European NUTS2 unit, the number of new firms that are registered in Crunchbase was taken as measure for entrepreneurial output.

Below, in Figure 3.1, 3.2, 3.3 and 3.4, the dimensions and boundaries of the NUTS2 are clearly depicted.

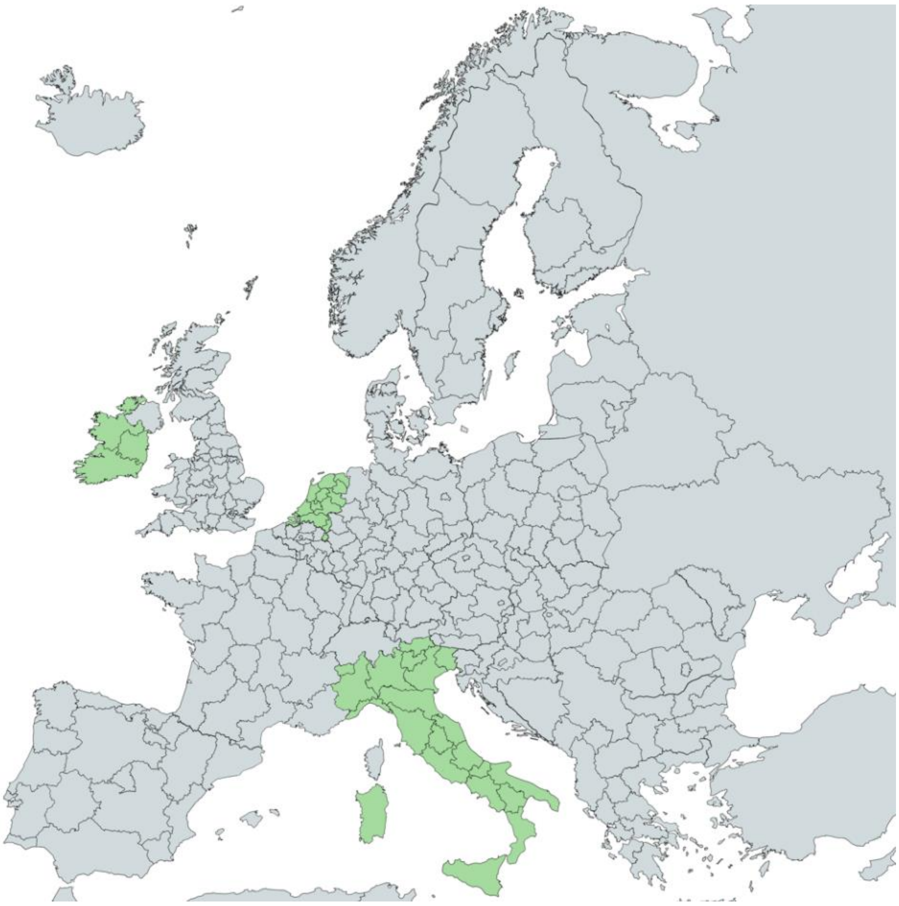

Figure 3.1 Countries selected for the thesis study

Figure 3.2 Italy NUTS2 classification

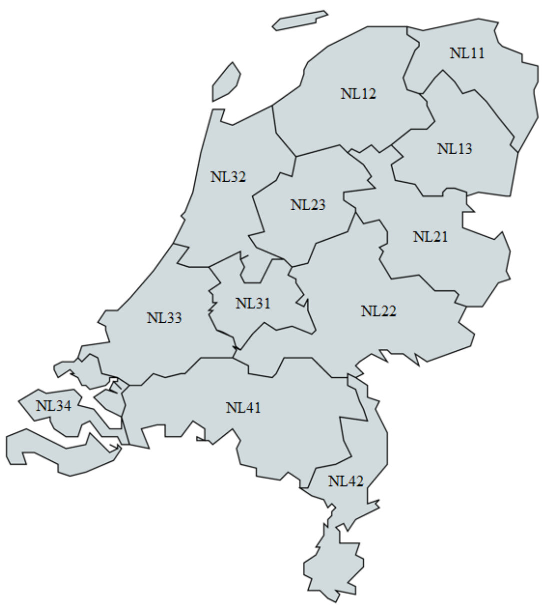

Figure 3.3 Netherlands NUTS2 classification

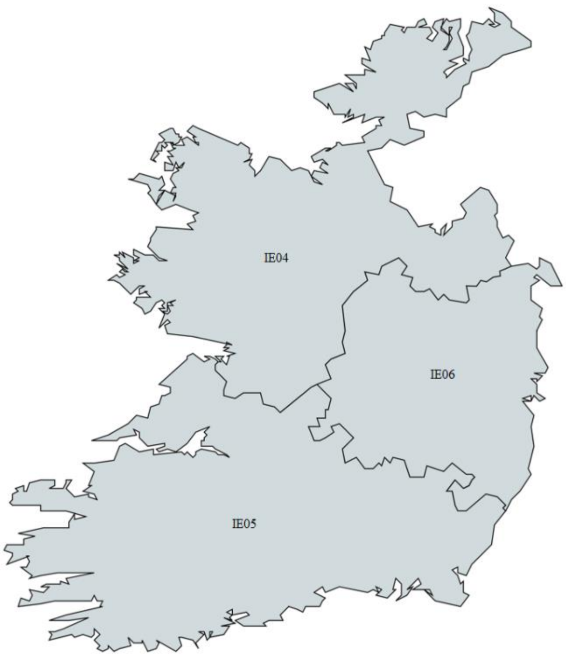

Figure 3.4 Ireland NUTS2 classification

3.2 Database construction procedure

The construction of the database was executed through a two-phase process. Initially, the groundwork involved identifying starting points for each state, so the incubation and acceleration activities already listed on various platforms. Subsequently, the actual construction phase took place. During this latter stage, it was not feasible to automate the online search for organizations, as many websites restricted access to web scraping algorithms and the information required was too diverse. Therefore, a manual search was employed, demanding greater effort but ensuring higher accuracy. This approach was adopted to compile the database in a meticulous and comprehensive manner. These two phases will now be analyzed in detail.

3.2.1 Starting points

The common starting point for all three states was the Crunchbase web platform. In the case of Italy and Ireland, two additional sources were available, respectively the list of certified incubators from the Registro delle Imprese and the database of the website Enterprise Ireland. All these sources are listed, accessible, and verifiable in the *References* chapter of this thesis.

Below, in Table 3.1, the initial data available for each country are summarized, considering the initial situation, namely the Crunchbase list, and the subsequent addition of auxiliary sources.

Table 3.1 Initial data available

	ITALY	*NETHERLANDS*	*IRELAND*
Number of organizations	89	70	40

3.2.2 Subsequent operations

The subsequent construction phase, which was conducted manually, entailed a two-step process:

- First step: Enter the phrase "incubators/accelerators in *region*" into the Google Chrome search platform, where *region* refers to a NUTS 2 area. Compile a list of all organization names found within the first two pages of the search engine results.
- Second step: With the list of organizations compiled, individually search each name within the search engine, gathering all data defined before available on the first page of the results.

This methodical approach was iterated for all the 35 NUTS2 areas (20 for Italy, 12 for The Netherlands and 3 for Ireland), ensuring a thorough collection of data. The results of the process are displayed below, in Table 3.3.

It becomes clear that the initial coverage provided by Crunchbase and the other sources does not accurately reflect the actual situation. This indicates that there was a need for an updated and detailed mapping as a foundation for subsequent analyses.

Table 3.2 Number of organizations founded after the research process, and initial sources coverage

	ITALY	*NETHERLANDS*	*IRELAND*
Number of organizations available at the starting point	89	70	40
Total number of organizations after the research process	217	113	86
Initial sources coverage	41.01 %	61.95 %	46.51 %

3.3 Database overview

Below, in Figure 3.5, a brief overview of the database resulted from the search procedure is finally provided. As stated before, it offers information about the state and region where the organization is located, the year of foundation, the organizational legal nature, the type of organization and the area of focus. The link to access the organization's main webpage is also included. The NUTS2 code associated with the region is contained in another section of the database. The complete version of the latter is available upon reasonable request.

Name	Country	Region (NUTS2)	Foundation year	Nature	Link	Type	Sector
BlockchainLab	ITA	Lombardia	2016	Private	blockchainlab.it	accelerator	Blockchain technologies, Internet of Things (IoT) and Machine Learning.
Boox	ITA	Lombardia	2011	Private	boox.it	accelerator	Generalist
BrainDTech	ITA	Lombardia	2016	Private	braindtech.com	incubator	MedTech
b-ventures	ITA	Lombardia	2013	Private	b-ventures.net	accelerator	Generalist

Figure 3.5 Database overview

4. Data analysis and descriptive statistics

From the previous chapter, it has clearly emerged that, at least with respect to the countries under examination, the initially available sources are not capable of providing an adequate overview regarding the presence of incubators and accelerators. These sources, including Crunchbase, which is increasingly being considered a reliable provider of data regarding startups and related actors (Dalle et al., 2017), provide a result that, when compared to what was obtained with our research methodology, corresponds to an initial coverage of 41,01 % for Italy, 61,95 % for The Netherlands and 46,51 % for Ireland. The database constructed thus provides a complete and realistic representation of the incubation and acceleration activities.

Below, in Table 4.1, an overview of the collected data is displayed, including the NUTS 2 codes and names of the regions under examination, their population[2], the number of incubators/accelerators, and the number of these organizations per million inhabitants. More comprehensive tables, indicating, for instance, the number of public, private, public/private organizations, or the division between generalist and vertical incubators/accelerators, will be introduced in the following paragraphs.

Table 4.1 Number of organizations identified in each region, along with the related index showing the number of these entities per million inhabitants

NUTS 2 Code	*Region*	*Population*	*Incubators/accelerators*	*Incubators/accelerators per million inhabitants*
IE04	Northern and Western Region	894.601	11	12.30
IE05	Southern Region	1.670.658	25	14.96
IE06	Eastern and Midland Region	2.494.745	50	20.04
NL13	Drenthe	497.743	2	4.02
NL23	Flevoland	434.771	1	2.30

[2] Sources: dati.istat.it (Italy), ec.europa.eu/eurostat (Ireland and Netherlands)

NL12	Friesland	654.019	2	3.06
NL22	Gelderland	2.110.472	6	2.84
NL11	Groningen	590.170	1	1.69
NL42	Limburg	1.118.302	5	4.47
NL41	Noord-Brabant	2.592.874	11	4.24
NL32	Noord-Holland	2.909.827	60	20.62
NL21	Overijssel	1.171.910	2	1.71
NL31	Utrecht	1.369.873	4	2.92
NL34	Zeeland	386.767	1	2.59
NL33	Zuid-Holland	3.753.944	18	4.79
ITC1	Piemonte	4.251.351	18	4.23
ITC2	Valle d'Aosta	123.130	1	8.12
ITC3	Liguria	1.507.636	5	3.32
ITC4	Lombardia	9.976.509	58	5.81
ITF1	Abruzzo	1.272.627	2	1.57
ITF2	Molise	290.636	1	3.44
ITF3	Campania	5.609.536	15	2.67
ITF4	Puglia	3.907.683	6	1.54
ITF5	Basilicata	537.577	4	7.44
ITF6	Calabria	1.846.610	3	1.62
ITG1	Sicilia	4.814.016	6	1.25
ITG2	Sardegna	1.578.146	4	2.53
ITH1/ ITH2	Trentino Alto Adige	1.077.143	5	4.64
ITH3	Veneto	4.849.553	14	2.89
ITH4	Friuli Venezia Giulia	1.194.248	4	3.35
ITH5	Emilia Romagna	4.437.578	25	5.63
ITI1	Toscana	3.661.981	17	4.64
ITI2	Umbria	856.407	3	3.50
ITI3	Marche	1.484.298	3	2.02
ITI4	Lazio	5.720.536	22	3.85

4.1 Foundation years trend

As previously stated, the complete database contains information related to the year of foundation, the organizational legal nature and the area of focus of incubators and accelerators. We will now proceed to analyze these elements on an overall level, visually representing their content through graphic representations. This exploration will not only highlight the key trends and patterns but also offer a deeper understanding of the underlying data.

The analysis begin with the first element, namely *the year of foundation*, i.e. the year in which the organization initiated its operations. Employing the statistical programming language R, histograms have been generated for each country to showcase the annual distribution regarding the founding of organizations. These charts effectively illustrate the quantity of organizations[3] established on a yearly basis, offering a comprehensive view of the trends in organizational establishment over time. Figures 4.1, 4.2, and 4.3 respectively display the situation in Italy, the Netherlands, and Ireland.

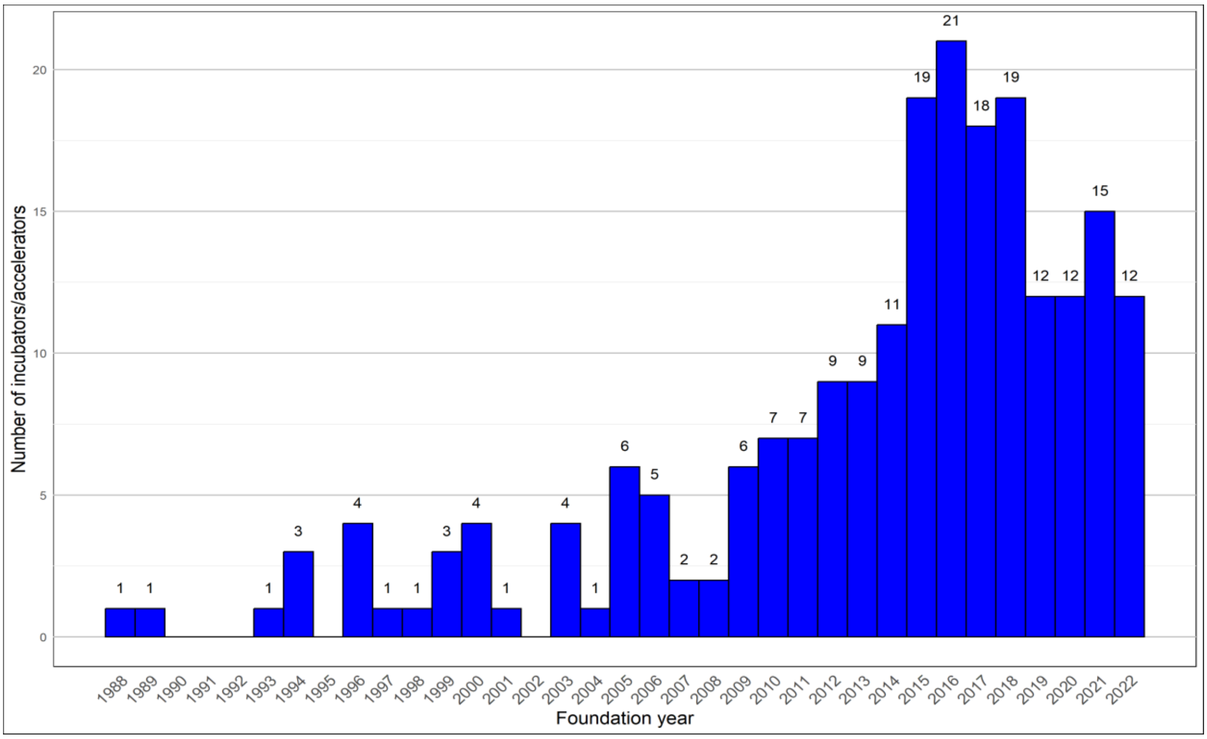

Figure 4.1 Annual distribution of incubators/accelerators founded in Italy

[3] Since the database only includes organizations that are operational, the underlying graphical analysis does not take into account incubators and accelerators that have ceased their operations.

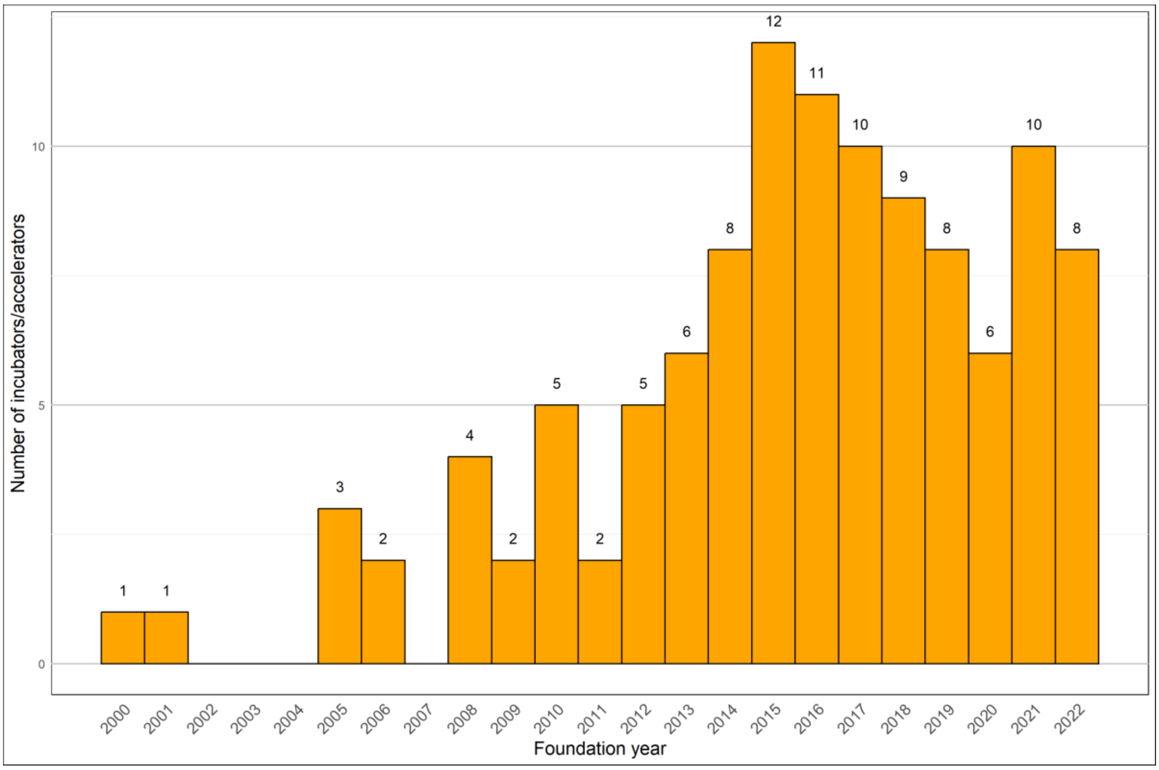

Figure 4.2 Annual distribution of incubators/accelerators founded in The Netherlands

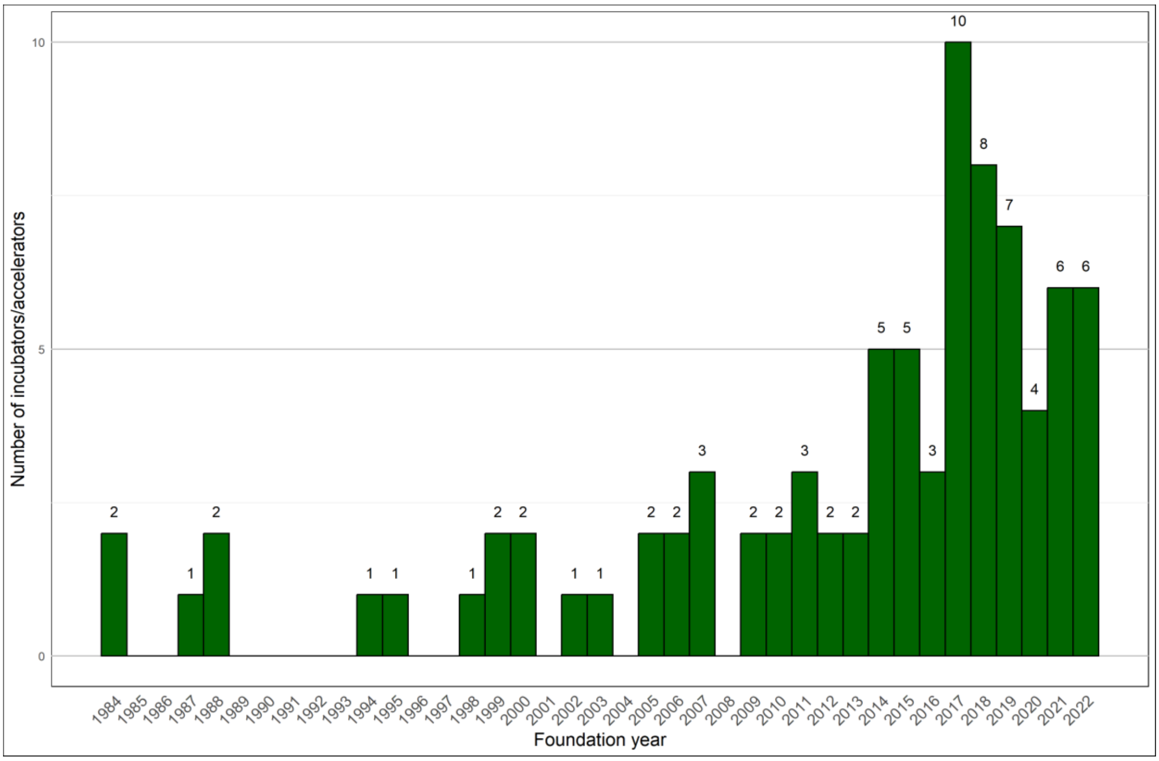

Figure 4.3 Annual distribution of incubators/accelerators founded in Ireland

In examining the histograms, it becomes clear that the establishment of incubators and accelerators is a relatively recent trend within the three nations, marked by a notable rise in the number of such organizations over the past decade. This upsurge reflects the growing interest in entrepreneurship and the corresponding support systems. Additionally, all countries have experienced a resurgence in the number of organizations founded from 2021 onwards, likely signaling a sector recovery from the pandemic's impact.

For Italy, as depicted in Figure 4.1, there is a peak in the creation of these entities between 2014 and 2018. This surge is likely a result of the 'Decreto Crescita 2.0' (19/12/2012), the Ministerial Decree for the self-certification of startup incubators (22/02/2013) and the Ministerial Decree updating the self-certification requirements (22/12/2016). The peak in Italy for 2021, apart from being an indicator of recovery as mentioned earlier, is also attributed to the emergence of the first accelerators within the 'Rete Nazionale Acceleratori CDP - Venture Capital'.

The Dutch landscape, illustrated in Figure 4.2, shows a more gradual yet consistent increase throughout the years. This pattern lacks the sharp spikes observed in Italy but demonstrates a steady addition of new incubators and accelerators. This trend could be indicative of a stable and supportive policy environment for startups and innovation in the Netherlands, characterized by a growth trajectory not as directly affected by specific legislative measures as seen in Italy.

Meanwhile, Ireland's data in Figure 4.3 shows a pattern of growth with some fluctuations. Notably, there is a steep increase in new organizations established in recent years, suggesting a delayed but rapid consolidation of the sector. This could potentially be linked to Ireland's strategic focus on becoming a global technology hub, attracting both local and international entrepreneurs.

4.2 Organizational legal nature

As far as the *organizational legal nature* element is concerned, the following classification has been made: public organizations, managed exclusively by public administrations or bodies, often through the creation of "in-house" companies; public/private organizations, whose corporate structure includes both public and private entities; private organizations, namely organizations managed exclusively by private entities.

Table 4.2 contains, for each region, the number of organizations belonging to each of the categories mentioned above. Thereafter we will analyze the situation at the national level, in order to understand the different compositions of the three states under examination. To do this, we make use of Tables 4.3, 4.4, and 4.4, and of Figures 4.4, 4.5 and 4.6.

Table 4.2 Number of organizations identified in each region and subdivision based on their organizational legal nature

NUTS 2 Code	*Region*	*Public*	*Private*	*Public/Private*
IE04	Northern and Western Region	4	3	4
IE05	Southern Region	5	8	12
IE06	Eastern and Midland Region	14	19	17
NL13	Drenthe	0	2	0
NL23	Flevoland	0	1	0
NL12	Friesland	1	1	0
NL22	Gelderland	1	1	4
NL11	Groningen	0	1	0
NL42	Limburg	1	4	0
NL41	Noord-Brabant	1	7	3
NL32	Noord-Holland	3	43	14
NL21	Overijssel	0	1	1
NL31	Utrecht	0	3	1
NL34	Zeeland	0	1	0

NL33	Zuid-Holland	3	11	4
ITC1	Piemonte	4	8	6
ITC2	Valle d'Aosta	0	0	1
ITC3	Liguria	2	2	1
ITC4	Lombardia	2	49	7
ITF1	Abruzzo	0	2	0
ITF2	Molise	1	0	0
ITF3	Campania	2	10	3
ITF4	Puglia	1	4	1
ITF5	Basilicata	1	3	0
ITF6	Calabria	1	0	2
ITG1	Sicilia	0	3	3
ITG2	Sardegna	1	3	0
ITH1/ITH2	Trentino Alto Adige	2	2	1
ITH3	Veneto	3	5	6
ITH4	Friuli Venezia Giulia	1	0	3
ITH5	Emilia Romagna	5	11	9
ITI1	Toscana	4	7	6
ITI2	Umbria	1	1	1
ITI3	Marche	0	1	2
ITI4	Lazio	1	12	9

Table 4.3 Incubators/accelerators in Italy divided by their organizational legal nature

ITALY	
Public incubators/accelerators	33
Private incubators/accelerators	123
Public/Private incubators/accelerators	61

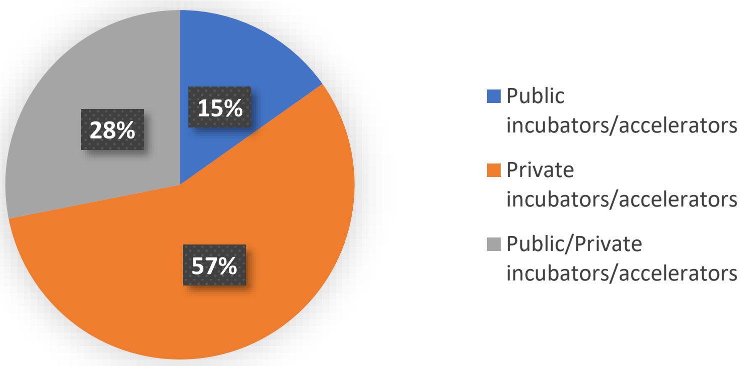

Figure 4.4 Pie chart of the Italian distribution of incubators/accelerators based on their organizational legal nature

Table 4.4 Incubators/accelerators in the Netherlands divided by their organizational legal nature

NETHERLANDS	
Public incubators/accelerators	10
Private incubators/accelerators	76
Public/Private incubators/accelerators	27

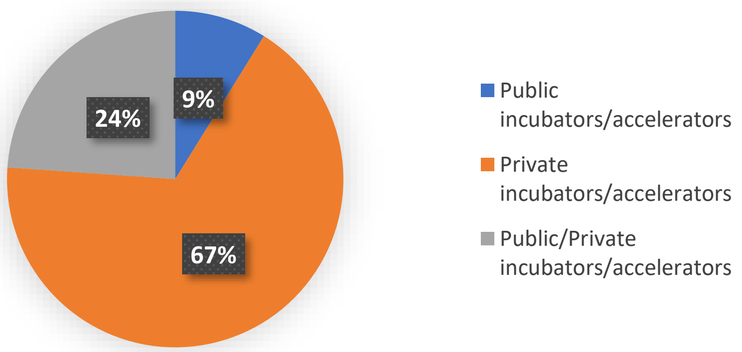

Figure 4.5 Pie chart of the Dutch distribution of incubators/accelerators based on their organizational legal nature

Table 4.5 Incubators/accelerators in Ireland divided by their organizational legal nature

IRELAND	
Public incubators/accelerators	23
Private incubators/accelerators	30
Public/Private incubators/accelerators	33

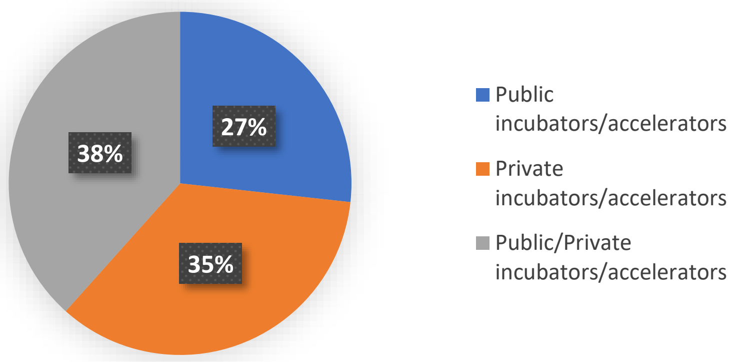

Figure 4.6 Pie chart of the Irish distribution of incubators/accelerators based on their organizational legal nature

The data and their visual representation highlight variable compositions across Italy, the Netherlands, and Ireland, reflecting distinct strategic approaches in nurturing startup ecosystems. Italy's innovation landscape is predominantly characterized by private organizations (123), followed by a substantial number of public/private hybrids (61) and public entities (33). This suggests the presence of an ecosystem where private investment and entrepreneurship play a pivotal role, even though public-private partnerships also contribute significantly. The Netherlands mirrors this trend with a strong emphasis on private organizations (76), supplemented by public/private hybrids (27) and a smaller presence of public entities (10). Ireland presents a more balanced mix, displaying an almost equal distribution among all three categories, highlighting a collaborative ecosystem that leverages both private innovation and public support.

Further analysis provided by Table 4.2 shows that at the regional level, some phenomena are more pronounced: regions with a higher presence of organizations (such as Noord-Holland and Lombardy) tend to have a massive presence of private organizations, indicating that private entities are key drivers in more densely populated or economically active areas. Conversely, regions with lower incubators/accelerators density exhibit a more balanced composition.

This phenomenon underscores the critical role of private sector investment and entrepreneurial activities in fostering vibrant innovation ecosystems in regions that are economically active or densely populated. On the other hand, regions with fewer incubators and accelerators tend to have a more balanced mix of organizational types, including public, private, and public/private entities. This balance may reflect a strategic approach to support innovation in areas that may not naturally attract as much private investment, with public and hybrid organizations playing a more prominent role.

4.3 Generalist and vertical organizations

While collecting data for the database, a division was also made with regard to the *area of focus* element, which distinguishes between generalist organizations, which accept startups from any sector, and vertical organizations, focused on a specific sector or industry.

Even in this case, Table 4.6 contains, for each region, the number of organizations belonging to the two categories mentioned above. In this paragraph, as done in the previous, we will then analyze the situation at the national level, in order to understand the different compositions of the three states under examination. To do this, we make use of Tables 4.7, 4.8, and 4.9, and Figures 4.7, 4.8, 4.9.

Table 4.6 Number of organizations identified in each region and subdivision based on their area of focus

NUTS 2 Code	*Region*	*Incubators/accelerators*	*Generalist*	*Vertical*
IE04	Northern and Western Region	11	3	8
IE05	Southern Region	25	10	15
IE06	Eastern and Midland Region	50	23	27

NL13	Drenthe	2	2	0
NL23	Flevoland	1	1	0
NL12	Friesland	2	2	0
NL22	Gelderland	6	3	3
NL11	Groningen	1	1	0
NL42	Limburg	5	3	2
NL41	Noord-Brabant	11	4	7
NL32	Noord-Holland	60	22	38
NL21	Overijssel	2	2	0
NL31	Utrecht	4	2	2
NL34	Zeeland	1	1	0
NL33	Zuid-Holland	18	11	7
ITC1	Piemonte	18	9	9
ITC2	Valle d'Aosta	1	0	1
ITC3	Liguria	5	1	4
ITC4	Lombardia	58	26	32
ITF1	Abruzzo	2	2	0
ITF2	Molise	1	1	0
ITF3	Campania	15	10	5
ITF4	Puglia	6	5	1
ITF5	Basilicata	4	3	1
ITF6	Calabria	3	2	1
ITG1	Sicilia	6	5	1
ITG2	Sardegna	4	3	1
ITH1/ITH2	Trentino Alto Adige	5	2	3
ITH3	Veneto	14	9	5
ITH4	Friuli Venezia Giulia	4	3	1
ITH5	Emilia Romagna	25	11	14
ITI1	Toscana	17	11	6
ITI2	Umbria	3	1	2
ITI3	Marche	3	2	1
ITI4	Lazio	22	11	11

Table 4.7 Distribution of generalist vs. vertical incubators/accelerators in Italy

ITALY	
Generalist incubators/accelerators	118
Vertical incubators/accelerators	99

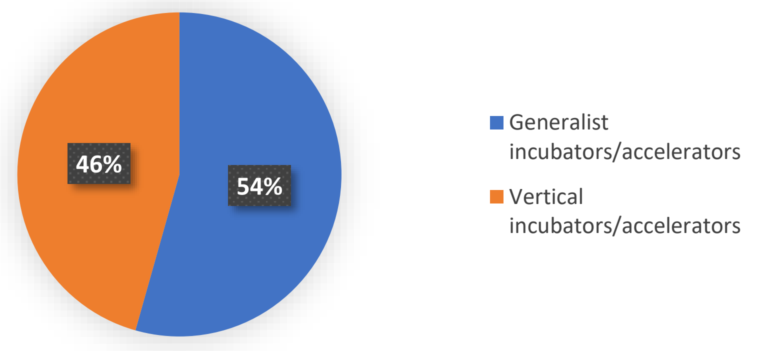

Figure 4.7 Pie chart of generalist vs. vertical incubators/accelerators distribution in Italy

Table 4.8 Distribution of generalist vs. vertical incubators/accelerators in the Netherlands

NETHERLANDS	
Generalist incubators/accelerators	54
Vertical incubators/accelerators	59

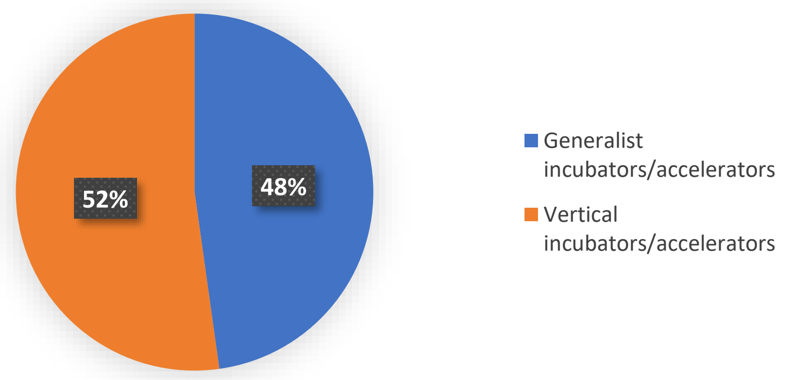

Figure 4.8 Pie chart of generalist vs. vertical incubators/accelerators distribution in the Netherlands

Table 4.9 Distribution of generalist vs. vertical incubators/accelerators in Ireland

IRELAND	
Generalist incubators/accelerators	36
Vertical incubators/accelerators	50

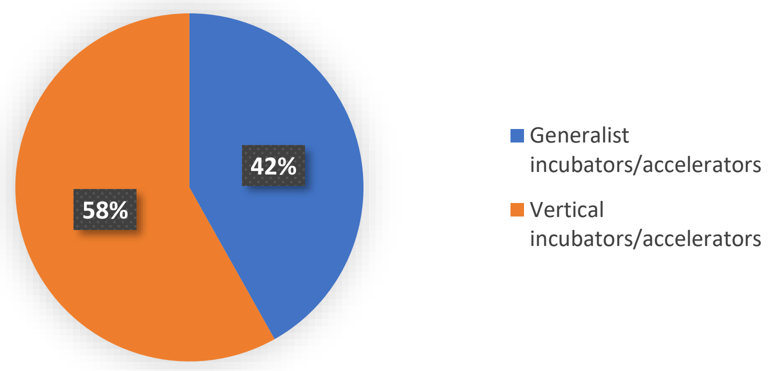

Figure 4.9 Pie chart of generalist vs. vertical incubators/accelerators distribution in Ireland

The segmentation between generalist and sector-specific entities across the three countries showcases varied approaches in fostering startup development. Italy presents an almost balanced split with 118 generalist and 99 vertical organizations, reflecting a comprehensive strategy that supports startups from a broad array of sectors alongside those requiring niche expertise. The Netherlands demonstrates a modest inclination towards sector-specific organizations (59) over generalist ones (54), suggesting a focus on developing specialized areas of innovation. Ireland, with a greater number of sector-specific (50) compared to generalist (36) entities, highlights a deliberate strategy to stimulate innovation, possibly aiming to capitalize on distinct industry advantages for economic expansion.

The data outlined in Table 4.6 allows us to delve deeper into the analysis, revealing that in regions with a higher concentration of incubators and accelerators, there is a predominant percentage of organizations with a sector-specific focus. This observation suggests that the latter areas are more likely to foster organizations that specialize in particular sectors or industries. This trend could be driven by the competitive landscape in these regions, where a deeper focus allows organizations to offer more targeted support and resources to startups, potentially leading to a higher success rate. It may also reflect the strategic alignment of these organizations with regional economic strengths, leveraging local expertise and market opportunities to foster growth in specific sectors.

In conclusion, it should be mentioned that the full database, which is available upon reasonable request, also details the specific sectors of interest for the various vertical-focused incubators and accelerators.

4.4 Geographical distribution of incubators and accelerators

In conclusion, we will conduct a visual analysis of the data outlined in Table 4.1, detailing the number of incubators/accelerators per region and their density per million inhabitants. To facilitate this analysis, specific heat maps have been developed, always by means of R. Each country is represented by two maps: the first displaying the count of organizations by region, and the second highlighting the density index. Specifically, Figures 4.10 and 4.11 are dedicated to Italy, 4.12 and 4.13 to the Netherlands, 4.14 and 4.15 to Ireland.

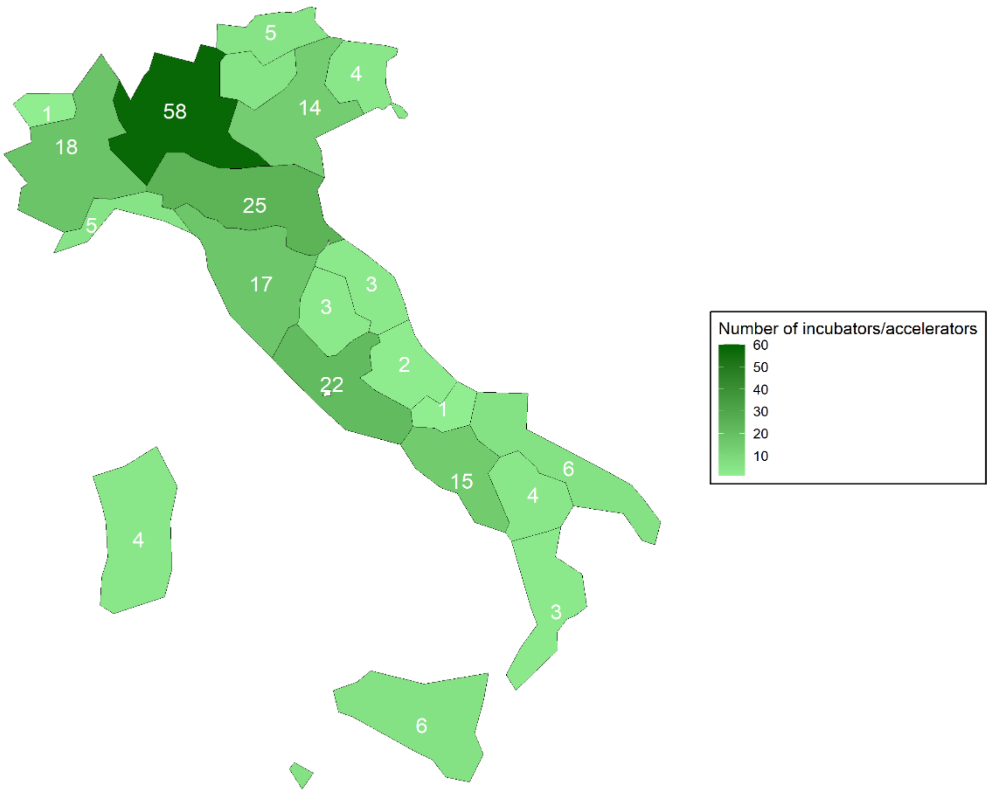

Figure 4.10 Heat map illustrating the distribution of incubators and accelerators across Italian regions

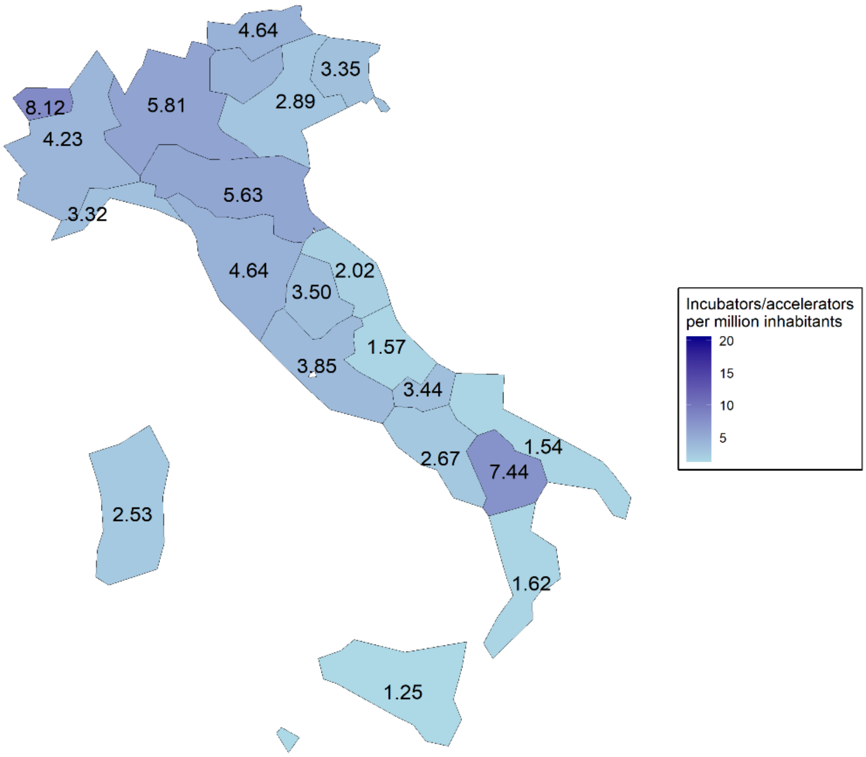

Figure 4.11 Heat map illustrating the number of incubators and accelerators per million inhabitants across Italian regions

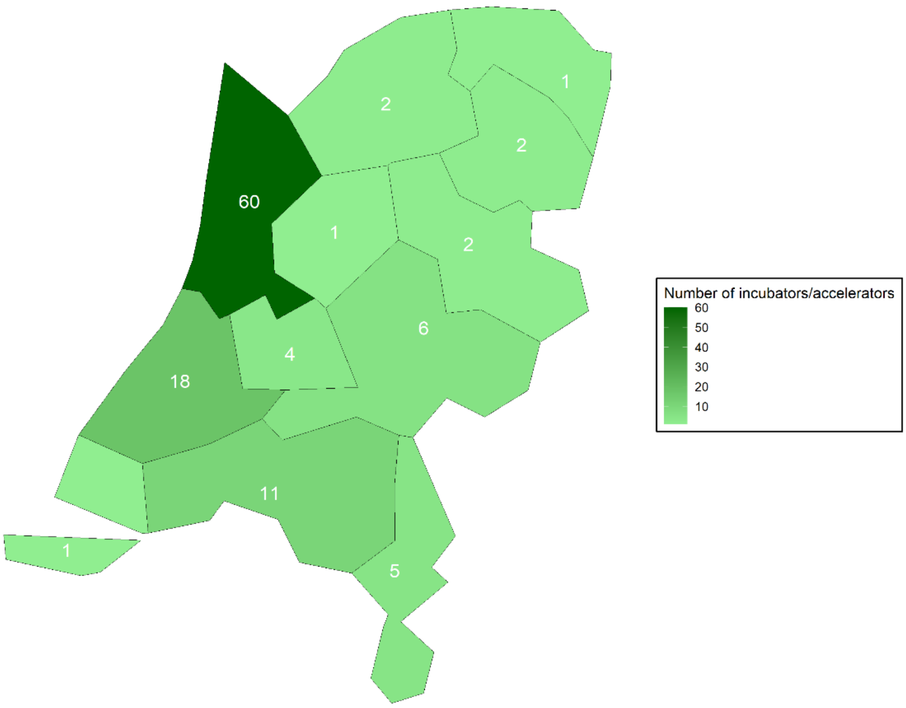

Figure 4.12 Heat map illustrating the distribution of incubators and accelerators across Dutch regions

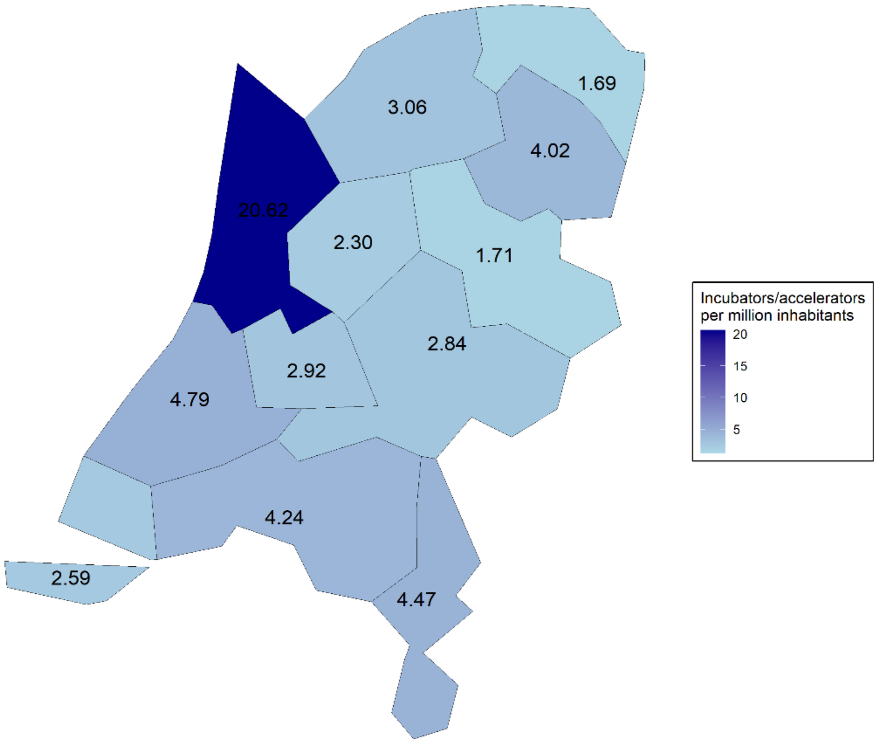

Figure 4.13 Heat map illustrating the number of incubators and accelerators per million inhabitants across Dutch regions

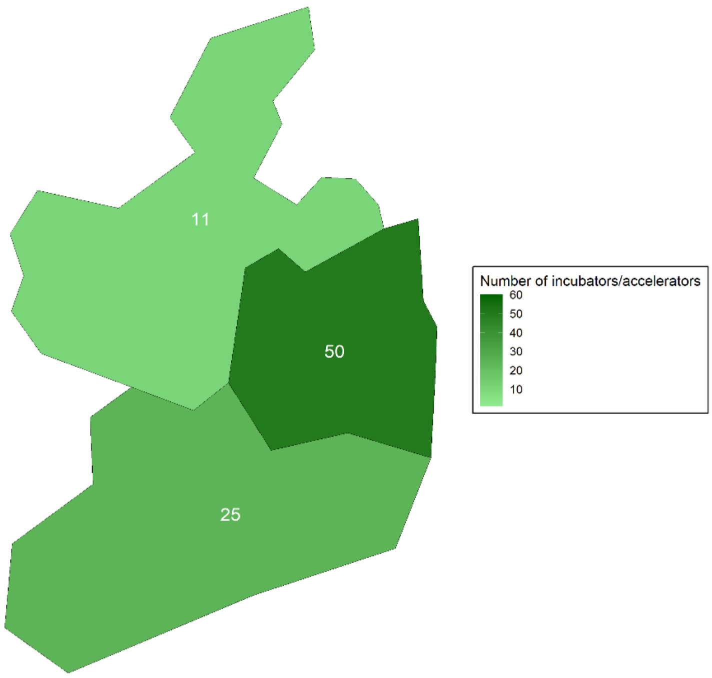

Figure 4.14 Heat map illustrating the distribution of incubators and accelerators across Irish regions

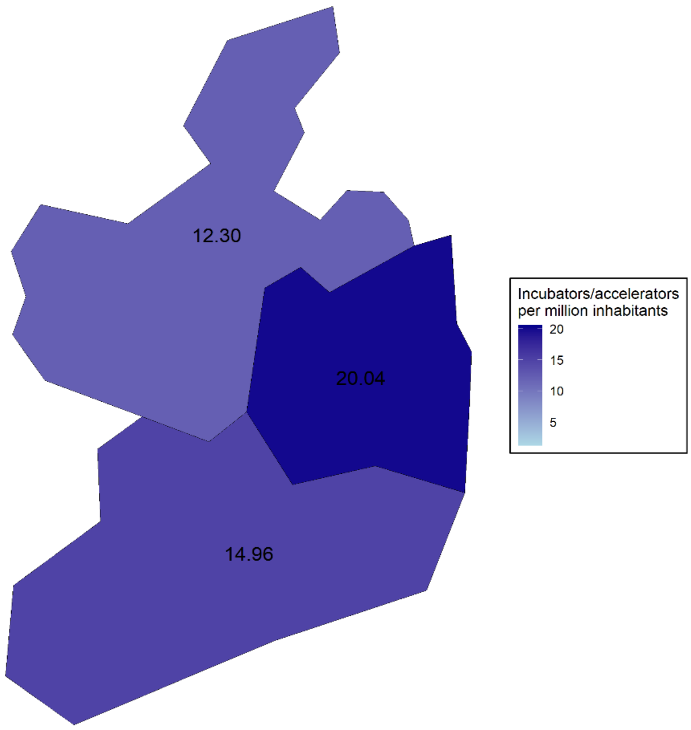

Figure 4.15 Heat map illustrating the number of incubators and accelerators per million inhabitants across Irish regions

In the examination of the entrepreneurial support networks within Italy, it is Lombardy that distinctly emerges as the epicenter of innovation activity. The region's pre-eminence is well-documented in Figure 4.10, demonstrating a significant aggregation of incubators and accelerators. This observation is congruent with the general trend prevalent across the northern Italian regions, where a proliferation of such entities signifies a potent infrastructure for enterprise development. However, the interpretation of the density data, as shown in Figure 4.11, necessitates prudence. Regions with lesser populations, like Basilicata and Valle d'Aosta, display disproportionately elevated density indices. These statistics, while ostensibly indicating a flourishing entrepreneurial environment, may indeed be reflective of the demographic variances rather than an authentic representation of entrepreneurial vigor.

The Netherlands presents an intriguing contrast. The concentration of incubators and accelerators within North Holland, as delineated in Figure 4.12, aligns with the region's economic prominence. The per capita dispersion across the provinces, represented in Figure 4.13, unveils a more equitable distribution of entrepreneurial infrastructure. The Netherlands appears to foster a consistent nurturing environment for startups, potentially attributed to a cultural inclination towards innovation and entrepreneurship that transcends geographic confines.

Ireland offers a compelling case in this regard. The concentration of such entities within Dublin, as depicted in Figure 4.14, suggests a strong urban bias in the allocation of resources. Yet, the density metric, portrayed in Figure 4.15, unveils a strategic dispersal of support networks across the nation. Such a balanced distribution of incubators and accelerators may well be indicative of Ireland's aspiration to establish itself as a technological hub. The Irish government has consistently invested in innovation and technology sectors, aiming to attract and cultivate high-tech businesses[4]. This strategy may well be bearing fruit, reflecting in the relatively high per capita density figures outside of Dublin, and could signal a mature, nationwide approach to innovation that supports a wide-reaching technological ascendancy.

In sum, the comparative analysis of these three nations underscores the importance of a dual perspective on both the absolute and the relative metrics when evaluating the vitality of innovation ecosystems. The nuanced interplay of these data points offers a first qualitative key to reading into the strategic orientations of national and regional policies.

[4] Impact 2030: Ireland's Research and Innovation Strategy, https://www.gov.ie/en/publication/27c78-impact-2030-irelands-new-research-and-innovation-strategy/

5. ESOs characteristics and entrepreneurial output: correlation and QCA

After discussing and qualitatively analyzing the distribution of incubators and accelerators, as well as their characteristics, across the three states under review, where some interesting trends have already emerged, this chapter aims to explore through quantitative and comparative methods the dynamics between the presence of these organizations in a given region and the entrepreneurial outcomes of the region itself. Specifically, it will investigate whether regional ecosystems characterized by strong entrepreneurial indicators - the definition of which will be discussed later - are marked by a significant presence of these organizations, and if ESOs with specific characteristics are consistently present in those regions. The empirical analysis will consist of two complementary approaches: correlation analysis and fuzzy-set Qualitative Comparative Analysis (fs-QCA).

The process starts by calculating the Pearson correlation coefficient to assess the strength and direction of the linear relationship between entrepreneurial activity and the density of incubators and accelerators per million inhabitants. The investigation then extends to a more granular level, evaluating the correlation between entrepreneurial output and the number of support organizations, categorized by their specific characteristics (such as private, public, vertical, or generalist), also per million inhabitants. This methodological approach aims to uncover the blurred dynamics of how different types of support organizations influence regional entrepreneurial ecosystems. By segmenting the data according to these characteristics and analyzing the correlations, the study seeks to provide a comprehensive understanding of the potential linkages and connections, thereby offering an initial comprehension of the existing interdependencies

However, acknowledging the complexity and multidimensionality of the phenomenon under study, the correlation analysis is supplemented with a fuzzy-set Qualitative Comparative Analysis (fs-QCA). This method allows for moving beyond the identification of mere correlations, enabling the investigation of configurations of conditions that lead to specific outcomes. By incorporating regional-level data of factors potentially influencing the EEs retrieved from the database provided by a previous study (Leendertse et al., 2022), fuzzy-set QCA offers an holistic view, allowing for the identification of combinations of factors that contribute to entrepreneurial success at the regional level.

In this chapter, therefore, the aim is to outline a more detailed and nuanced picture of entrepreneurial dynamics, seeking to clarify, within each of the two phases of empirical analysis, the aspects highlighted in the introduction: the first regarding the verification of the possible presence of a correlation between the entrepreneurial output of a region and its corresponding density of incubators/accelerators per million inhabitants, and possibly with a particular sub-category; the second aspect pertaining the role that these organizations play within the ecosystem.

5.1 Correlation analysis

As mentioned above, this phase of analysis begins with the calculation of the Pearson correlation coefficient to assess the strength and direction of the linear relationship between entrepreneurial activity and the density of incubators and accelerators per million inhabitants. The investigation then progresses to a more detailed examination, assessing the correlation between entrepreneurial output and the number of support organizations, differentiated by their specific characteristics (private, public, vertical or generalist), also on a per million inhabitants' basis.

Pearson correlation coefficient (R) is an extensively utilized measure in statistics to assess the degree of linear association between two variables. It is particularly effective in situations where the relationship being analyzed is hypothesized to be linear. The selection of Pearson's coefficient for this study is underpinned by its robustness in quantifying the strength and directionality of linear relationships, an essential preliminary step in the investigation of complex systems such as entrepreneurial ecosystems. The coefficient's value, ranging from -1 to +1, conveys a spectrum of correlation from perfect negative, indicating no correlation, to perfect positive, indicating complete correlation, offering an initial, yet insightful, glimpse into the interconnections within our data.

The key element involved in the correlation analysis is the entrepreneurial output. As described in section 2.1.3, the output of the entrepreneurial ecosystem is identified as productive entrepreneurship. This form of entrepreneurship contributes to the economic output and, consequently, leads to aggregate value creation, which is the system's outcome (Baumol, 1990). Productive entrepreneurship, a subset of total entrepreneurship, necessitates a different measure than, for example, the total number of new firms. For our correlation analysis, we utilized the dataset constructed for a previous study (Leendertse et al., 2022). In that study, the number of new firms registered in Crunchbase per capita was taken as a measure for entrepreneurial output[5] (Crunchbase, 2019; Dalle et al., 2017). Crunchbase predominantly captures venture capital-oriented innovative entrepreneurial firms and largely overlooks companies without growth ambitions, making it a reliable source for data on productive entrepreneurship (Dalle et al., 2017). That research selected the five-year timeframe from 2015 to 2019 to ensure the selection of companies experiencing their growth phase during the same time period. At the same time, this timeframe also aids in narrowing down the sample to innovative new firms, as Crunchbase includes incumbent, long-established, innovative firms as well.

Table 5.1 contains the data on entrepreneurial output for the regions under examination.

Table 5.1 List of regions and their respective entrepreneurial output

NUTS 2 Code	*Region*	*Entrepreneurial output*
IE04	Northern and Western Region	1.46
IE05	Southern Region	1.43
IE06	Eastern and Midland Region	5.00
NL13	Drenthe	0.38
NL23	Flevoland	1.22
NL12	Friesland	0.54
NL22	Gelderland	0.73

[5] The maximum score for any single region was set to five to prevent a disproportionate influence of strong-performing ecosystem elements.

NL11	Groningen	1.20
NL42	Limburg	0.69
NL41	Noord-Brabant	1.17
NL32	Noord-Holland	5.00
NL21	Overijssel	1.16
NL31	Utrecht	2.33
NL34	Zeeland	0.36
NL33	Zuid-Holland	1.80
ITC1	Piemonte	0.49
ITC2	Valle d'Aosta	0.01
ITC3	Liguria	0.38
ITC4	Lombardia	0.89
ITF1	Abruzzo	0.29
ITF2	Molise	0.24
ITF3	Campania	0.22
ITF4	Puglia	0.22
ITF5	Basilicata	0.38
ITF6	Calabria	0.20
ITG1	Sicilia	0.15
ITG2	Sardegna	0.43
ITH1/ITH2	Trentino Alto Adige	0.75
ITH3	Veneto	0.40
ITH4	Friuli Venezia Giulia	0.50
ITH5	Emilia Romagna	0.46
ITI1	Toscana	0.40
ITI2	Umbria	0.35
ITI3	Marche	0.28
ITI4	Lazio	0.65

To best complement this dataset with the thesis work, our database, whose construction methodology was outlined in Chapter 3, has been filtered to include only organizations founded until the end of 2018. This allows for a comparison with the data on entrepreneurial output. The correlation analysis was conducted using the R statistical software and consisted of a first phase aimed at assessing the strength and direction of the linear relationship between entrepreneurial activity and the density of incubators and accelerators per million inhabitants, derived from our database. The same study was also conducted using the number of organizations per million inhabitants available on Crunchbase, for comparison purposes. This is because the study from which the entrepreneurial output data were derived was one of the first to investigate the correlation between ESOs and entrepreneurial output, but it relied solely on Crunchbase as a source. Furthermore, it incorporated into the "intermediate services" context the percentage of employees in knowledge-intensive market services, thus moving away from a measure purely related to entrepreneurship. The investigation then progresses to a more detailed examination, evaluating the correlation between entrepreneurial output and the number of incubators and accelerators, this time categorized by their specific characteristics (such as private, public, vertical, or generalist), also per million inhabitants.

5.1.1 Initial phase of analysis

The first phase thus represented a comparison between the correlation outcome with the entrepreneurial output obtained using the densities of organizations derived from our database and those obtained from the dataset of the study by Leendertse et al. (2022), corresponding to Crunchbase. Table 5.2 summarizes the data used for the analysis, while Figures 5.1 and 5.2 display the scatter plots obtained.

Table 5.2 Dataset used for the initial phase of correlation analysis

NUTS 2 Code	*Incubators/accelerators per million inhabitants*	*Incubators/accelerators per million inhabitants (Leendertse et al. dataset)*	*Entrepreneurial output*
IE04	8.94	4.47	1.46
IE05	12.57	2.99	1.43
IE06	14.83	9.62	5
NL13	2.01	0	0.38

NL23	2.3	0	1.22
NL12	3.06	0	0.54
NL22	1.9	1.42	0.73
NL11	1.69	0	1.2
NL42	3.58	3.58	0.69
NL41	3.86	3.86	1.17
NL32	14.09	9.97	5
NL21	0.85	0	1.16
NL31	2.19	2.19	2.33
NL34	2.59	0	0.36
NL33	3.46	3.2	1.8
ITC1	2.82	1.88	0.49
ITC2	8.12	0	0.01
ITC3	2.65	0	0.38
ITC4	4.41	4.01	0.89
ITF1	0.79	0	0.29
ITF2	3.44	0	0.24
ITF3	1.43	0.53	0.22
ITF4	0.77	0.26	0.22
ITF5	7.44	1.86	0.38
ITF6	1.08	0	0.2
ITG1	1.04	0.42	0.15
ITG2	1.9	0.63	0.43
ITH1/ITH2	3.71	1.86	0.75
ITH3	2.27	0.62	0.4
ITH4	3.35	0	0.5
ITH5	3.61	0.9	0.46
ITI1	4.1	1.09	0.4
ITI2	1.17	0	0.35
ITI3	1.35	0	0.28
ITI4	2.8	1.57	0.65

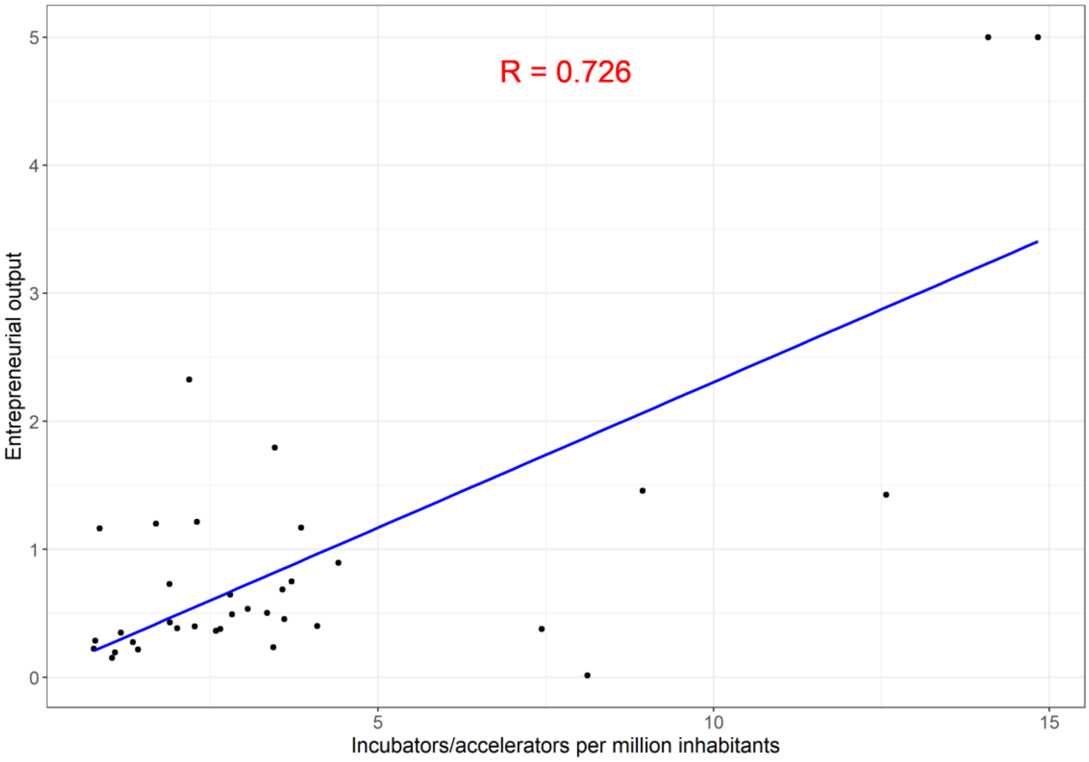

Figure 5.1 Scatter plot illustrating the correlation between the number of incubators/accelerators per million inhabitants and the entrepreneurial output

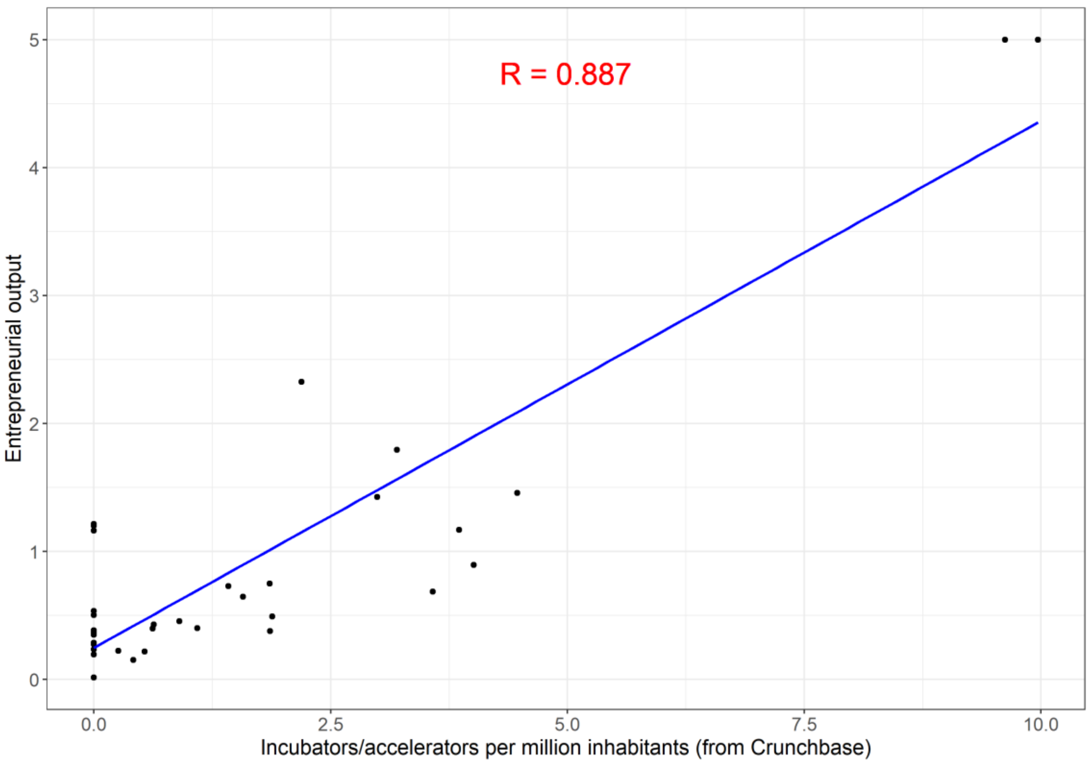

Figure 5.2 Scatter plot illustrating the correlation between the number of incubators/accelerators per million inhabitants (from Crunchbase) and the entrepreneurial output

In both analyses, a robust positive association is evident between organizational density per million inhabitants and entrepreneurial output. The dataset from Leendertse et al. (2022), comprising entities indexed by Crunchbase, reveals a more pronounced correlation. However, this may be skewed by the underrepresentation of incubators and accelerators in less prominent regions, contrasted with the comprehensive capture of such entities in economically vigorous areas. This disparity likely enhances the observed correlation. Despite this, the examination of our database affirms a meaningful positive relationship. Therefore, it is possible to proceed to a more in-depth analysis of the factors characterizing this latter correlation.

5.1.2 Second phase of analysis

For the subsequent phase of analysis, all incubators and accelerators within the database were classified according to the following characteristics:

- *Organizational legal nature*, distinguishing among public organizations managed solely by public administrations or entities, often through the formation of "in-house" companies; hybrid public/private organizations featuring a composite corporate structure of both public and private stakeholders; and exclusively private entities.
- *Area of focus*, differentiating between generalist organizations, open to startups from any sector, and specialized vertical organizations, which cater to specific sectors or industries.

For each category, the correlation with entrepreneurial output data was examined using the same statistical methods as in the initial phase, by means of the R statistical software package.

The public/private hybrid organizations were not treated as a separate category. For the sake of clarity, two scenarios were constructed: in **Scenario 1**, these mixed entities were classified as *public*, while in **Scenario 2**, they were deemed *private*. To maintain a concise discourse, the tables containing the correlation analysis data for this phase are included in Appendix A. Figures 5.3 to 5.8 present the scatter plots generated from this analysis.

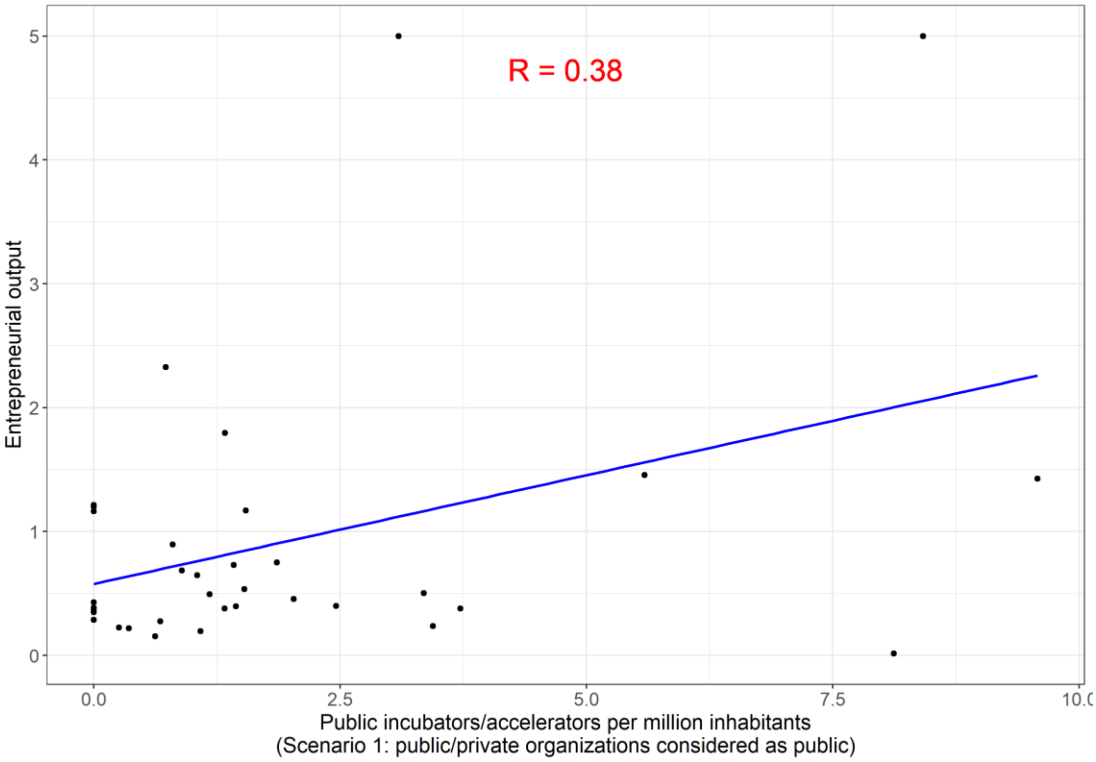

Figure 5.3 Scatter plot displaying the correlation between the number of public incubators/accelerators per million inhabitants and the entrepreneurial output (Scenario 1)

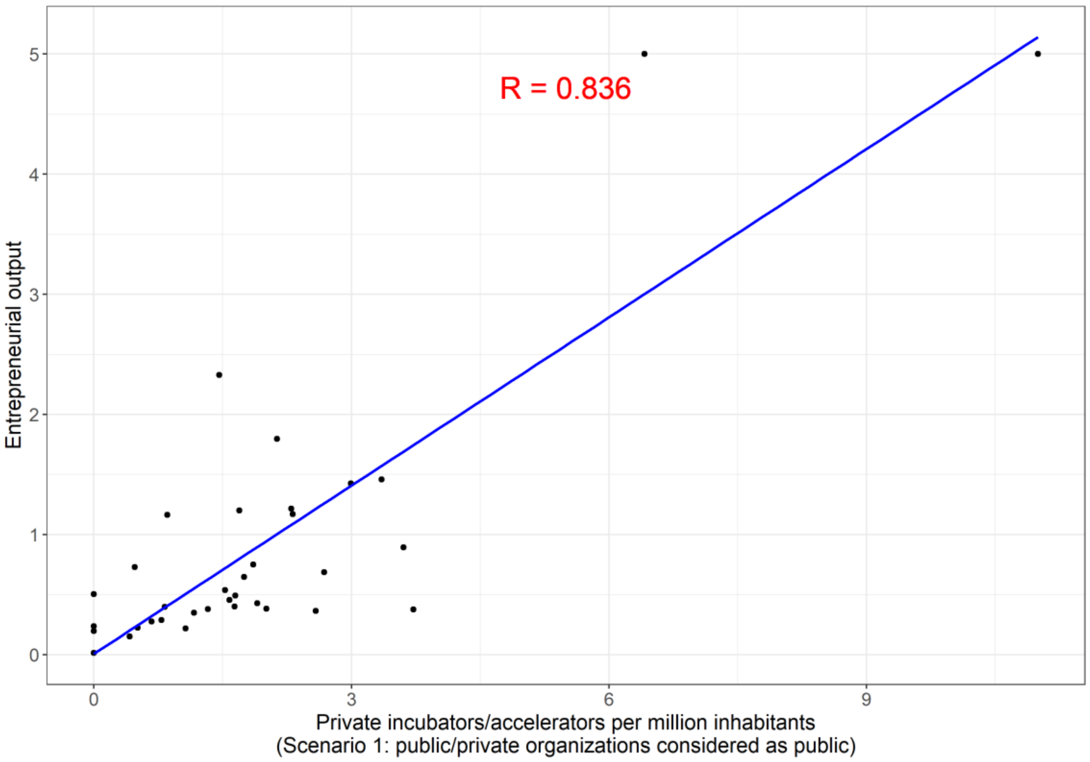

Figure 5.4 Scatter plot displaying the correlation between the number of private incubators/accelerators per million inhabitants and the entrepreneurial output (Scenario 1)

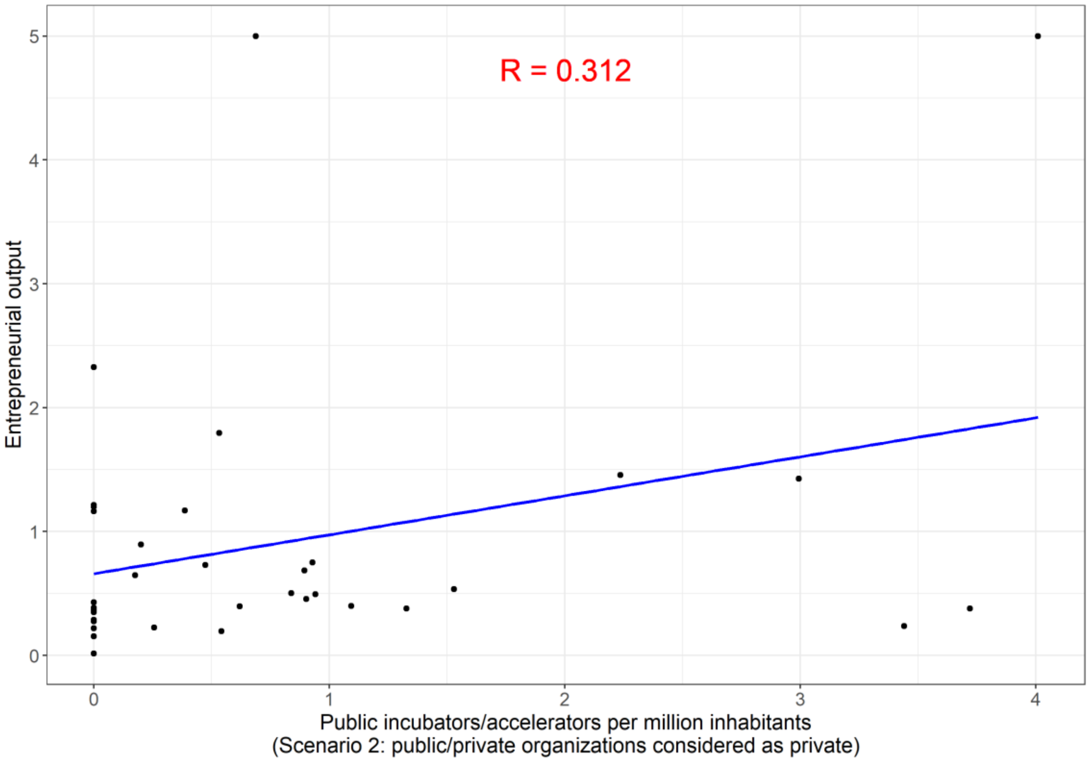

Figure 5.5 Scatter plot displaying the correlation between the number of public incubators/accelerators per million inhabitants and the entrepreneurial output (Scenario 2)

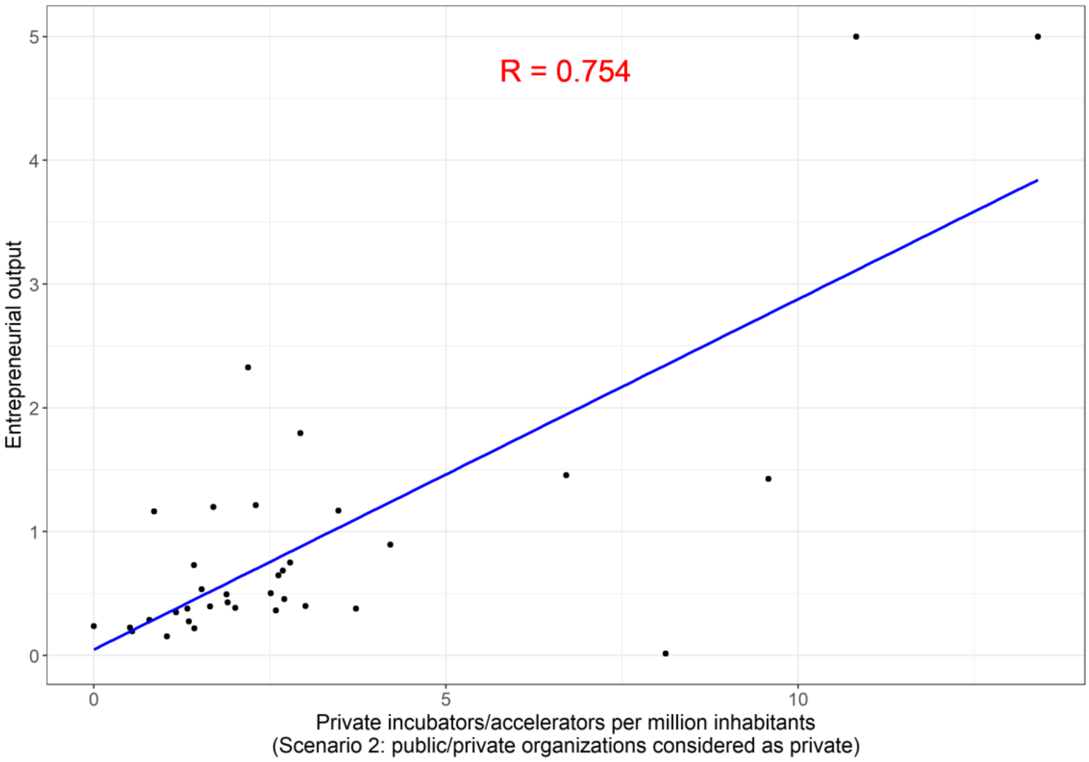

Figure 5.6 Scatter plot displaying the correlation between the number of private incubators/accelerators per million inhabitants and the entrepreneurial output (Scenario 2)

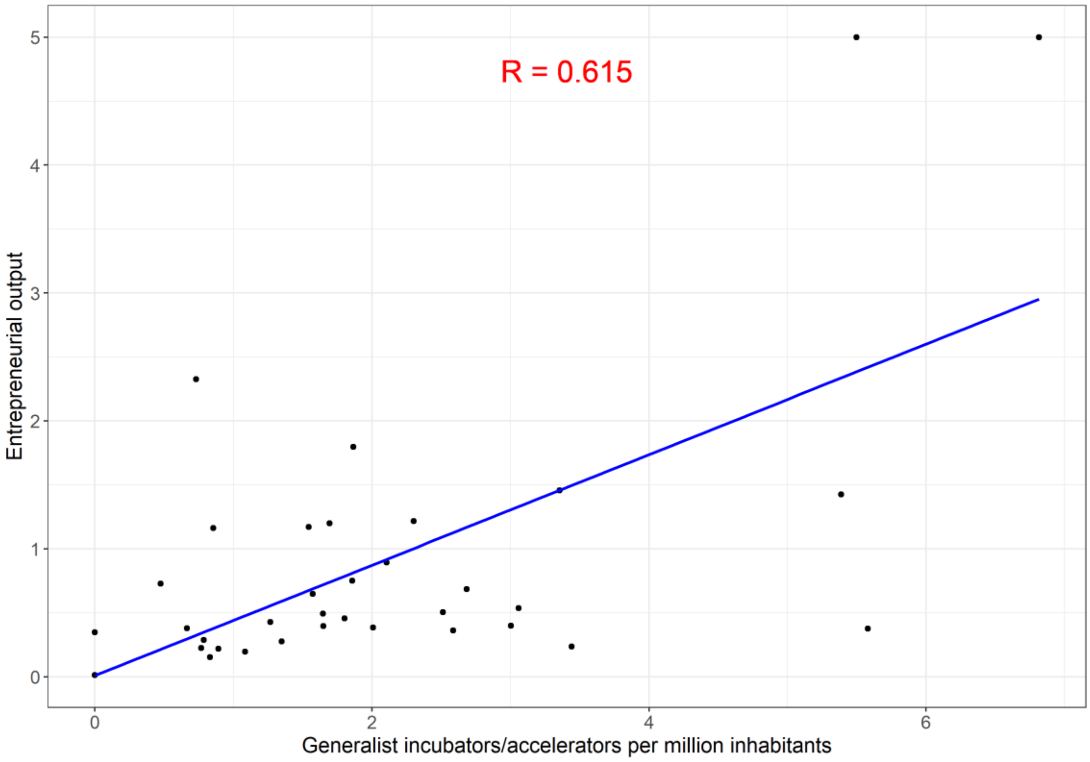

Figure 5.7 Scatter plot displaying the correlation between the number of generalist incubators/accelerators per million inhabitants and the entrepreneurial output

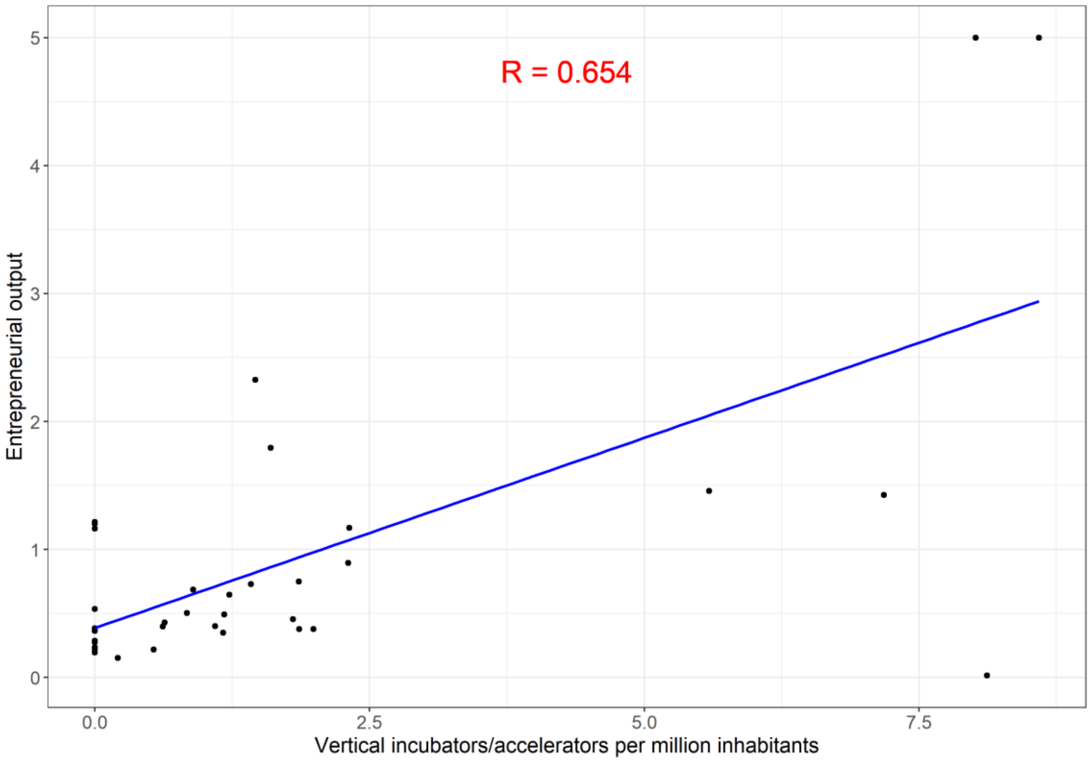

Figure 5.8 Scatter plot displaying the correlation between the number of vertical incubators/accelerators per million inhabitants and the entrepreneurial output

Initial observations for generalist and vertical incubators/accelerators suggest differential impacts on entrepreneurial activities. The moderate Pearson correlation coefficients obtained for both generalist (R = 0.615) and vertical (R = 0.654) organizations suggest that while there is a positive relationship with entrepreneurial output, the connection is not as robust as one might expect. This moderate correlation for generalist incubators/accelerators suggests that while they provide valuable support and resources to a broad range of startups, the diversity in their services may not translate into a potent impact on entrepreneurial output across all sectors. The slightly higher correlation for vertical entities hints at the potential benefits of specialized support that aligns closely with the needs of startups within specific industries.

The distinction between public and private incubators/accelerators is, however, more pronounced.. Private entities present a stronger correlation with entrepreneurial output (R = 0.836 in Scenario 1 and R = 0.754 in Scenario 2), which may reflect the targeted and perhaps more agile nature of private investment and management in fostering entrepreneurial environments. In contrast, the correlation is notably weaker for public incubators/accelerators (R = 0.312 in Scenario 2 and R = 0.38 in Scenario 1), suggesting that public endeavors might not be as closely aligned with the generation of entrepreneurial output, or that they may operate under a set of constraints that dilute their effectiveness.

These observations, while insightful, come with inherent limitations. The Pearson correlation assessment presupposes linear connections and is susceptible to outliers, potentially distorting the perceived strength of relationships. Additionally, the analysis cannot definitively establish causality; myriad external factors, such as regional economic policies, capital availability, market trends, and socio-economic variables, could be influential yet remain unaccounted for. Nonetheless, it is undeniable that these findings offer some intriguing points for contemplation.

To delve deeper and navigate beyond these limitations, we will engage with a fuzzy-set Qualitative Comparative Analysis (fsQCA). This approach will facilitate a more thorough exploration of causality by considering the complex interplay of various determinants that drive entrepreneurial success. Through the identification of configurations of influential conditions, fsQCA aims to clarify the precise contexts in which incubators/accelerators thrive, thus yielding strategic insights of great value to the entrepreneurial ecosystem's stakeholders.

5.2 Qualitative Comparative Analysis

The fuzzy-set Qualitative Comparative Analysis (fsQCA), as developed by Ragin (1987, 2000, 2009), represents a methodological approach capable of identifying and elucidating recurrent patterns within datasets (Schneider & Wagemann, 2010). Employing a set-theoretic framework grounded in the notion of complex causality, QCA techniques forge logical linkages between conditions to capture the equifinality of outcomes, i.e. the principle that a system can reach an identical endpoint through varying trajectories and from disparate initial states (Fiss, 2007). Distinct from classical quantitative methods, which typically assess conditions that are concurrently necessary and sufficient, complex causality methods like QCA enable the separate evaluation of conditions as either necessary or sufficient for certain outcomes. This distinction equips researchers with an advanced mechanism to address the constraints of traditional regression analysis (Schneider & Eggert, 2014).

Within the QCA spectrum, the choice was made to implement the fuzzy-set QCA, which has the benefit of allocating membership scores along a continuous range, thus permitting values between 0 and 1. This attribute not only enriches the understanding of how different elements in configurations act as complements or substitutes but also sheds light on the relative importance of individual components in achieving the desired results and how they might be combined effectively (Fiss, 2007). The inherent multiplicity and conjunctive nature of the phenomena under study make fsQCA an especially apt tool for this investigation (Kraus et al., 2018).

In the context of this thesis, to more accurately ascertain the role of different categories of incubators and accelerators within the ecosystem, the dataset was enhanced with regional-level data on factors potentially impacting the entrepreneurial ecosystem, derived from the database collated by Leendertse et al. (2022). This comprehensive database encompasses a collection of variables relevant to the European Union states, as previously referenced in this thesis (see Section 2.1.2, Table 2.1). With data on *intermediate services* already available, we utilized, for the states in question, information pertaining to *Formal institutions*, *Entrepreneurship culture*, *Networks*, *Physical infrastructure*, *Finance*, *Leadership*, *Talent*, *Knowledge*, and *Demand*. A detailed description of these elements, along with the indicators and resources employed to define them, is available in Appendix B, while the values related to the regions under examination are listed in Appendix C.

Before incorporating these data into our database, it was necessary to subject them to a comprehensive factor analysis to identify latent variables, exploiting even in this case the R software package. This statistical technique effectively condenses a large set of observed, interrelated variables into a smaller set of factors. These factors are constructs that represent significant, underlying dimensions of the data. This was done to condense the nine elements listed above into three macro-categories, making the continuation of the QCA much more manageable. Three distinct groups were identified through this process:

1. *Entrepreneurial Orientation*: This factor aggregates variables related to the propensity of a region to initiate and support entrepreneurial activities. It reflects the region's overall attitude and inclination towards entrepreneurship (elements included: *formal institutions, culture, networks, finance, talent*).
2. *Resource Circulation*: This factor embodies the efficiency and effectiveness with which resources are distributed and utilized within the entrepreneurial ecosystem. It indicates the ability of a region to sustain and support business activities through the movement of capital, talent, and information (elements included: *physical infrastructure, knowledge, demand*).
3. *Ecosystem Dynamism*: The third factor captures the vibrancy and changeability of the entrepreneurial environment. It reflects the degree to which the ecosystem is evolving, adapting, and responding to new opportunities and challenges (elements included: *leadership*).

An in-depth explanation of the factoring process is provided in Appendix D, illustrating how the various starting elements are placed within the three macro-categories. It is important to note that in factor analysis, the appearance of negative values for certain factors does not imply a reduction in their significance or a negative impact. Rather, these negative values signify inverse correlations between some of the original variables and the specific factor. This can offer insights into unique characteristics of the entrepreneurial ecosystem that differentiate one region from another or highlight areas for potential improvement.

Table 5.3 lists the values of the three factors resulting from the factoring process for each region under examination.

Table 5.3 List of regions and their respective elements resulting from the factoring process

NUTS 2 Code	*Entrepreneurial orientation*	*Resource circulation*	*Ecosystem dynamism*
ITC2	-0.63	-0.43	-0.32
ITG1	-0.73	-0.38	-0.30
ITF6	-0.43	-0.53	-0.48
ITF3	-0.80	-0.19	-0.35
ITF4	-0.52	-0.40	-0.46
ITF2	-0.57	-0.64	-0.20
ITI3	-0.68	-0.26	-0.24
ITF1	-0.64	-0.44	-0.21
ITI2	-0.63	-0.49	-0.12
NL34	2.04	-0.55	-1.09
ITF5	-0.45	-0.56	-0.46
ITC3	-1.13	0.15	-0.03
NL13	2.22	-1.10	-0.57
ITH3	-0.79	-0.02	-0.44
ITI1	-0.72	-0.27	-0.19
ITG2	-0.41	-0.54	-0.23
ITH5	-0.89	-0.01	-0.20
ITC1	-1.01	0.41	-0.47

ITH4	-0.64	-0.33	-0.15
NL12	1.55	-0.35	-0.77
ITI4	-0.97	0.41	-0.30
NL42	1.27	1.00	-1.30
NL22	0.88	1.75	-0.46
ITH1	-0.35	-0.63	-0.35
ITC4	-1.07	0.33	-0.21
NL21	1.50	0.01	-0.22
NL41	0.49	2.37	-0.75
NL11	2.22	-1.49	1.05
NL23	0.34	2.06	-0.80
IE05	0.60	-1.40	1.05
IE04	0.35	-1.40	1.02
NL33	0.31	1.93	0.47
NL31	0.05	1.80	3.41
IE06	-0.51	-0.77	2.73
NL32	0.77	1.05	2.01

5.2.1 Calibration phase

We initiated our analysis by calibrating[6] the data, a crucial process that necessitates the establishment of thresholds to ascertain each case's level of set membership. According to Misangyi and Acharya (2014), for each condition, three pivotal values must be identified: the "fully in" value (above which set membership is unequivocally considered as 1), the "crossover point" (at which cases are ambiguously positioned as neither in nor out), and the "fully out" value (below which set membership is definitively set to 0). In our analysis, the datasets pertaining to the values of private and public incubators/accelerators per million inhabitants (for both scenarios 1 and 2), and vertical-general organizations per million inhabitants, were manually calibrated. The placement of the three thresholds was meticulously chosen based on the data distribution itself. Figures 5.9 to 5.14 illustrate, for each dataset, the distribution of the data and the corresponding threshold positions.

Regarding the three conditions derived from the preceding factoring process, which reflect the remaining entrepreneurial ecosystem (EE) enabling factors, the calibration approach was meticulously applied. The full-in threshold was established at the 75th percentile, indicating that cases surpassing this value demonstrate the characteristic of interest to a degree justifying their classification as full members of the set. In contrast, the full-out threshold was positioned at the 25th percentile, suggesting that cases falling below this benchmark lack the characteristic of interest to a significant extent, warranting their classification as full non-members. The critical crossover point, delineating a threshold of maximum ambiguity where cases oscillate between being more in than out (or vice versa), was determined to be the median value. This calibration strategy inherently assumes that the data distribution is approximately normal, leveraging the median and percentiles as thresholds is most efficacious when the data distribution exhibits symmetry around a central point—a characteristic indeed observed for the three variables resulting from the factoring process.

[6] During this stage, and for the ongoing analysis, the fsQCA tool provided by COMPASS has been employed (https://compasss.org/software/).

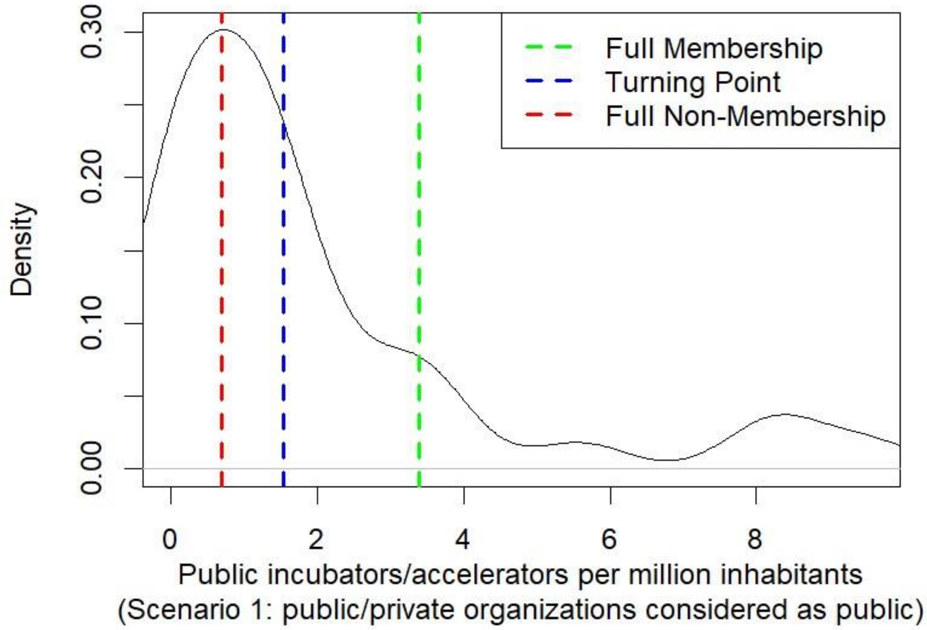

Figure 5.9 Density plot with calibrated thresholds for public incubators/accelerators per million inhabitants (Scenario 1)

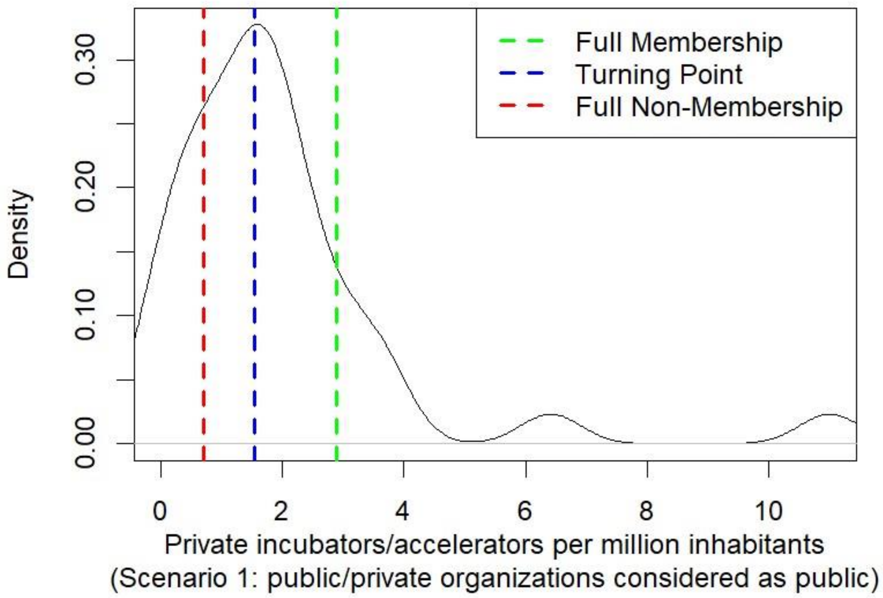

Figure 5.10 Density plot with calibrated thresholds for private incubators/accelerators per million inhabitants (Scenario 1)

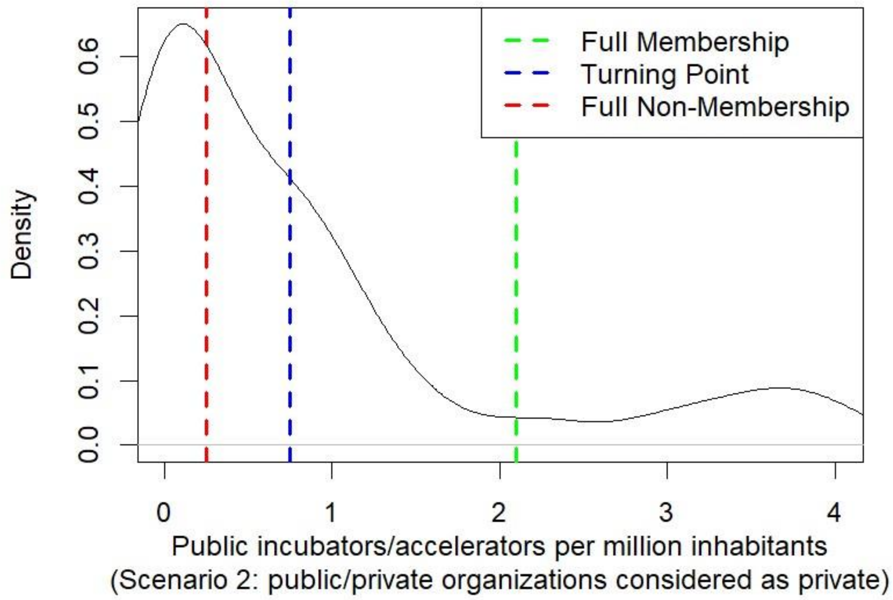

Figure 5.11 Density plot with calibrated thresholds for public incubators/accelerators per million inhabitants (Scenario 2)

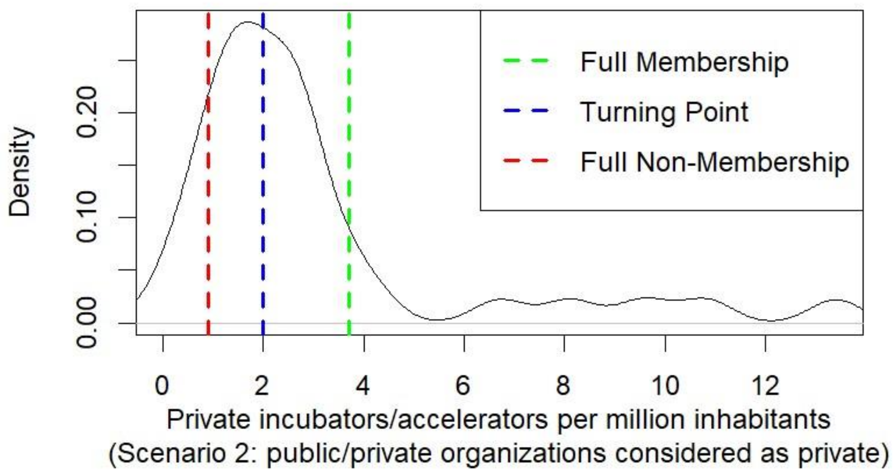

Figure 5.12 Density plot with calibrated thresholds for private incubators/accelerators per million inhabitants (Scenario 2)

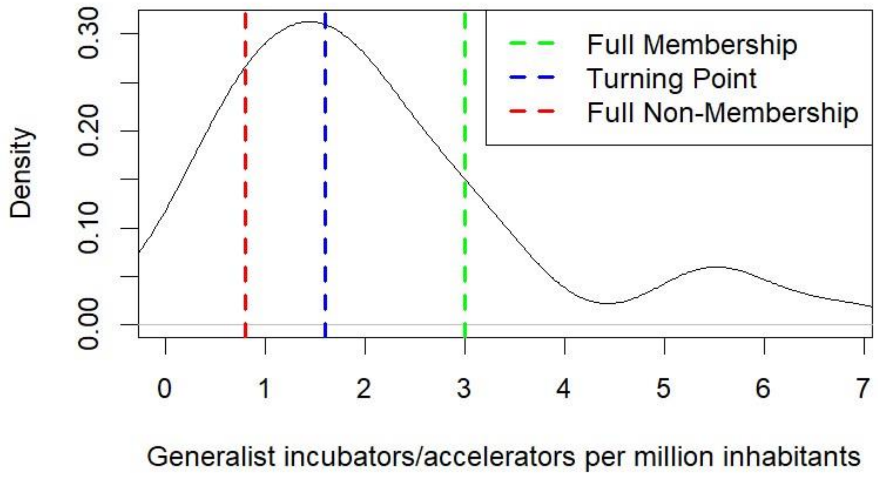

Figure 5.13 Density plot with calibrated thresholds for generalist incubators/accelerators per million inhabitants

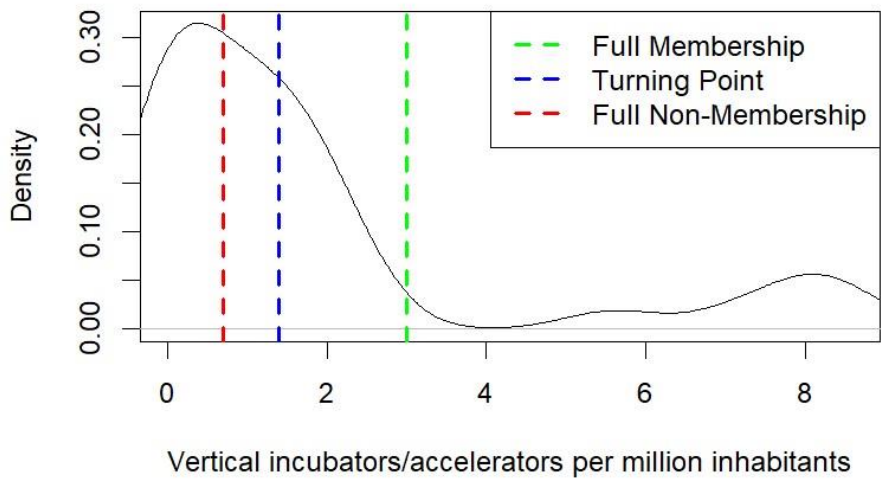

Figure 5.14 Density plot with calibrated thresholds for vertical incubators/accelerators per million inhabitants

Table 5.4 summarizes the threshold values selected for each dataset, offering a comprehensive overview of the calibration decisions made throughout our analysis. It is important to note that all pre-calibration values of the variables are contained in Appendix A and in Table 5.3.

Table 5.4 Overview of the thresholds selected during the calibration phase

Element	*Full membership*	*Turning point*	*Full non-membership*
Public incubators/accelerators per million inhabitants (Scenario 1)	3.40	1.55	0.70
Private incubators/accelerators per million inhabitants (Scenario 1)	2.90	1.55	0.70
Public incubators/accelerators per million inhabitants (Scenario 2)	2.10	0.75	0.25
Private incubators/accelerators per million inhabitants (Scenario 2)	3.70	2.00	0.90
Generalist incubators/accelerators per million inhabitants	3.00	1.60	0.80
Vertical incubators/accelerators per million inhabitants	3.00	1.40	0.70
Entrepreneurial orientation	0.46	-0.48	-0.72
Resource circulation	0.30	-0.35	-0.55
Ecosystem dynamism	-0.13	-0.24	-0.47

5.2.2 Fuzzy-Set analysis

At the end of the calibration process, we were finally able to proceed with the actual analysis. Since the categories into which the incubators/accelerators (public, private, vertical, generalists) were divided derive from the same dataset and therefore exhibit overlaps (a public incubator will also fall into the vertical or generalist category), we conducted three different fsQCAs. In all of these, the dataset related to entrepreneurial output was set as the Outcome[7], while for the Causal Conditions, in addition to the three factors representing the EE enabling factors, were complemented respectively with: datasets related to public and private organizations (scenario 1) for the first fsQCA, datasets related to the same characteristics but for scenario 2 in the second analysis, and datasets related to generalist and vertical organizations for the last analysis.

Once the Outcome and Causal Conditions were defined within the software, each analysis proceeded by minimizing the truth table. In line with previous literature (Ragin, 2006, 2009), we adopted a frequency threshold of 1 and a consistency threshold of 0.70. Finally, we applied the Quine-McCluskey algorithm (Quine, 1952) to elaborate solutions.

The objective of the analysis was to identify configurations of EEs' enabling factors (including the three factors previously illustrated and incubators/accelerators divided by characteristics) that characterize regions distinguished by certain values of entrepreneurial output. Tables 5.5 and 5.6 display the results of the fsQCA sufficiency analyses.

Sufficiency analysis aims to pinpoint combinations of conditions sufficient for the occurrence of a given outcome, exploring whether specific sets of conditions consistently lead to a particular result. This approach not only highlights configurations that guarantee the outcome but also underscores the causal complexity

[7] For the proper continuation of the analysis, it was necessary to also calibrate the dataset of the Outcome, namely the one related to the entrepreneurial output. In this case, it was sufficient to define a single threshold, above which a region is assigned a value of 1, indicative of a high level of entrepreneurial activity, while below this threshold the assigned value is 0, representing a region with entrepreneurial output results not worthy of note. The threshold value was also in this case manually selected based on the distribution of the data, and is equal to 0.89.

and the principle of equifinality, where different combinations can produce the same result.

The outcomes of the first two fsQCAs, differentiated by the inclusion in the causal conditions of the two scenarios related to public/private organizations, are combined to compare the different configurations obtained as the public-private boundary varies. For each configuration, filled circles (●) signify the presence of a condition is associated with the outcome, white circles (○) denote the absence is associated, and empty cells indicate conditions can be present or absent. Intermediate solutions are displayed, providing additional insights into the relationships between enabling factors and entrepreneurial outcomes.

Table 5.5 Analysis of sufficient conditions for the presence of high entrepreneurial outcome values in a region, with incubators/accelerators divided by organizational legal nature

	Scenario 1 (public/private organizations considered as public)		Scenario 2 (public/private organizations considered as private)	
	A	B	B	C
Public incubators/accelerators per million inhabitants	○	●	●	
Private incubators/accelerators per million inhabitants		●	●	●
Entrepreneurial orientation	●	●	●	●
Resource circulation	●			●
Ecosystem dynamism	●	●	●	●
Consistency %	83	99	94	82
Raw coverage %	18	32	32	21
Unique coverage %	14	28	21	11
Overall consistency %	93		90	
Overall coverage %	46		42	

Table 5.6 Analysis of sufficient conditions for the presence of high entrepreneurial outcome values in a region, with incubators/accelerators divided by area of focus

	a	b
Generalist incubators/accelerators per million inhabitants	●	○
Vertical incubators/accelerators per million inhabitants	●	○
Entrepreneurial orientation	●	●
Resource circulation		●
Ecosystem dynamism	●	●
Consistency %	97	75
Raw coverage %	35	13
Unique coverage %	32	9
Overall consistency %	91	
Overall coverage %	45	

Before analyzing the results obtained, let us clarify some terms presented in the tables above:

- **Consistency:** Consistency measures the extent to which a configuration of conditions is systematically associated with a specified outcome. It denotes the proportion of cases where the presence (or absence) of a configuration of conditions leads to the anticipated outcome. A consistency value approaching 1 (or 100%) indicates that the configuration is a highly reliable indicator of the outcome; the vast majority of cases exhibiting this configuration of conditions share the same outcome. Conversely, low consistency suggests that the configuration is not a dependable predictor of the outcome. In practical terms, consistency values above 0.80 are generally considered acceptable to support the relevance of a configuration.

- **Raw Coverage:** Raw coverage quantifies the proportion of all cases exhibiting the outcome of interest that can be explained by a specific configuration of conditions. A significant raw coverage value implies that a considerable portion of cases with the desired outcome can be attributed to that configuration, underscoring its importance in elucidating the phenomenon under study.
- **Unique Coverage:** Unique coverage measures the proportion of cases exhibiting the outcome of interest that are uniquely explained by the configuration under consideration, devoid of overlap with other configurations. This metric highlights the exclusive contribution of a configuration to the explanation of the outcome, beyond what is elucidated by other configurations.
- **Overall Consistency:** Overall consistency assesses the collective level of consistency with which the identified set of configurations is associated with the outcome of interest. High overall consistency signifies that the aggregated configurations exhibit a robust and systematic relationship with the outcome across the cases analyzed. This measure provides a global indication of the fsQCA model's reliability, reflecting the degree to which the combined configurations are consistently related to the outcome.
- **Overall Coverage:** Overall coverage evaluates the extent to which the identified set of configurations collectively accounts for or explains the cases manifesting the outcome of interest. Elevated overall coverage indicates that the fsQCA model furnishes a comprehensive and pertinent explanation for the phenomenon under investigation, denoting that a large share of the outcome occurrences is encompassed by the identified configurations.

5.2.3 Results

The three fsQCAs conducted unveil recurring patterns that offer significant insights into the determinants of entrepreneurial success. A prominent feature from this analysis is the consistent presence of entrepreneurial orientation and ecosystem dynamism across all configurations examined. This ubiquity highlights the critical nature of these elements: a robust entrepreneurial orientation and a dynamic, evolving ecosystem serve as essential foundations for a flourishing environment conducive to entrepreneurial activities. Their presence in all successful configurations underscores that these factors are crucial for catalyzing entrepreneurial output, regardless of the specific support structure in place.

Upon a detailed exploration of configurations involving public and private incubators and accelerators, it is observed that for both scenarios, the configuration with the highest consistency and coverage includes a combination of public and private supports. This finding suggests that a synergy between governmental resources and the private sector creates the most conducive environment for entrepreneurial endeavors. The interplay between these two support types enriches the ecosystem with a diverse array of resources, networks, and opportunities, demonstrating the value of an integrated approach in enhancing entrepreneurial output.

Nevertheless, configurations that solely involve private incubators/accelerators, or those where the absence of public support does not detract from achieving a positive outcome, also emerge as successful. These patterns underscore the significant role that private entities play within the entrepreneurial ecosystem, capable of independently fostering a dynamic and productive environment for entrepreneurship, even without public sector involvement.

With regards to the roles of generalist versus vertical incubators and accelerators, the analysis reveals that both types hold significant yet distinct importance. The concurrent presence of generalist and vertical support in particular configurations highlights the effectiveness of a comprehensive approach that incorporates both specialization and broad support, proving especially beneficial for stimulating innovation and entrepreneurial growth.

Moreover, the analysis indicates that the absence of either generalist or vertical support does not inherently impede entrepreneurial success. This observation suggests that other factors within the ecosystem can compensate for and bolster entrepreneurial output, implying that, in specific contexts, the resilience and diversity of the entrepreneurial ecosystem are sufficient to bridge any specific support gaps.

6. Conclusions

Entrepreneurial Support Organizations (ESOs) are crucial in nurturing entrepreneurial activities and supporting high-growth potential firms (HGPFs). While outcomes at the firm level are mixed, ESOs significantly contribute to the development of Entrepreneurial Ecosystems (EEs) by facilitating resource sharing, managing exchanges, and reducing information asymmetries. They also play a pivotal role in evolving and coordinating EEs, promoting a unified vision, and enhancing the flow and dynamism of resources. It is important to note that ESOs, such as incubators and accelerators, vary in their strategic focus and organizational legal nature, which implies that certain models might be more adept at addressing specific challenges. Despite this, the literature on the effectiveness of various ESOs typologies in fostering ecosystem growth is sparse. This thesis aims to address this gap with a mixed-methods approach, employing regional correlation analyses and Qualitative Comparative Analysis (QCA), to shed light on how different ESO categories contribute to vibrant entrepreneurial regions.

6.1 Key findings

A constant across all successful configurations was the presence of the “entrepreneurial orientation” and “ecosystem dynamism” factors, underscoring their indispensable role in cultivating high-value entrepreneurial ecosystems. This discovery reaffirms the theoretical assertion that a conducive cultural and adaptive environment forms the bedrock of entrepreneurial success.

The analysis revealed that configurations showcasing the highest consistency and coverage in fostering entrepreneurial outcomes often involved a collaborative synergy between public and private ESOs. This suggests that a balanced approach, leveraging both governmental support and private sector agility, provides a fertile ground for entrepreneurial ventures.

Notably, configurations where private incubators/accelerators were present, with or without their public counterparts, also led to successful entrepreneurial outcomes. This indicates a potentially more significant role for private entities in driving the dynamism of entrepreneurial ecosystems.

The study's findings regarding generalist versus vertical ESOs suggest a more complex relationship than previously assumed. The simultaneous presence and absence of both types in various successful configurations indicate that the classification of ESOs as either generalist or vertical might not be relevant in shaping entrepreneurial success. This observation underscores the notion that other factors within the entrepreneurial ecosystem likely play a more significant role in fostering vibrant entrepreneurial activities. Thus, while diversity in support strategies remains valuable, the emphasis might better be placed on other dimensions of ESO functionality and integration within the ecosystem.

The findings advocate for tailored policy interventions that foster a synergistic ecosystem involving both public and private ESOs. Policymakers are encouraged to facilitate conditions that enhance collaboration between different types of support organizations to maximize the entrepreneurial output. Moreover, given the critical role of private ESOs, there is a need for policies that incentivize private investment in startup support infrastructure. This could include tax incentives, matching funds, or regulatory reforms that make it easier for private entities to contribute to the ecosystem.

6.2 Limitations and future research directions

While this thesis provides valuable insights, it acknowledges the limitations inherent in its scope, which is restricted to three countries, and the reliance solely on incubators and accelerators among the various forms of ESOs that exist.

Future studies could extend the geographical coverage, incorporate additional ESO categories, and evaluate the quality of services they provide. The analysis herein was limited to the presence of the organizations without actually delving into the quality of their services. Furthermore, a potentially more informative measure for future research could be the density of ESOs per square kilometer. This approach might mitigate the influence of 'anomalous' regions, which show high values of incubators/accelerators per million inhabitants despite having low absolute numbers, thus providing a clearer picture of the distribution and effectiveness of these organizations. Additionally, this study did not conduct tests on the calibration thresholds used during the Qualitative Comparative Analysis (QCA). Not having verified the robustness of findings by slightly varying these thresholds to assess stability might limit the reliability of the analytical framework. Future research should consider these tests to enhance the validity and robustness of the conclusions drawn.

Nonetheless, the research contributes significantly to the Entrepreneurial Ecosystem literature by presenting empirical evidence on the sophisticated roles ESOs play in fostering high levels of entrepreneurial activity. It underscores the ecosystem's complexity and the importance of creating policies that promote an inclusive, diverse, and dynamic support network. This study not only highlights the intricate dynamics of fostering entrepreneurship but also establishes a foundation, through a purpose-built database and observed trends, for future exploration of the constantly changing entrepreneurial ecosystem landscape.

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Appendix A: correlation analysis datasets

This section contains the datasets used for the second phase of the correlation analysis.

Table A.1 Dataset used for the second phase of correlation analysis
(Scenario 1: public/private organizations considered as public)

NUTS 2 Code	*Public incubators/accelerators per million inhabitants*	*Private incubators/accelerators per million inhabitants*	*Entrepreneurial output*
IE04	5.59	3.35	1.46
IE05	9.58	2.99	1.43
IE06	8.42	6.41	5.00
NL13	0.00	2.01	0.38
NL23	0.00	2.30	1.22
NL12	1.53	1.53	0.54
NL22	1.42	0.47	0.73
NL11	0.00	1.69	1.20
NL42	0.89	2.68	0.69
NL41	1.54	2.31	1.17
NL32	3.09	11.00	5.00
NL21	0.00	0.85	1.16
NL31	0.73	1.46	2.33
NL34	0.00	2.59	0.36
NL33	1.33	2.13	1.80
ITC1	1.18	1.65	0.49
ITC2	8.12	0.00	0.01
ITC3	1.33	1.33	0.38
ITC4	0.80	3.61	0.89
ITF1	0.00	0.79	0.29
ITF2	3.44	0.00	0.24
ITF3	0.36	1.07	0.22

ITF4	0.26	0.51	0.22
ITF5	3.72	3.72	0.38
ITF6	1.08	0.00	0.20
ITG1	0.62	0.42	0.15
ITG2	0.00	1.90	0.43
ITH1/ITH2	1.86	1.86	0.75
ITH3	1.44	0.82	0.40
ITH4	3.35	0.00	0.50
ITH5	2.03	1.58	0.46
ITI1	2.46	1.64	0.40
ITI2	0.00	1.17	0.35
ITI3	0.67	0.67	0.28
ITI4	1.05	1.75	0.65

Table A.2 Dataset used for the second phase of correlation analysis (Scenario 2: public/private organizations considered as private)

NUTS 2 Code	*Public incubators/accelerators per million inhabitants*	*Private incubators/accelerators per million inhabitants*	*Entrepreneurial output*
IE04	2.24	6.71	1.46
IE05	2.99	9.58	1.43
IE06	4.01	10.82	5.00
NL13	0.00	2.01	0.38
NL23	0.00	2.30	1.22
NL12	1.53	1.53	0.54
NL22	0.47	1.42	0.73
NL11	0.00	1.69	1.20
NL42	0.89	2.68	0.69
NL41	0.39	3.47	1.17
NL32	0.69	13.40	5.00
NL21	0.00	0.85	1.16
NL31	0.00	2.19	2.33

NL34	0.00	2.59	0.36
NL33	0.53	2.93	1.80
ITC1	0.94	1.88	0.49
ITC2	0.00	8.12	0.01
ITC3	1.33	1.33	0.38
ITC4	0.20	4.21	0.89
ITF1	0.00	0.79	0.29
ITF2	3.44	0.00	0.24
ITF3	0.00	1.43	0.22
ITF4	0.26	0.51	0.22
ITF5	3.72	3.72	0.38
ITF6	0.54	0.54	0.20
ITG1	0.00	1.04	0.15
ITG2	0.00	1.90	0.43
ITH1/ITH2	0.93	2.79	0.75
ITH3	0.62	1.65	0.40
ITH4	0.84	2.51	0.50
ITH5	0.90	2.70	0.46
ITI1	1.09	3.00	0.40
ITI2	0.00	1.17	0.35
ITI3	0.00	1.35	0.28
ITI4	0.17	2.62	0.65

Table A.3 Dataset used for the second phase of correlation analysis

NUTS 2 Code	*Generalist incubators/accelerators per million inhabitants*	*Vertical incubators/accelerators per million inhabitants*	*Entrepreneurial output*
IE04	3.35	5.59	1.46
IE05	5.39	7.18	1.43
IE06	6.81	8.02	5.00
NL13	2.01	0.00	0.38
NL23	2.30	0.00	1.22

NL12	3.06	0.00	0.54
NL22	0.47	1.42	0.73
NL11	1.69	0.00	1.20
NL42	2.68	0.89	0.69
NL41	1.54	2.31	1.17
NL32	5.50	8.59	5.00
NL21	0.85	0.00	1.16
NL31	0.73	1.46	2.33
NL34	2.59	0.00	0.36
NL33	1.86	1.60	1.80
ITC1	1.65	1.18	0.49
ITC2	0.00	8.12	0.01
ITC3	0.66	1.99	0.38
ITC4	2.10	2.31	0.89
ITF1	0.79	0.00	0.29
ITF2	3.44	0.00	0.24
ITF3	0.89	0.53	0.22
ITF4	0.77	0.00	0.22
ITF5	5.58	1.86	0.38
ITF6	1.08	0.00	0.20
ITG1	0.83	0.21	0.15
ITG2	1.27	0.63	0.43
ITH1/ITH2	1.86	1.86	0.75
ITH3	1.65	0.62	0.40
ITH4	2.51	0.84	0.50
ITH5	1.80	1.80	0.46
ITI1	3.00	1.09	0.40
ITI2	0.00	1.17	0.35
ITI3	1.35	0.00	0.28
ITI4	1.57	1.22	0.65

Appendix B: EEs enabling factors overview

Table B.1 List of EEs enabling factors, along with their description, empirical characterization, and data source

Element	*Description*	*Empirical indicators*	*Data source*
Formal institutions	The rules of the game in society	Two composite indicators measuring the overall quality of government (consisting of scores for corruption, accountability, and impartiality) and the ease of doing business	Quality of Government Survey (QOG) and the World Bank Doing Business Report
Culture	The degree to which entrepreneurship is valued in a region	A composite measure capturing the regional entrepreneurial culture, consisting of entrepreneurial motivation, cultural and social norms, importance to be innovative, and trust in others	Global Entrepreneurship Monitor (GEM) and European Social Survey (ESS)
Networks	The social context of actors, especially the degree to which they are socially connected	Percentage of SMEs that engage in innovative collaborations as a percentage of all SMEs in the business population	Regional Innovation Scoreboard (RIS)
Physical infrastructure	Transportation infrastructure and digital infrastructure	Four components in which the transportation infrastructure is measured as the accessibility by road, accessibility by railway and number of passenger flights and digital infrastructure is measured by the percentage of households with access to internet	Regional Competitiveness Index (RCI)
Finance	The presence of financial means to invest in activities that do not yet deliver financial means	Two components: The average amount of venture capital per capita and the percentage of SMEs that is credit constrained	Invest Europe and European Investment Bank (EIB)
Leadership	The presence of actors taking a leadership role in the ecosystem	The number of coordinators on H2020 innovation projects per capita	Community Research and Development Information Service (CORDIS)
Talent	The skills, knowledge and experience possessed by individuals	Four components: The percentage of the population with tertiary education, the percentage of the working population engaged in lifelong learning, the percentage of the population with an entrepreneurship education, the percentage of the population with e-skills	Eurostat and the Global Entrepreneurship Monitor (GEM)

Knowledge	Investments in (scientific and technological) knowledge creation	Intramural R&D expenditure as a percentage of Gross Regional Product	Eurostat
Demand	The presence of financial means in the population to purchase goods and services	Three components: disposable income per capita, potential market size expressed in GRP, potential market size in population. All relative to EU average.	Regional Competitiveness Index (RCI)

Appendix C: EEs enabling factors values

NUTS 2 Code	Formal institutions	Culture	Networks	Physical infrastructure	Finance	Leadership	Talent	Knowledge	Demand
IE04	1.6678652	1.0631799	0.6277251	0.184070702	1.2708249	1.4279068	0.6206543	0.5701072	0.2025863
IE05	1.595957	1.0849386	0.6909695	0.292569498	0.6957435	0.9724232	0.8866963	0.279203	0.3687376
IE06	1.595957	0.7858384	0.6788364	0.876436795	1.9474239	3.97105	0.8866963	0.2951636	0.6643794
ITC1	0.1742795	0.3383378	0.3860089	0.802012197	0.3697124	0.3778491	0.1825554	0.7372738	1.2466635
ITC2	0.2281053	0.3708811	0.1992307	0.244377174	0.2825014	0.2462024	0.1766194	0.189561	0.7658373
ITC3	0.1687902	0.1685921	0.2244117	0.664381968	0.3421095	0.8321716	0.2104737	0.3831759	0.8563102
ITC4	0.2528103	0.3974195	0.265626	0.75551678	0.781839	0.4819052	0.20325	0.3246464	2.0709956
ITF1	0.1152649	0.2678314	0.2803701	0.272547325	0.4647619	0.2227623	0.188163	0.2416991	0.5763625
ITF2	0.1749207	0.136437	0.2716441	0.127100577	0.2825014	0.2054945	0.1801375	0.1869061	0.5000062
ITF3	0.1215375	0.4121452	0.166544	0.384535438	0.4067845	0.2312808	0.156027	0.3220262	0.6849233
ITF4	0.1446632	0.5720164	0.2904484	0.296238614	0.4274421	0.2133618	0.1571637	0.2521456	0.4207549
ITF5	0.1356226	0.6965039	0.1609623	0.175432001	0.2987548	0.2149398	0.1720529	0.1808138	0.3365426
ITF6	0.1035111	0.6036221	0.2649187	0.20826907	0.3018893	0.2082861	0.1666944	0.1935977	0.269185
ITG1	0.1447391	0.1983308	0.215154	0.270136517	0.2869054	0.1921127	0.146784	0.2530576	0.3763003
ITG2	0.1703024	0.1917326	0.5959186	0.296451517	0.7132336	0.2088265	0.1780124	0.2146106	0.2335234
ITH1	0.2688152	0.6678504	0.2780466	0.170804321	0.2825014	0.4448665	0.2219476	0.20081	0.7658373
ITH3	0.2557453	0.4949695	0.2415808	0.509833739	0.3432117	0.3716151	0.1795694	0.2781594	1.2466635
ITH4	0.2518836	0.4448934	0.3043994	0.374577308	0.6146513	0.4090036	0.2178463	0.4246535	0.8222364
ITH5	0.2560138	0.4290049	0.2227584	0.527888291	0.4459894	0.5840089	0.2128317	0.5287804	1.4081614
ITI1	0.2084225	0.402386	0.2630051	0.390303286	0.5327537	0.4322983	0.1982194	0.3406638	0.8738729
ITI2	0.1473441	0.2483633	0.2709524	0.250432533	0.3690559	0.3272065	0.2270396	0.2454794	0.6849233
ITI3	0.1574963	0.3976707	0.2795346	0.406546583	0.5055182	0.2549861	0.2109245	0.2207831	0.6849233
ITI4	0.1458061	0.500997	0.4214555	0.886758202	0.4025322	0.8495767	0.2431893	0.4401331	1.1611519
NL23	1.1806097	3.8974136	0.9892378	2.807224171	1.0704941	0.2307475	1.2242677	0.4769677	1.8149614
NL32	1.0486035	5	0.9892378	2.807224171	3.0167483	3.0833276	1.9231834	0.4769677	1.8149614
NL11	1.1930631	4.6753309	1.4088808	0.866593269	1.3874516	4.4695218	1.3792342	0.6910923	0.7279365
NL12	1.1930631	3.919336	0.8865714	1.127485179	0.9894456	0.2308253	1.0071674	0.2192444	0.7279365
NL13	1.1930631	3.6746086	1.4498581	0.792873451	1.428404	0.1963838	1.0630347	0.2133603	0.8917959
NL21	1.1806097	4.290653	1.0348601	1.570467682	1.6623918	0.6505383	1.242409	0.55825	1.1611519
NL22	1.1806097	5	1.1046647	2.82926462	1.6174609	1.2410076	1.4067817	0.743115	1.690469
NL31	1.0486035	4.1854135	1.3650145	3.583689506	2.8361394	5	2.289921	0.7903675	2.3156545
NL33	1.0486035	4.50304	1.1518438	3.01796643	2.0857748	2.6246828	1.4328769	0.7509169	2.0293735
NL34	1.0486035	4.3511155	1.206678	1.034844766	1.4472757	0.1908714	0.981147	0.1737562	1.5586134
NL41	1.1185035	4.8045797	1.0751181	3.129662813	1.685308	0.6461431	1.3329896	1.26432	1.9289412
NL42	1.1185035	5	1.0472135	2.073192804	1.5934467	0.7193756	1.0145383	0.5564006	1.8149614

Appendix D: detailed factor analysis output

This appendix details the factor analysis performed using the maximum likelihood method with a varimax rotation. The analysis aimed to distill the observed variables into a smaller number of factors that capture the underlying structures within the European Entrepreneurial Ecosystem dataset.

Standardized loadings (pattern matrix) based upon correlation matrix:

Variable	*ML2*	*ML1*	*ML3*	*h2*	*u2*	*com*
Formal_institutions	0.74	0.15	0.39	0.73	0.274	1.6
Culture	0.82	0.52	0.12	0.96	0.037	1.7
Networks	0.85	0.35	0.27	0.92	0.077	1.5
Physical.infrastructure	0.41	0.87	0.27	1.00	0.005	1.6
Finance	0.59	0.48	0.57	0.90	0.099	2.9
Leadership	0.28	0.19	0.82	0.79	0.213	1.3
Talent	0.70	0.51	0.49	0.99	0.014	2.7
Knowledge	0.22	0.67	0.20	0.54	0.460	1.4
Demand	0.22	0.82	0.11	0.74	0.261	1.2

Summary Statistics and Factor Adequacy:

The analysis resulted in three factors explaining a significant portion of variance within the dataset, with the following summary statistics supporting the factor structure's adequacy:

- SS Loadings: ML2 = 3.13, ML1 = 2.83, ML3 = 1.60
- Proportion of Variance: ML2 = 0.35, ML1 = 0.31, ML3 = 0.18
- Cumulative Variance Explained: 0.84
- Mean item complexity = 1.8

Goodness-of-fit measures and hypotheses tests indicate the model fits well with the data:

- Tucker Lewis Index of factoring reliability = 1
- RMSEA index = 0 (90% CI: 0 to 0.174)
- BIC = -30.68

- The root mean square of the residuals (RMSR) = 0.02

Factor Score Adequacy:

- Correlation of (regression) scores with factors: ML2 = 0.97, ML1 = 0.99, ML3 = 0.93
- Multiple R square of scores with factors: ML2 = 0.94, ML1 = 0.98, ML3 = 0.87
- Minimum correlation of possible factor scores: ML2 = 0.89, ML1 = 0.96, ML3 = 0.74