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The impact of Foreign Direct Investment on Evolutionary Entrepreneurial Ecosystems

By

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for the degree of Doctor of Philosophy*

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ABSTRACT

Entrepreneurship and foreign direct investment (FDI) are significant foundations of economic development in most economies, particularly in modern advanced ones. This thesis focuses on how the interplay between FDI and indigenous enterprises in the host location impacts on regional economic development. This study examines the evolution of an entrepreneurial ecosystem (EE) in an FDI-dominated hi-tech local domain, the Dublin internet space. In this dissertation, I investigate to what extent the arrival and growth of multinationals (MNEs) influenced local economic development through direct spillovers in the form of spinouts. Specifically, the research examines the impact of FDI in the form of alumni founder spinouts from MNEs in the host region, which may join the local EE agglomeration.

Beyond policy circles, the EE concept has emerged in recent years as an effective framework for measuring the entrepreneurial interdependence of actors within a local community. EE policy and literature have helpfully placed the entrepreneur and entrepreneurship at the forefront of regional development. Furthermore, the EE literature has placed a strong emphasis on place, actors, governance and, somewhat surprisingly for an ecosystem, evolutionary processes. There is scope to extend this aspect as a field of evolutionary entrepreneurial ecosystems (EEEs). The principal research question for the study is *whether spinouts from MNEs trigger or inhibit the formation of an EE and transition its evolution into a resilient ecosystem?* This dissertation is organised across the following three studies, two conceptual and one empirical, that interconnect to holistically address the overarching research question.

Study 1 conceptually proposes using the evolutionary EE concept as a macro complementary perspective of cluster theory and the GVC framework to usefully understand the complexity and dynamics of the innovation process across global boundaries. Study 2 first examines the bibliometric growth of the EE literature. Second, it identifies and categorises the current themes in the EE literature, actors, place, governance and evolution, that serve as the primary foci of the EE concept in order to guide future research. Third, by categorizing the themes, it contributes to the EE concept by refocusing EE research on its core elements, away from any unhelpful meandering. This study ultimately advocates for a greater emphasis on the EE concept's critical evolutionary dynamics and processes, preferably through a longitudinal lens. Building on this insight, Study 3 empirically investigates the role of FDI in the evolution of an EE. It questions whether FDI-based tech MNEs support or restrict entrepreneurship in a region. In an idiosyncratic, purposely selected case study of a high-tech region, this study explores the role of MNEs in the horizontal evolution of Dublin's internet EE. Primary and secondary data from various actors in the EE of Internet companies in Dublin was collected and analysed using the Gioia method. This paper makes a

number of contributions. First, this study sheds light on the evolution of an EE by identifying direct, rather than simply indirect, spillover effects of FDI, using the concrete measures that are MNE alumni spin-outs. Second, it extends theory in that it demonstrates how MNEs, on balance, inhibit more than nurture entrepreneurship in this local regional context. Third, it advances methodology by employing a multi-level case study with a pluralist lens, particularly through interpretive sense making and contextualized explanation. In summary, despite its limitations, this thesis makes an important contribution to the EE literature and the fields of international business (IB) and entrepreneurship by investigating the interaction of FDI and indigenous enterprises in the host region and how this affects regional economic development. Overall, this thesis represents another step toward understanding and exposing the origins and evolution of the EE.

KEYWORD: Entrepreneurial ecosystem, evolution, process, spinout, multinationals (MNEs), regional development, FDI, Case study, resilience, adaptation, systematic review

1 Introduction

1.1 Aim of the thesis and research objectives

Entrepreneurship and foreign direct investment (FDI) are the pillars of economic development in most economies, particularly in modern advanced ones (De Backer & Sleuwaegen, 2003; Young et al., 1994). This thesis focuses on how the interplay between FDI and indigenous enterprises in the host location impacts on regional economic development. In particular, this study examines the evolution of an entrepreneurial ecosystem (EE) in Dublin. In the early 2000s, the Irish government attracted multinational tech-companies to set up subsidiaries in the greater Dublin city region. For instance, global internet companies, primarily from the USA, flooded into the Dublin Docklands Area (IDA, 2018). In this dissertation I investigate how the arrival and growth of multinationals (MNEs) impacted local economic development via direct spillovers. Specifically, this research examines the impact of FDI in the form of indigenous spinouts from MNEs in the host region that may agglomerate as an EE.

In recent years, the EE concept emerged as an effective framework for measuring the entrepreneurial interdependence between actors within a local community (Acs et al., 2017; Alvedalen & Boschma, 2017; Cohen, 2006), beyond mere policy circles (Isenberg, 2010; Stam, 2015). Antecedent evolutionary systems, such as evolutionary economic geography (Boschma, 2015; Martin & Sunley, 2006) and cluster life cycle theory (Menzel & Fornahl, 2009) have addressed issues of evolution in regional development. In spite of this, in previous regional development approaches the entrepreneur is either absent or under-emphasized as the agent of evolution in the expansionary processes of specialisation and adaptation. Contrastingly, EE policy and literature has usefully placed the entrepreneur and entrepreneurship front and centre in regional development. Additionally, the EE literature has strongly focused on place (O'Connor et al., 2018); actors (Ryan et al., 2020), and governance (Colombelli et al., 2019). This is where a role exists for developing the field of evolutionary entrepreneurial ecosystems (EEEs). Surprisingly, the element of 'ecosystem' is underplayed within EE concept. Ecosystems are by nature dynamic and evolutionary from their origin. While some studies argue that evolutionary entrepreneurial ecosystems have now emerged (Cantner et al., 2020; Mack & Mayer, 2016; Roundy et al., 2018), the majority have been unhelpfully static and cross-sectional. Evolution is essentially a series of change over time (Spigel & Harrison, 2018). This thesis takes a dynamic perspective of evolutionary processes. The principal research question is *whether spinouts from MNEs trigger or inhibit the formation of an EE and transition its evolution into a mature, strong, vibrant, and resilient ecosystem?* This dissertation is organised into three studies, each with its own set

of research aims that interconnect to the overarching question. Table 1 presents an overview of three papers in terms of research objectives, methods, and levels of analysis.

Table 1 Overview of the Three Studies

Paper	Research objectives	Method	Analysis	Publication status
1	Whether the emerging EE literature can shed light further on the way innovation is carried out in the global economy?	Conceptual review	-	Published as book chapter by Oxford University Press
2	What are the developments to date in the furtherance of still under-theorised concept of entrepreneurial ecosystems?	Systematic literature review	Bibliometric and Thematic analysis	Published in Small Business Economics (ABS 3)
3	The extent to which multinationals nurture or inhibit the evolution of entrepreneurial ecosystems in their host locations?	Qualitative case study	Gioia method (Multi-level)	Presented in EIBA Annual Conference 2021 (competitive paper)

1.2 Contributions to Knowledge

The research is presented as three separate but interwoven papers that each may the following contributions to theory on the impact of inward FDI on the evolution of EEs.

1.2.1 Paper 1: Complementary frameworks for examining global innovation: Aligning global value chains (GVCs), industrial clusters and entrepreneurial ecosystem

The first paper contributes to theory by conceptually reviewing the cluster, global value chains (GVCs), and entrepreneurial ecosystem literature in order to capture the processes of global innovation. It draws on industrial clusters, GVCs and EEs interdependently. This study calls for the combination

of elements from different disciplines of a complex phenomenon. Scholars have focused on two separate, yet interdependent theoretical frameworks, notably industrial clusters and GVC. Innovation, however, has only attracted partial attention to date, due to the focus on the firm-level interactions, hence suggesting substantial space for further research (Coe & Yeung, 2015; Kano, 2018).

Despite the theory expanding the knowledge on the dynamics of firms' innovation and resilience in the global economy, neither the cluster theory nor the GVC framework explicitly highlighted the micro-foundations underlying innovation (Kano et al., 2020; Pietrobelli & Staritz, 2018). Majority of the studies have been conducted at the meso-level of analysis (Kier & McMullen, 2018; Szirmai et al., 2011). While the growing literature recognises the need to identify how leading firms compete at the intersection of GVCs and local clusters, it is not clear how entrepreneurs contribute to global innovation development.

Also, this paper contributes to the methodology by proposing an entrepreneurial ecosystem perspective to capture the micro-dynamics and longitudinal studies to examine the global innovation. To date, only limited research in cluster and GVCs studies have assessed firms' competitiveness and innovation through a real-time longitudinal approach, hence limiting the understanding to a rather static research perspective. Central to EE is the role of entrepreneurs as they trigger innovation and propel industries' evolution (Brown & Mason, 2017). The entrepreneurs are the primary unit of analysis which allows the dynamics of the micro-foundations. A cluster can evolve into unrelated varieties and cause innovation in the global market through spinoffs and spinouts. Entrepreneurs acquire local knowledge and blend it with new ideas, thereby generating innovation. While local knowledge is accumulated in established cluster firms, new technologies can emanate from the global economy and are integrated into local production systems through GVCs. By mixing local and global knowledge, the entrepreneur is often the catalyst that bridges different types of knowledge to generate innovative processes.

Overall, EE literature can enhance the comprehension of how innovation unfolds in today's global economic scenario. Thus, this research suggests utilising evolutionary EE concept as a complementary perspective of the cluster theory and GVC framework to understand the complexity and the dynamics of the innovation process across the boundaries.

1.2.2 Paper 2: Evolutionary entrepreneurial ecosystems: A research pathway

The second paper is a systematic literature review and contributes to theory development in several ways. First, the study examines the bibliometric growth progress of the literature and identifies the potential methodological approaches. Second, it emphasizes current themes that serve as the

primary focus of the EE concept to guide future research. Third, by categorizing the topics, this research contributes to the EE concept by resetting the current discussion to core elements and addressing the perplexity. The study follows the robust examples of systematic reviews in entrepreneurship and international business (IB) domains to ensure reliability and replicability (Jones et al., 2011; Karami et al., 2019; Pittaway & Cope, 2007; Schmeisser, 2013).

As is typical for an emerging domain, a slow start in EE was followed by a significant increase in research output, in this case triggered by a widely publicized piece by Isenberg (2010). The EE concept appeals to researchers and policymakers seeking entrepreneur-centred local economic growth (Acs et al., 2017; Mason & Brown, 2014). Since 2016, the EE literature has seen an unprecedented increase in the number of outputs, which has hampered theory development. This paper surveys the EE literature, summarizing the research to date and refocusing on the framework's key principles. For example, the study sheds light on the entrepreneurs and key actors who drive the EE concept and moves away from concepts such as universities and accelerators, which are only one component of an EE. Recently there have been a number of systematic literature reviews on EEs (Cao & Shi, 2020; Wurth et al., 2021). However, this is the first paper that focuses specifically on the evolution of EEs to date. As a result, the contribution of this paper is that it clearly outlines the developments to date in the advancement of the still unexplored concept of EEs. This research calls for a greater emphasis on the evolutionary dynamics and processes that are critical aspects of the concept. There have been minimal attempts that explored the evolution of EEs through a longitudinal lens due to difficulties in data collection (Ryan et al., 2020). Therefore, this paper makes some recommendations for longitudinal process approaches for future research to advance the evolutionary aspect of EEs.

1.2.3 Paper 3: Multinational enterprise alumni spinouts in an entrepreneurial ecosystem: Where art thou?

This paper contributes to theory by investigating the horizontal evolution mechanism in Dublin internet companies. The study examines whether FDI-based tech MNEs support or restrict entrepreneurship in the region through an intensive search using social media (LinkedIn) and primary interviews with the ecosystem's actors. According to this research, only 45 (co-)founders have spun out and been active since the year 2000, out of more than 50,000 MNE employees (That is only one out of one-thousand in terms of number). This paper makes several contributions. This paper makes several contributions. First, this study sheds light on the evolution of an EE by identifying direct, rather than simply indirect, spillover effects of FDI, by using concrete measures MNE alumni spin-outs. Second,

it extends theory by exploring the horizontal evolution of an EE and demonstrates how MNEs, on balance, inhibit more than nurture entrepreneurship in the local region. Third, identifies the multi-level inhibitors of MNE spinouts for Dublin's internet EE. Finally, from the perspective of a policymaker, drawing and tracking the emergence of an EE over time allows for a better understanding of an ecosystem's evolutionary trajectories as well as mapping future areas of investment and policy intervention.

1.3 Structure of the thesis

Chapter two will explore the theoretical framework of EEs as well as antecedent systems, such as, industrial districts, clusters, evolutionary economic geography (EEG), and business systems (BSs) that have influenced the EE literature. The main themes are introduced through thematic analysis: 1) actors, 2) governance, 3) places, and 4) evolution. A focus on the evolutionary aspect and spinout is further explored to understand the impact of MNEs on the Dublin EE. The theoretical framework is presented. Chapter three outlines the research philosophy, research design and the research method. Critical realism is applied as a research philosophy. Exploratory and a retroductive study is the research strategy with a focus on the case study method. The Gioia method is used in this thesis to investigate the evolution of an EE. The three papers run from chapter four to chapter six. The seventh chapter discusses the conclusion and adds future research.

2 Theoretical Framework

2.1 Introduction

The concept of an entrepreneurial ecosystem (EE) has piqued the interest of academics and practitioners alike. The hunt for a concrete definition and explanation of EE, on the other hand, is still ongoing. The lineages and major themes of EE will be discussed in this chapter. First, ideas influencing the EE will be examined, including industrial districts, clusters, regional innovation systems (RIS), evolutionary economic geography (EEG), and business ecosystem (BE). Second, the terminology and theoretical foundations of EE are presented. Third, there are four key topics in EE literature: 1) place, 2) governance, 3) actors, and 4) evolution. The evolutionary element of EE will be closely investigated in conjunction with the spinout based on those concepts. Lastly, theoretical framework for this thesis will be introduced.

2.2 The definitions and underpinnings of EE

Cohen (2006, p. 6) defined EE for the first time as "an interconnected group of actors in a local geographic community committed to sustainable development through the support and facilitation of new sustainable ventures". His research emphasized the interplay between the different parties who contribute to British Columbia's long-term growth. His research also discovered three factors that influence EE. The growth of EE was first impacted by institutional networks such as universities, government, professional support services, talent pool, and huge corporations. Second, informal networks - family members, friends, and angel investors – were critical in the early stage of the business formation. Thirdly, infrastructure such as transportation and supply chains and culture were important.

Isenberg (2010) is another academic who popularized the EE concept and expanded the EE concept to practitioner's communities. He introduced various elements of EE, such as, conducive policy, capital, markets, human skills, culture and supports. He also referred to ecosystem dynamic as self-regulating network of many different types of actors and focused on important connectors and influencers that create entrepreneurship hotspots (Isenberg, 2011). Feld (2012) introduced the notion of entrepreneurial education to the general public, emphasizing the significance of community in EE. He classified four aspects of a 'prosperous ecosystem' based on a case study of the Boulder community: 1) It is run by entrepreneurs. 2) It has a welcoming culture. 3) The mentors were long-term (at least 20 years) and there were numerous chances for mentoring and funding during the regular sessions.

Some scholars have focused on the interdependence between the actors of EE. Mason and Brown (2014, p. 14), for example, highlighted that EE consisted of “a set for interconnected entrepreneurial actors” such as entrepreneurial organizations (e.g. firms, venture capitalists, angel investors and banks), institutions (e.g. universities, public sector agencies and financial regulators) and entrepreneurial process (e.g. the business birth rate, numbers of high-growth companies, levels of “blockbuster entrepreneurship”, number of serial entrepreneurs, degree of sell-out mentality within firms, and level of entrepreneurial ambitions) to boost the performance of local area. Stam (2015) also emphasized the coordination of interdependent actors and circumstances to enable fruitful entrepreneurship in his work. The variables that determine the interaction of the actors in the ecosystem, according to his work, are the network of entrepreneurs, leadership, finance, talent, and support services. He went on to propose three conditions of EE: 1) the baseline element of systematic and framework conditions, 2) entrepreneurial activity as the output condition, 3) and aggregate value creation for the outcome.

Some studies have begun to include EE's regions and boundary conditions. Roundy (2017) describes an ecosystem as a confined area that can yield entrepreneurial activity, whereas Audretsch and Belitski (2017) focused on networks that allow for the identification of entrepreneurial opportunities. Neck, Meyer, Cohen, & Corbett (2004) defined EE as the interplay of factors that encourage the formation of new businesses in a given region. Spigel (2017) described how a region's diverse characteristics work together to foster new ventures.

Table 2 below summarizes the many definitions. The focus has been on the ‘entrepreneur’ as the core player and the ‘interdependence’ among the many parts within the ecosystem, despite the fact that definitions of EE have been relatively diverse. The EE concept are broken down below in Table 2 to help comprehension.

Table 2 Definitions of EE

Author	Definitions of EE	Domain
Cohen (2006)	Sustainable EEs are defined as an interconnected group of actors in a local geographic community committed to sustainable development through the support and facilitation of new sustainable ventures. (p. 3)	Business strategy
Isenberg (2010,2011)	This EE consists of a dozen or so elements... that, although they are idiosyncratic because they interact in very complex ways,... conducive policy, markets, capital, human skills, culture, and supports. (p. 6) By definition, an ecosystem is a dynamic, self-regulating network of many different types of actors. In every entrepreneurship hotspot, there are great connectors and influencers who may not be entrepreneurs themselves.	Business strategy
Feld (2012)	The Boulder thesis states that a prosperous ecosystem has four characteristics: “(a) entrepreneurs lead it; (b) it is inclusive where everyone is welcomed; (c) the involved people are committed to long term (at least 20 years) to the ecosystem; and (d) there are many opportunities for gathering, that is, a lot of events.” (p. 26)	Cluster
Mason and Brown (2014)	A set of interconnected entrepreneurial actors ...entrepreneurial organizations (e.g., firms, venture capitalists, business angels, and banks), institutions (universities, public sector agencies, and financial bodies), and entrepreneurial processes (e.g., the business birth rate, numbers of high growth firms, levels of “blockbuster entrepreneurship,” number of serial entrepreneurs, degree of sell-out mentality within firms, and levels of entrepreneurial ambition) which formally and informally coalesce to connect, mediate and govern the performance within the local entrepreneurial environment. (p. 9)	Innovation&Strategy

Stam (2015)	<p>A set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship (p. 1765)</p> <p>The entrepreneurial ecosystem concept emphasises that entrepreneurship takes place in a community of interdependent actors. (p. 1761)</p> <p>The systemic conditions are the heart of the ecosystem: networks of entrepreneurs, leadership, finance, talent, knowledge, and support services. The presence of these elements and the interaction between them predominantly determine the success of the ecosystem. (p. 1766)</p>	Evolutionary economic geography
Audretsch and Belinski (2017)	We define systems of entrepreneurship (further ecosystem) as institutional and organisational as well as other systemic factors that interact and influence the identification and commercialisation of entrepreneurial opportunities. (p. 2)	Evolutionary economic geography
Cukier, Kon, and Krueger (2015)	define a start-up ecosystem as a "limited region within 30 miles (or 1-hr travel) range, formed by people, their start-ups, and various types of supporting organisations, interacting as a complex system to create new start-up companies and evolve the existing ones." (p. 1)	Regional development
Gauthier, Penzel, and Marmer (2017)	We defined ecosystems ... around the concept of a shared pool of resources generally located within a 60-mile (100-km) radius around a centre point. (p. 24)	Regional development
Roundy et al. (2017)	Communities of agents, social structures, institutions, and cultural values that produce entrepreneurial activity (p. 99)	Regional development
Theodoraki et al. (2018)	<p>The entrepreneurial ecosystem includes three dimensions: actors who form it and their interactions (formal and informal network), physical infrastructure, and culture. (p. 50)</p> <p>The entrepreneurial ecosystem may be described as a general context aiming to foster entrepreneurship within a given territory. Therefore, it consists of a horizontal network (customers and providers) and a vertical network (competitors and complementors). It also</p>	Regional development

	<p>includes organizations supporting entrepreneurs: public or private funding agencies (banks, business angels, venture capital, etc.); support entities (business incubators, consultants, etc.); research organizations (research centres, laboratories, etc.); and businesses' consortiums (active businesses, associations and trade unions, etc.). (p. 56)</p> <p>The entrepreneurial ecosystem seems to be composed of both physical and non-physical elements. The latter includes elements such as regulation and entrepreneurial culture, which are, for instance, connected to geographic specificities. (p. 57)</p>	
Mack and Mayer (2016)	EE is defined as the interacting components of entrepreneurial systems, which foster new firm creation in a specific regional context. (p. 21, 20)	Regional studies
Spigel (2017)	<p>Entrepreneurial ecosystems ... are the union of localised cultural outlooks, social networks, investment capital, universities, and active economic policies that create environments supportive of innovation-based ventures. (p. 49)</p> <p>Entrepreneurial ecosystems are combinations of social, political, economic, and cultural elements within a region that support the development and growth of innovative start-ups and encourage nascent entrepreneurs and other actors to take the risks of starting, funding, and otherwise assisting high-risk ventures. (p. 50)</p>	Entrepreneurship

2.3 The role of evolutionary theory on entrepreneurship

In the aftermath of the 1960s stagflation, economists emphasized the importance of small businesses as the source of entrepreneurship, routes of innovation, industry dynamics, and job creation (Acs et al., 2009). According to Baumol (1993), productive entrepreneurship is a by-product of entrepreneurial activities. The early pioneers of entrepreneurship theory focused on the dynamic role of entrepreneur, which was most directly linked with change and economic growth (Kirzner, 1985). Schumpeter (1934) drew attention to the innovative entrepreneur. Entrepreneurship was combined with new endogenous growth economic theory, which explained long-term economic growth. Variables such as capital or education affect productivity growth, which in turn “influences the long-run value of these variables” (Baumol, 1993, p. 259). Endogenous growth theory has introduced a new link between entrepreneurship and innovation in growth models (Wennekers & Thurik, 1999). According to Romer (1990), the research sector is a growth engine that generates new varieties of capital goods. This relates to Schumpeter’s later work (1994) in which growth is anchored by monopoly rents triggered by the introduction of new products and innovation (referred to as “creative destruction”). According to Aghion and Howitt (1990), new production technologies in R&D sectors render existing technologies obsolete. While producers incorporate this new production technique, innovator is rewarded until it is replaced by a newer technique. The intermediate variable of innovativeness, amplifying the long-term growth, is regarded as key factors of endogenous growth theory. Despite the fact that technological creativity has been more of an exception than a norm, the new growth theory emphasizes the role of endogenous entrepreneurship (i.e., innovation and human capital formation) in explaining economic growth (Lucas Jr, 1988; Mokyr, 1990, 2005). Porter’s work (1990, 2005) provided distinctive starting points for the role of entrepreneurship in explaining economic development and national growth. To enhance rivalry within the competitive market, entrepreneurs are the drivers of innovation (Eliasson, 2011).

Schumpeter’s contribution to evolutionary theory has been extended by scholars to examine the role of productive entrepreneurship in long-term growth. They investigated endogenous growth induced by technological knowledge accumulation (Aghion & Howitt, 1990), productive entrepreneurship (Baumol, 1996), and the role of institutions (Mokyr, 2005). In classical economic theory, there is a clear distinction between a sector-specific agglomeration (vertical supply chain) and a multi-sectored agglomeration (Jacobs). This raises the question of whether learning is more effective in agglomerations that are functionally specialised but divers in terms of sector. However, top innovation clusters are not captured by traditional concepts of specialisation and diversity. To fill this gap, new

concepts such as related and unrelated varieties were introduced (Frenken et al., 2007; Neffke et al., 2011). They argue that firm clustering through the use of related technologies involving many different output sectors create synergies for innovation into related and unrelated varieties of outputs. In evolutionary economic theory and theories of technological change, previous technological endowments play a significant role in creating innovation (Nelson and Winter, 1982). According to Jacobs (1961), more diversified economies have a higher rate of successful knowledge transitions.

Some studies focus on high-growth startups as a source of innovation, productivity growth, and employment (Mason & Brown, 2014), while others oppose the idea of limiting firms to high-growth startups, arguing that a network of innovative startups or entrepreneurial employees can also be a source of productive entrepreneurship. Productive entrepreneurship, according to Baumol (1996, p. 34), is "activity that contributes directly or indirectly to the economy's net output or potential to produce extra output." It also contains catalytic ventures that did not make it in the market but provided fertile ground for subsequent ventures. However, typical entrepreneurship metrics, such as self-employment and small business are not included in EE. It is primarily focused on growth-oriented and innovative entrepreneurship (Henrekson & Sanandaji, 2014). Thus, in order to describe entrepreneurship, economic success is required.

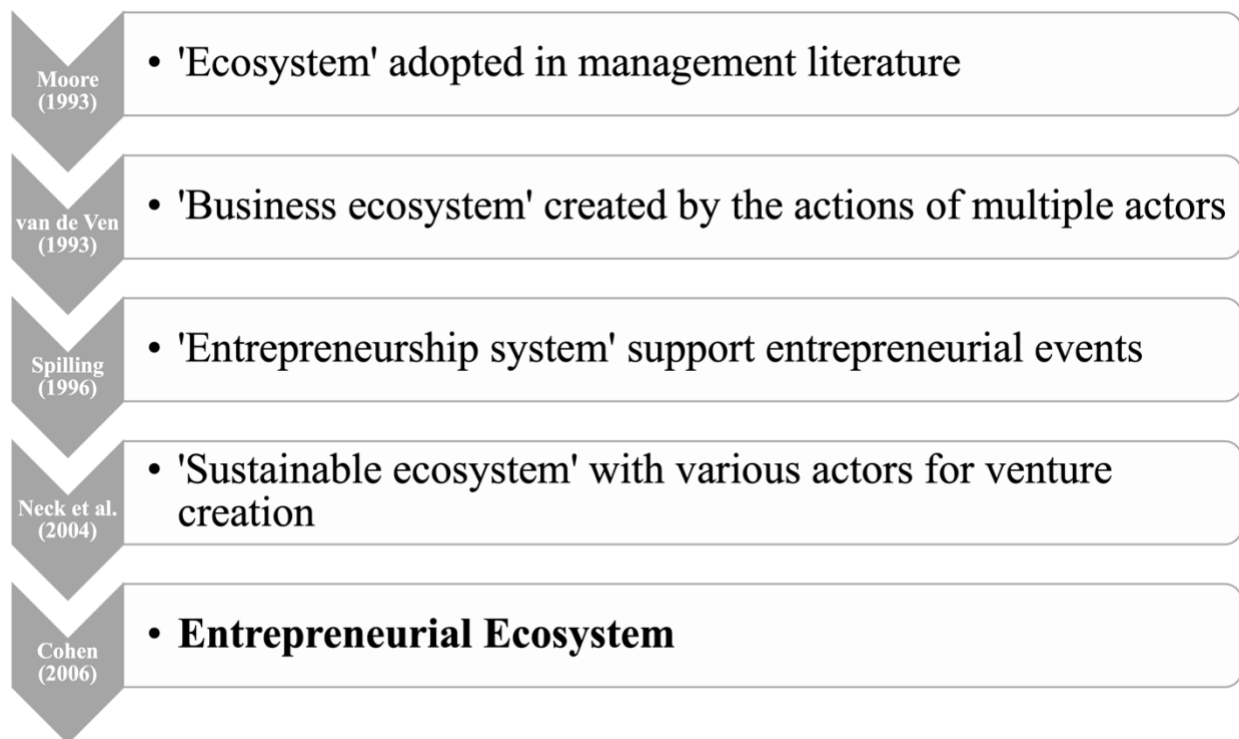


Figure 1 Literature from ecosystem to EE

The term ecosystem refers to EE's structural aspect. Moore (1993) was the first scholar to use the term "ecosystem" in business and management, and Adner (2016) classified it as affiliation and structure. Affiliated ecosystem, such as, 'business ecosystem' (Moore, 1993) emphasizes openness and focus. Many partners and network density, as well as actor centrality in larger networks, such as 'Silicon Valley' is key to this concept (Saxenian, 1996). Increasing centrality in the ecosystem leads to more bargaining power in the system (Jacobides et al., 2006). Furthermore, the structure of the ecosystem establishes the configurational boundaries within the ecosystem for value propositions (Adner, 2016). Previous studies of EE literature examined various aspects of the ecosystem. Van De Ven (1993) called for the actions of multiple actors that constitute and create a successful business ecosystem. Nelson (2009) emphasized the evolutionary aspect of the ecosystem. Spilling (1996) emphasized the importance of events, entrepreneurial activities, and independent actors in advancing economic development. Neck et al. (2004) introduced the holistic view of Boulder ecosystem. Thus, an ecosystem is fundamental to performance and performance is the key to economic growth (Acs, Stam, Audretsch, & O'Connor, 2017). The seminal literature from ecosystem to EE is illustrated in Figure 1 above.

Thus, the concept of EE is complex and has been influenced from three main literature streams: 1) the regional development (industrial district and cluster), 2) evolutionary economic geography and 3) strategy literature (regional innovation system (RIS) and business ecosystem). The majority of the connections stem from ecological thinking, with a focus on the interdependence of various actors, particularly a community that can create new value in industrial organizations (Acs et al., 2014). The following section will present the EE lineages, which are summarized in the Figure 2 below.

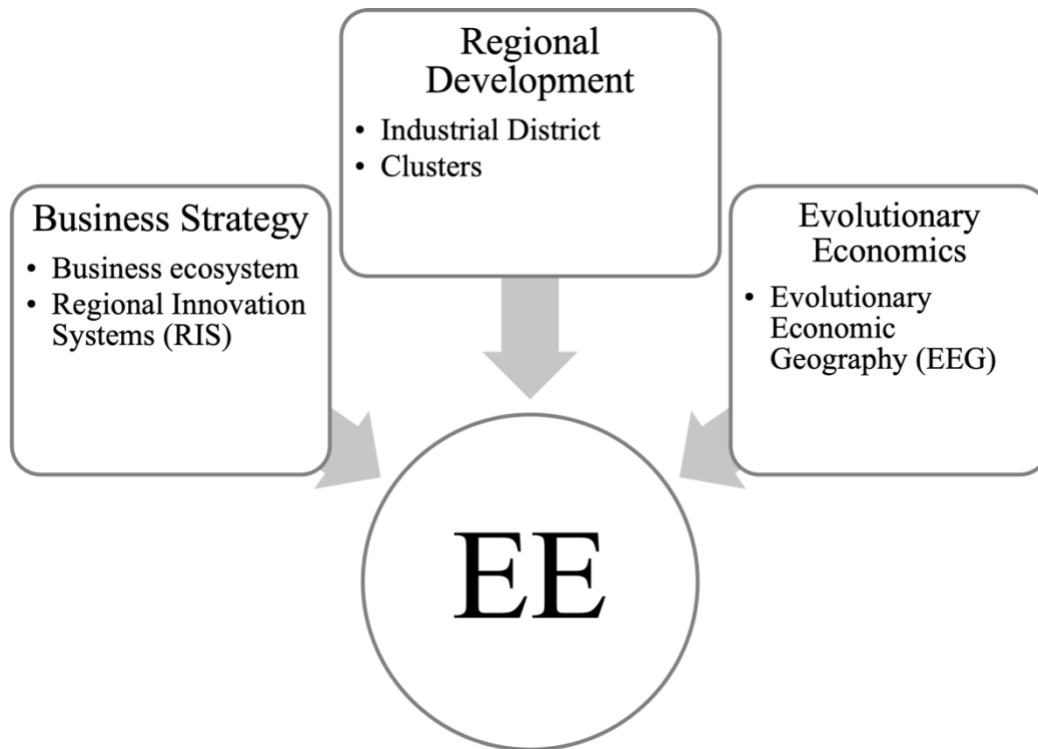


Figure 2 Influences from antecedent systems to EE

2.4 Antecedent Systems

While the literature on regional development focuses on territorial boundedness and aggregate value creation, evolutionary economic geography focuses on the spatial organization of production. Strategic literature focuses more on global markets and the creation of value by firms (Nelson & Winter, 1982; Uzunca et al., 2017).

EE, along with industrial districts, clusters, and regional innovation systems, is the most recent concept that explains agglomerative economies. In contrast to other theories in which firms and institutions play important roles, entrepreneur(ship) takes center stage in the EE concept (Stam & Spiegel, 2016). The EE approach, like regional development and strategy literature, recognizes the interdependence of actors and factors; however, a focus on entrepreneurship as value creation as an output of EE is lacking (Spiegel & Harrison, 2018). Although the EE concept is appealing, theory development is difficult and time-consuming. The EE approach has gotten ahead of itself in terms of answering fundamental conceptual, theoretical, and empirical questions (Stam, 2015).

2.4.1 Industrial districts – Marshallian & Italianate

Regional ecosystems were identified in the regional development literature as having varying socioeconomic performance (Stam & Spiegel, 2016). The antecedent systems are industrial districts and clusters (Terjesen et al., 2017). The industrial district approach focuses on the local division of labour of an industry (Marshall, 1920) and the community of people and firms within a social territory (Becattini, 1990). A successful entry into international markets necessitates the establishment of an industrial district. Marshall (1920) introduced the industrial district as an agglomeration of economies and an industry concentrated in specific localities in his seminal work. Firms benefit from strong pace, particularly from the development of human capital, specialized suppliers and infrastructure of the same sector. Marshall (1920) describes the advantages of primitive localization as: 1) hereditary skill- trade can be acquired unconsciously, 2) the growth of subsidiary trades with specialized supplier within the district, 3) division of labour, and 4) attracting special human resources. Following Marshall, Jacobs (1969) argued that knowledge spillover between unrelated industries is possible within an urbanized agglomeration. Van Der Panne (2004), on the other hand, introduced the different aspects of Marshall's industrial district by contrasting the unrelated varieties. Early studies of industrial district highlighted the socioeconomic model (Brusco, 1986).

Over the course of the history, the definition of an industrial district evolved to emphasize the socio-territorial entity that is defined by the active presence of both a community of people and a population of businesses in a naturally and historically bounded area. An ideal-type industrial district (Ottati, 1994) has a common culture in a naturally and historically bounded area that reproduces through time, people in the common culture have more face-to-face interactions, and people in the common culture share the same reciprocity norms. It was "new economic geography" (Feldman, 1999) that was at the center of industrial success later on, in the 1980s and beyond 'Third Italy' evolved as a result of an interconnected SME's concentration in Northern Italy (Piore & Sabel, 1986).

2.4.2 Clusters

In the 1990s, geographical 'clusters' became the centre of entrepreneurship research (Porter, 2000). By the definition of Porter (1998, p. 78), clusters are "geographical concentrations of interconnected companies, specialized suppliers, associated institutions that compete or cooperate". Cluster has adopted the agglomeration and further expanded the interconnectedness between the firm and the providers (Porter, 1998). The search for the replica of Silicon Valley led to the theory of untraded interdependency of certain regions. In clusters, firms can benefit from local specialization and knowledge spillovers. Untraded interdependence provides firms with human capital, special suppliers

and exchange of knowledge (Storper, 1995). In his seminal work, Markusen (1996) compared the cluster as sticky places (as the cluster is led by the anchor tenant) in slippery space (emphasizes on the mobility between the actors). Saxenian (1996) examined successful clusters within specific regions and discovered a fundamental and distinctive difference between clusters, such as, Route 128 and Silicon Valley. Those studies influenced policymakers for a search of next Silicon Valley (Neck et al., 2004). As a result, from a policy standpoint, cluster was evaluated for its ability to generate economic performance (Audretsch et al., 2015). Cluster policies, in particular, explained the deficiency of an industrial district that oversees the supply-side strategy for international markets (Pitelis, 2012).

The network approach, which focuses on the positions of local knowledge networks, has recently been adopted by cluster literature (Boschma & Ter Wal, 2007). Actors in clusters are critical to clusters' success in complex adaptive systems (Audretsch et al., 2015). However, some scholars such as Martin and Sunley (2015) recognized cluster rather a as brand than a theory, stating that the clusters are with the motivation of competitiveness and innovation and replicable and re-applicable. Van Leeuwen, Vermeulen, & Glasbergen (2003) has described geographical cluster as a 'closed-loop system' between the producers, consumers and other actors of society and economy.

2.4.3 Regional Innovation Systems (RIS)

Innovation scholars explained RIS as the process of localized knowledge generation and knowledge transfer (Freeman, 1987). Cooke, Uranga, & Etxebarria (1997) examined the regional construction of knowledge architecture in various economies. Also, their emphasis on wide actors within the RIS was the main character to form and disassemble knowledge. Lundvall (2010) stated that the RIS concept focuses on the relationship between different institutional actors and how this facilitates the innovation process. Key pillars in RIS are universities, research organizations, technical training colleges, related government institutions, and venture capitalists. In regional economies, these actors form an innovation circle, which investigates the networks of actors (firms, organizations, and institutions) involved in the use of innovation. However, RIS literature has largely ignored the role of the entrepreneur as an innovator, instead focusing on organizations and institutions (Ács et al., 2014; Landström et al., 2012). Regional innovation systems (RIS) extend the concept of a cluster to knowledge producing institutions (Cooke et al., 1997) such as universities and research institution that collaborate with innovative firms.

2.4.4 Evolutionary economic geography (EEG)

During the last three decades, there has been critical theoretical development in the field of economic geography (Martin & Sunley, 2015). Economic geographers provided different insights from traditional economic theory and moved to the more interdisciplinary field in the social sciences. The primary interest has been on institutional and cultural aspect (Boschma & Martin, 2010). At the same time, scholars such as Michel Porter and Paul Krugman underlined the importance of economic spatial agglomeration in understanding local competency dynamics. Krugman (1991) labelled this field as 'new economic geography'. However, there was a lack of the concept of how the economic landscape evolves. Therefore, evolutionary economic geography is defined as "the process by which the economic landscape – the spatial organization of economic production is transformed from within over time (Clark, Feldman, Gertler, & Wójcik, 2018, p. 214)". EE has been influenced by theoretical and conceptual foundation of EEG that are: 1) generalized Darwinism, 2) complexity theory, and 3) path dependency theory (See Figure 3 below). Varieties, novelty, selection, fitness, retention, mutation, and adaptation are all examples of generalized Darwinism that have been accepted by the evolutionary EE (McMaster, 2006). Complexity theory explains complex aspects such as 'far-from-equilibrium' adaptive systems – emergence, self-organization, adaptation, fitness landscapes and hysteresis. The role of contingency and self-reinforcing dynamics in producing "lock-in" via increasing returns (network externality) and branching and path formation was the focus of path dependency theory (Martin & Sunley, 2007). Because of the link between EEG and entrepreneurship, entrepreneurship was a crucial component of evolutionary economics, as 'newcomers' to the economy are the capitalist's engine (Schumpeter & Opie, 1983). The framework is depicted in the following diagram.

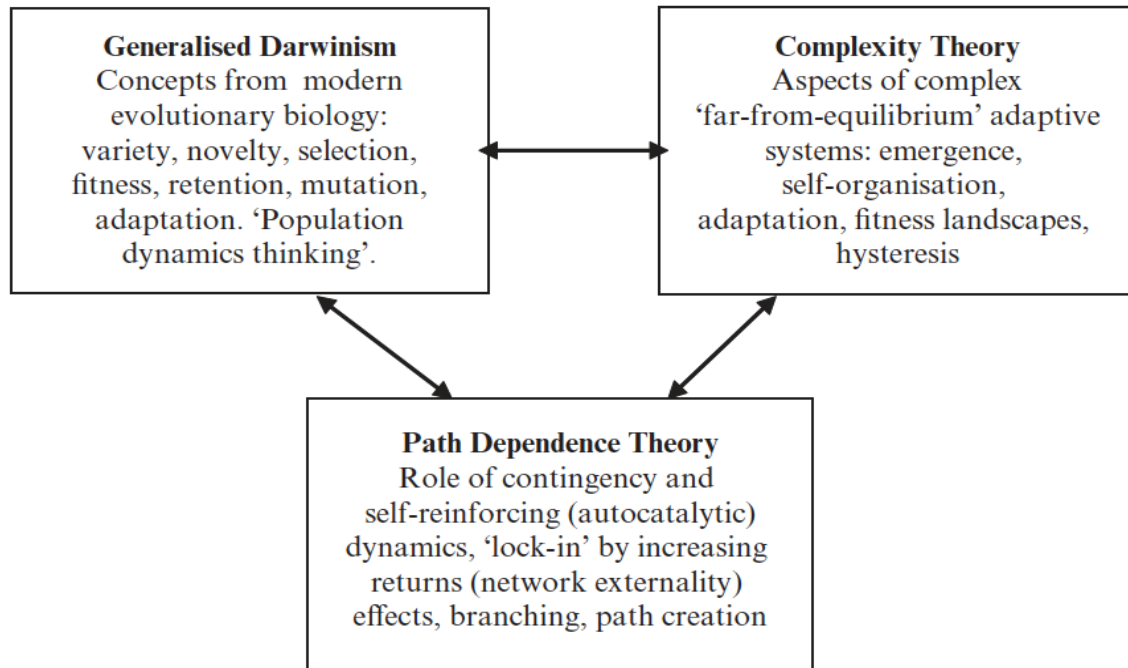


Figure 3 Three major theoretical frameworks for evolutionary economic geography (adopted from Boschma & Martin, 2010)

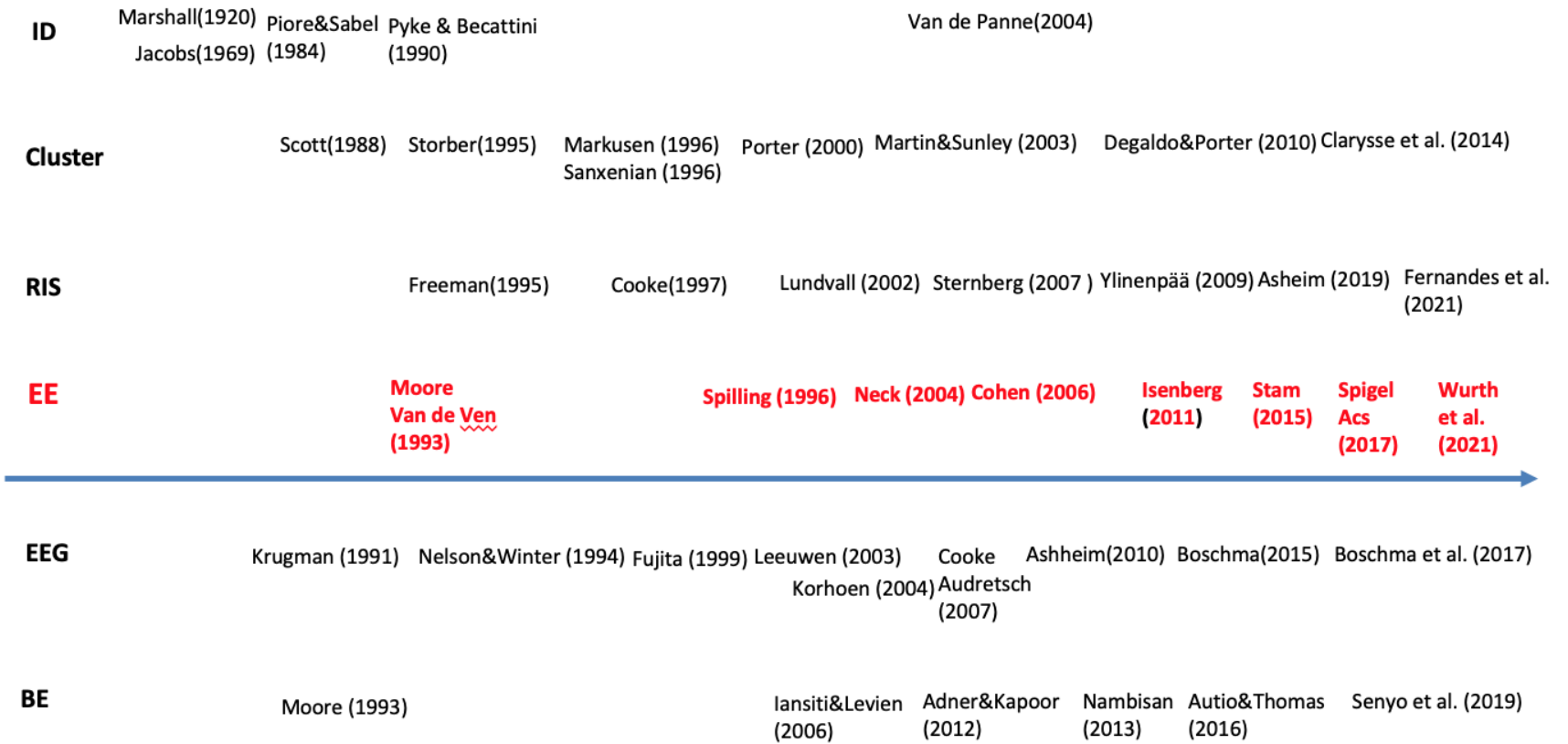
2.4.5 Business ecosystem

Business ecosystems have affected EE in the strategy literature in the following ways. First, a firm's ability to produce value in a business ecosystem is dependent on a variety of actors who provide complementary services and products (Adner & Kapoor, 2010; Iansiti & Levien, 2004; Senyo et al., 2019). Second, a business ecosystem is a community of partners who must be in sync in order for the value proposition to materialize in the marketplace (Adner, 2017). Third, structure and strategy are essential to a firm's value creation chained with the ecosystem partners (Adner & Kapoor, 2010; Hult et al., 2020; Jacobides et al., 2006). The partners include several stakeholders such as rival firms, component suppliers, complementors, buyers, user communities, and universities (Adner et al., 2013). Finally, the emphasis was on the firms to shape the perceptions of existing and future participants (Autio et al., 2018; Gawer & Cusumano, 2002). Table 3 summarises the key concepts of antecedent systems and influence one. Figure 4 below explores the timeline and seminal articles of EE and antecedent systems.

Table 3 Key concepts of antecedent systems and influence on EE

Concepts	Key actors	Key concepts	Influence on EE	Key outcome
Industrial District (Marshall, Italian)	SMEs; local government	Labor market pooling, specialized goods and services, knowledge spillovers, market competition, Flexible specialization, inter-firm cooperation, social embeddedness	Local competitiveness in labor & intermediate entities (specialized goods and producers), knowledge spillover, Networks between enterprises and entrepreneurs	Regional economic growth (productivity& employment)
Cluster	Innovative firms	Factor & demand conditions, supporting industries, firm structure, strategy, and competition	Talent, finance, physical infrastructure, demand, support services and intermediaries	National / regional competitiveness (specialized industry)
Regional Innovation System (RIS)	Innovative firms, national governments	Networks, inter-organizational learning system	Knowledge, finance, formal institution, demand	Innovation
Evolutionary Economic Geography	Firms, network, and institution	Interactions between Darwinian evolution, complexity theory and path dependency	Culture, growth in knowledge and financial capital	Spatial organization of economic production
Business ecosystem	Innovative firms	Co-innovation, adoption chain, shared value proposition	Interdependence of actors involved in innovation; global networks	Value creation, firm survival

* Source: Adopted from Spigel (2017)



• ID: Industrial district / RIS: Regional Innovation Systems / EEG: Evolutionary Economic Geography / BE: Business Ecosystem

Figure 4 Timeline of EE and antecedent systems

2.5 Correlation of the concepts and uniqueness of EE

The literature on industrial districts and clusters, as well as regional innovation systems and EE, all share the belief that external characteristics of an individual firm contribute to the competitiveness of a new venture in the context of a specific region (Spigel, 2017). These concepts are related to three different aspects. First, shared cultural integration facilitates inter-firm interactions and accelerates the process of knowledge sharing, while firm mobility acts as a barrier to these activities (Gertler, 2003; Henry & Pinch, 2001; Staber, 2007). Second, regional social networks result in knowledge spillovers between firms and universities (Owen-Smith & Powell, 2004). The networks also aid in the dissemination of information about entrepreneurial opportunities and provide entrepreneurs with a variety of funding and financing options (Arenius & De Clercq, 2005; Powell et al., 2002). Finally, government policies and academic institutions can support the embedded culture by lowering institutional barriers, providing training for highly skilled workers, and funding events and incubation (Feldman, 2000). Clusters are networks of small and medium-sized (SMEs) firms that compete and cooperate within the same industry, whereas the EE concept extends beyond the industry (Stam, 2015). However, in both cluster and EE concepts, the actors benefit from cooperation and even competition (Pitelis, 2012), with industrial districts and clusters gaining competitive advantages with the leading actors forming a hierarchy. The lack of formalised enforcement methods among EE actors may impede informal interaction between firms (Spigel & Harrison, 2018). An industrial district, cluster, or RIS is defined by all definitions as a concentration of related (similar) businesses and supporting entities that are specific to a specific type of industry or a given technology (Cruz & Teixeira, 2010). As a result, they can benefit from knowledge spillovers collectively. The orientation of EE, on the other hand, is not industry specific. It is adaptable and consists of systems that discover and pursue entrepreneurial opportunities (Acs et al., 2014). The following are the distinctions between industrial districts, clusters, RIS, and EE: 1) the role of the governing body, 2) the availability of regional resources, and 3) the role of knowledge (Spigel & Harrison, 2018). Governments and policies are the primary motivators and organizers of the success of industrial districts, clusters, and RIS, as well as the primary source of funding for R&D. In EE perspective, an entrepreneur is a key player who can create networking for demanded sources, where the state can assist. Cluster literature tends to focus on internalizing knowledge spillovers by accessing regional resources. In contrast, by EE, an entrepreneur faces difficulties in accessing localized resources in the new environment. Knowledge plays a different role in clusters and EE. Research labs play an important role in clusters, large anchor firms, public agencies, and universities, and they help firms enter new markets (Spigel & Harrison, 2018). Instead, EE focuses on entrepreneurial knowledge in order to form a new venture that establishes the entrepreneurial culture. There is, however, a scarcity of research on

entrepreneurship in clusters, and some of the research only mention the 'configuration of networks in EE' (Motoyama & Knowlton, 2017). In addition, there are some differences between the concepts of clusters and EE. Clusters are associated with a specific industry, whereas EE includes multi-disciplinary industries. Firms in clusters can profit with similar industry by benchmarking, learning production techniques, and managing larger clients (Piore & Sabel, 1986). It is not always applicable to the EE concept, where the core lies in the entrepreneur with a higher skill set, knowledge, and a network rather than a common client market. This is also related to 'resources specific to the entrepreneurship process' (Spigel & Harrison, 2018). By sharing knowledge in specific regions, an entrepreneur can build a network of investors, advisors, and mentor-mentee relationships. Furthermore, cluster emphasizes the importance of network relationships, whereas EE focuses on entrepreneurs and their surroundings (Auerswald & Dani, 2017).

Despite the differences between cluster and EE, the inter-linkages of the two concepts are only recently being investigated. MNEs have shed light on the evolution within the cluster (i.e., Buciuni & Pisano, 2018). Multinationals, in particular, can trigger the evolution of an industry cluster (Giblin & Ryan, 2012; Stephan, Silvia, & Arie, 2008) or enter an existing high-tech cluster (Mudambi & Swift, 2012), which may develop into a more resilient and dynamic cluster (Ryan et al., 2018). Clusters can morph into EE, according to some evolutionary longitudinal studies (e.g., Adams, 2020; Ryan et al., 2020). Others contend that the dynamics of EEs can extend beyond the cluster (Malecki, 2018) or transect industries and technologies (Auerswald & Dani., 2017). As a result, the EE concept has a broader scope but a narrower unit of analysis than cluster theory (Ryan et al., 2020). Entrepreneurship is reflected in a systematic manner by EE (Borissenko & Boschma, 2016). Entrepreneurship agents are at the heart of EE. Actors, on the other hand, are not independent of the entrepreneurial community (Stam, 2015). A thriving community is more than the "sum of their parts" because it is more than a "function of specific attributes" (Borissenko & Boschma, 2016, p. 8). EE offers a new theoretical framework for analysing the dynamics of venture creation and formation, which vary depending on regional conditions.

EE differs from predecessor systems in four ways. First, rather than a specific industry or agglomeration, EE focuses on the ecosystem's actors, particularly entrepreneurs, and their interdependence (Spigel, 2017). While the industrial district emphasizes the agglomeration of manufacturing firms as well as the impact of various suppliers, and clusters emphasize labour pooling within the specialized zone, EE emphasizes the knowledge spillover of the actors in the ecosystem that maximizes the benefit of utilizing the resources. Second, EE has prioritized performance and the establishment of global, high-tech firms, with the goal of capturing the ecosystem's gazelle startups or unicorns (Mason & Brown, 2014). The industrial district's focal point was specialized labour pools and suppliers. Where the firms in the cluster were tied together in the same contents or industry in order to benefit from various externalities. Third, EE focuses on

cultural understandings and institutional environments as underlying beliefs and fundamentals of regional entrepreneurship (Stam, 2015). Fourth, a social network is essential for gaining access to funding and new technological knowledge, as well as mentors such as angel investors (Audretsch et al., 2015; Boschma, 2015). This is taken from the evolutionary economics literature. Finally, in the global context, EE requires a more evolutionary and empirical approach (Alvedalen & Boschma, 2017; Mack & Mayer, 2016; Ryan et al., 2020). Table 4 below summarises the correlations between EE and antecedent systems

Table 4 Correlations between EE and antecedent systems

Approach	Antecedent systems	EE
Focus	Place (Region) is central for setting up an economic and social structure for innovation and competitiveness.	Start-ups are core to an EE regarding conceptual development and policy formation.
Presence of Start-ups	Little distinction is made between the (high-growth) start-up and general firms	Clear distinction between large firms (lower-growth SMEs) and start-ups
Role of knowledge	Knowledge works as a source of new technology and market insights. The combined knowledge increases the firm's competitiveness. Knowledge spillover from other institutions (university, research organization) is essential.	With the knowledge from the antecedent systems, entrepreneurial knowledge is essential. This knowledge is shared with mentors and entrepreneurs through informal social networks and entrepreneurship organizations, and training courses offered.
Key actors	Firms and supporting organizations based on the region Manufacturing and conventional service firms	Entrepreneurs and highly -skilled entrepreneurial employees Highly digitalized and tech-pushed ventures
Role of the government	Key policy provider and support	supporter

* Adopted from Spigel (2017), Spigel & Harrison (2018)

2.6 Themes of EE

In the paper 2, the term “entre* ecosystem*” have been searched from 2006 to 2020. The search was conducted using four databases: Web of Science (WoS), Scopus, Business source complete, and Google scholar. From a total of 576 publications, 137 high-ranking ABS articles (ABS 3, ABS 4, and ABS4*) were chosen for thematic analysis. The research has identified four distinct EE themes. With 53 articles, actors were the most studied of the themes. Governance and place followed with 35 and 34 articles. With 15 articles, the underdeveloped theme was evolution. The search method is explained in Chapter 5 (paper 2) in more detail. Four different themes of EE are explained below.

2.6.1 Actors

2.6.1.1 MNEs

Some scholars emphasize the importance of multinational corporations in assessing the dynamics of EE. They contribute to the growth of EE by acting as incubators and encouraging high-tech startup spinouts (Brown & Mason, 2017; Klepper, 2007; Neck et al., 2004; Spigel & Harrison, 2018). MNEs act as ‘knowledge integrators,’ interacting with new ventures to create knowledge spill-over based on the ecosystem’s absorptive capacity (Bhawe et al., 2019; Buciuni & Pisano, 2018). Klepper and Sleeper (2005) argue in their seminal paper on MNE spinouts that employees’ learning about how to develop variants of the core product is likely to spawn new ventures. To act as ‘centres of excellence’ (Andersson & Forsgren, 2000), a subsidiary of an MNE must negotiate with the HQ to become an initiative-taking subsidiary (Birkinshaw, 1997). The MNE can trigger indigenous spinouts as local indigenous knowledge evolves (Ryan et al., 2018). As a result, it is critical to determine whether MNEs can serve as anchor tenants in the evolving ecosystem (Clarysse et al., 2014; Colombelli et al., 2019). Heterogeneity is essential for an ecosystem's long-term viability and evolution. And the interaction of different types of companies determines the evolution of an ecosystem. If MNE enter the market, the region with higher absorptive capacity performs better in the ecosystem. MNEs are more likely to collaborate with local businesses, resulting in knowledge spillovers. However, because local firms have different stocks of knowledge, high absorptive capacity does not automatically result in heterogeneity. Mutual learning and adaptation are the primary mechanisms for MNE and local new firm evolution. In other words, ecosystems with greater ‘heterogeneity of entrepreneurial activities’ are more responsive to global market changes. To avoid competition, local replicators must differentiate their product in order to find a niche in the growing market. This customization has the potential to spark innovation and evolution

within the ecosystem. MNEs will benefit as well if they establish and maintain a co-evolving network with local innovators through effective knowledge management.

MNEs can catalyse industrial districts and strengthen an existing cluster's resilience. The anchors in the industry cluster form the EE formation condition. Ryan et al. (2020) investigate how anchor MNEs initiated an idiosyncratic EE by incubating entrepreneurs. Furthermore, these anchors disseminated knowledge through multiple spin-outs of ex-employees in related and unrelated varieties.

2.6.1.2 Universities

Large firms are not the only actors supporting the evolution of an entrepreneurial ecosystem. Universities can also deepen an entrepreneurial ecosystem's technology base and enhance its capacity as the breeding ground for entrepreneurship. Extensive research shows that universities can incubate and facilitate new venture spinoffs in an entrepreneurial ecosystem too (Cunningham et al. 2019; Hayter et al. 2018; Johnson et al. 2019; Miller and Acs 2017; Nicholls-Nixon et al. 2020; Theodoraki et al. 2018). Renowned entrepreneurial ecosystems, such as Silicon Valley, Route 158 and Cambridge UK have world-class universities that record-high rates of such spinoffs (Audretsch and Belitski, 2013). These spinoff ventures are commonly in new technology domains either in related or unrelated varieties (Boschma and Frenken 2011; Meoli et al. 2019; Meoli and Vismara 2016). This increased heterogeneity amplifies the resilience of the entrepreneurial ecosystem (Roundy 2017).

Some academics even refer to universities as EEs in their own right. With the help of public funding, university-centred EE (UCEE) increased knowledge spillover, including technology transfer and cluster formation, acting as a catalyst for high-growth firms (Miller & Acs, 2017). This ecosystem also benefits science and medical start-ups significantly. These startups are based on the following: 1) a research, education and support program, 2) student and postdoc groups, 3) periodic boot camps, competitions, events and seminars, 4) investor, mentor and alumni networks, and 5) incubators, accelerators and co-work space (Johnson et al., 2019). By providing infrastructure, universities serve as conduits for campus-based innovation to local commercial development. They collaborate and communicate with firms and knowledge providers by forming larger networks (Heaton et al., 2019).

Some researchers investigate the interplay among three main elements of an entrepreneurial ecosystem such as local universities, local financial system, and residents' attitudes. The presence of cooperative banks in a region where residents tend to act opportunistically amplifies the positive effect of university knowledge on high-tech entrepreneurship (Ghio et al., 2019). Other studies examine the composition, contributions, and evolution of social networks among faculty and graduate student entrepreneurs, as well as the role of knowledge intermediaries. Hayter (2016)

investigates how spinouts evolve their social networks by developing a taxonomy of social network evolution. Universities' contributions are dependent on the existence and interdependence of loosely coordinated, heterogeneous knowledge intermediaries with a strong support for academic entrepreneurship.

Some academics investigate various managers who contribute to academic spinoffs. Academic spinoff differs according to two different metrics. First, industry executives with entrepreneurial experience encourage technology-based spinoffs. Second, local stakeholders and professors drive service-driven and non-technological spinoffs to improve dynamics within the EE (Meoli et al., 2019). University-based incubators promote academic spinoffs and share best practices during the economic development of EE. In order to improve its own performance, the incubator optimizes resource allocation and collaborates with other members of the EE. In addition, incubators foster trust, allow for complementarity among ecosystem members, and engage constructively (Theodoraki et al., 2018).

2.6.1.3 Accelerators and venture capitalists (VCs)

Accelerators are described as a new form of institution that creates a temporal and socially bounded arena for actors to shape their aspirations and actions. Various program elements of the accelerator act as catalysts to stimulate acceleration. The success of acceleration is determined by how entrepreneurs engage with these program elements (Qin et al., 2019). The growth of student start-ups, particularly those that participate in university accelerators, can better support the entrepreneurial efforts of students (Breznitz & Zhang, 2019).

Several empirical studies have been conducted that analyse data from accelerator graduates, accelerator managers, and other ecosystem stakeholders. Accelerator expertise can interact with different elements within the ecosystem with the support of connection, development, coordination, and selection (Qin et al., 2019). The elements' interconnectedness increases stakeholder commitment to the EE and leads to venture validation. It suggests that accelerators contribute to ecosystems in ways that are distinct from, but complementary to, the development of individual ventures.

Venture capitalists (VCs) also play a role in the advancement of EE. They exert control through their board seats and other contractual rights that can cause changes in a startup that are required to successfully attract a strategic acquirer (Cumming et al., 2019).

2.6.2 Governance

The debate over whether ecosystems are natural or artificial gives rise to the governance of EE. Entrepreneurs seek opportunities within the ecological systems that evolve throughout the business cycle (Schumpeter & Hausman, 1994). Ecosystem reveals the relationship between

environment context and economic organization (Hannan & Freeman, 1989). Governance of EE has two aspects, both visible (top-down) and invisible (bottom-up) (Colombo et al., 2019). In the top-down approach, the boundary conditions are determined by the relationship between the key actors. The necessary resources have an effect as a feeder of EE, but there is a lack of holistic co-creation within the EE (Stam, 2015). On contrary, the success of Silicon Valley is path-dependent and self-interested. In EE, a distinct culture and a dynamic network of actors foster bottom-up and invisible governance (Bosma et al., 2018). Examining the individual entrepreneur has improved the domain of entrepreneurship (Aldrich & Fiol, 2007). Recent literatures emphasize the importance of local conditions in the formation of appealing EE. Some studies, however, focus on critical elements for EE development rather than governance (Colombelli et al., 2017). The business ecosystem has introduced the concept of ‘anchor tenant,’ which forms and leads the governance to create value in the ecosystem (Clarysse et al., 2014). The anchor tenant is a company, or a group of companies, that help to expand the ecosystem to both hierarchical and relational governance (Agrawal & Cockburn, 2003). When there is only one leader in the ecosystem, governance is based on explicit patterns of authority (Gibbons & Henderson, 2012).

Some scholars focus on relational governance. Multiple firms have an implicit understanding of the interdependence of cooperative norms and informal routines. The types of governance influence how EE evolves. Hierarchical is strong in the birth phase, with a path-dependent anchor tenant. The anchor tenant resolves, and the actors in the ecosystem transform to relational governance. Isenberg (2011) argues that there are no specific remedies for the creation of EE. However, based on regional innovation and growth literature such as Boschma and Martin (2010) and Cooke et al. (2011), he proposes six distinct domains of the ecosystem. If EE is proposed, their features include policy, finance, culture, support, human capital, and markets. Spigel (2017) divides these studies into three categories: cultural, social, and material – from which he derives the level of entrepreneurial activity as a result of EE. The cultural output includes supportive culture and histories of entrepreneurship, social attributes (worker talent, investment capital, networks, mentors and role models), and material output (policy and governance, universities support services, physical infrastructure and open markets). These attributes do not exist in isolation, but are created and produced as a result of interrelationships. Figure 5 below depicts the relationships between the attributes.

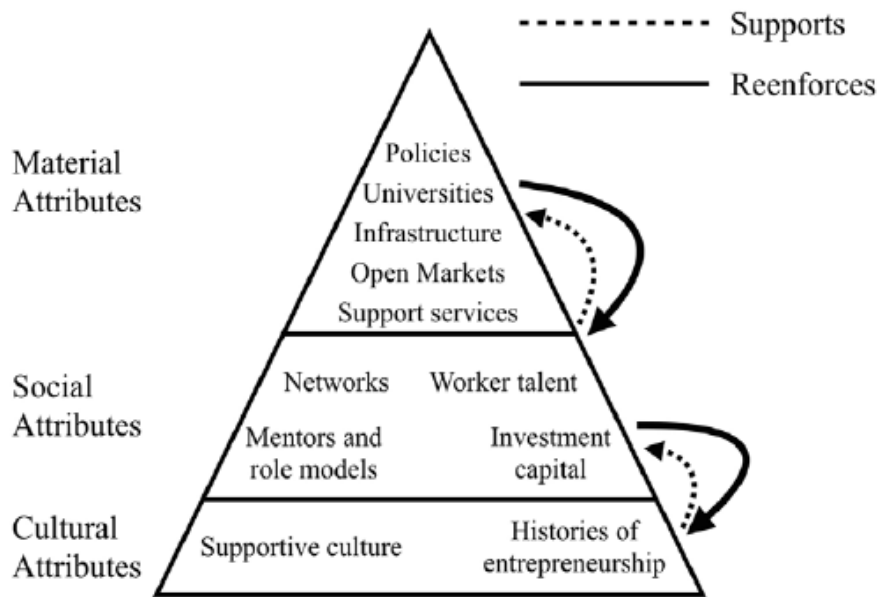


Figure 5 Relationships between cultural, social and material attributes of EE (Spigel, 2017)

Governance of EE can be observed in higher education. A micro level principal investigator (PI)-centred governance framework can identify: (1) the value creation indicators, (2) PI capabilities and problem categories, and (3) solving mechanisms in large-scale publicly funded research programs. Leading such research programs requires PIs to interact with various actors within entrepreneurial ecosystems and effectively manage governance issues, conflicts, and tensions at the micro level in order to deliver the anticipated benefits and costs for each actor (Cunningham et al., 2019).

Spigel and Harrison (2018) focus on the development of process perspective on governance of EE. The ecosystem is undergoing development and flow of entrepreneurial resources such as human, capital, business know-how, and cultural attitudes. This flow explains the evolutionary transformation of EE over time and distinguishes the degree of EE function. Three processes of resource creation, recycling, and resource flow between the actors in EE serve as the mechanism for the evolution and transformation of EE. It is critical to comprehend the internal mechanisms, such as recycling of ventures that allow resources to flow into the ecosystem. This ecosystem serves as the global pipeline for entrepreneurs in the region. Successful exits, such as acquisitions and IPOs, encourage entrepreneurs to reinvest resources back into the ecosystem. These success stories will help to foster an entrepreneurial culture in the region and increase the rate of new start-ups. The knowledge, capital, and know-how in the EE will be passed down through the social ties of previously successful entrepreneurs. The ecosystem will be revitalized as a result of this mechanism. Figure 6 below depicts the ecosystem transformation process.

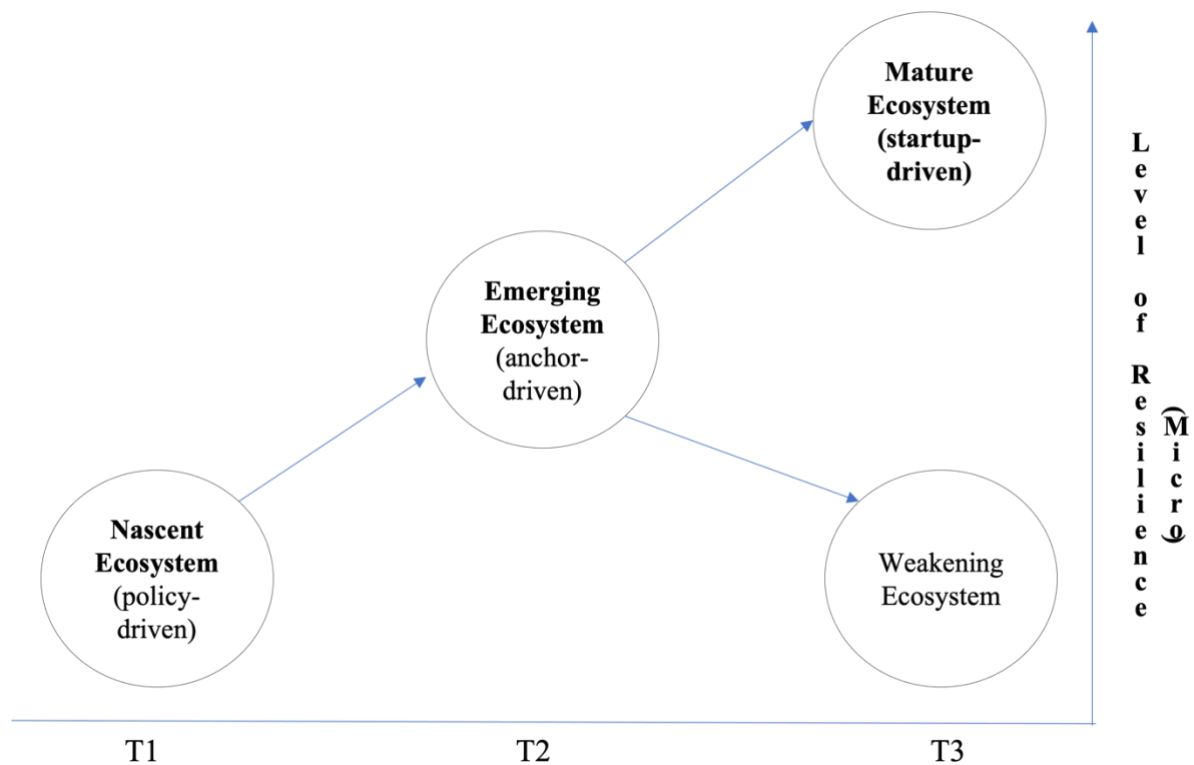


Figure 6 Transformation of Entrepreneurial Ecosystem (adopted from Spigel & Harrison, 2018)

2.6.3 Place

Entrepreneurship is essential for the innovative transformation of places. Strong and resilient EE can transform regional boundaries in global, national, regional level. These creative destructions, however, do not happen overnight (Schumpeter & Opie, 1983). Regional development has been the focus of EE and other antecedent systems, such as industrial districts, clusters, regional innovation systems (RIS), and business ecosystems, as introduced in Acs et al. (2017) research. O’Connor, Stam, Sussan, & Audretsch (2018, p. 2) emphasize that every place has an EE. However, each place has its own “performance, practices, strengths, weaknesses, opportunities, threats, objects, and actors.” For transformation to occur, place-based alignment of the elements is critical. Entrepreneurs define the EE boundary as a place to gain access in the venture development process (Fuentelsaz et al., 2018). According to some scholars, entrepreneurship can be measured within the national system (Ács et al., 2014). The national level of EE can be born in small countries such as Singapore. EE, on the other hand, evolves primarily in communities (Bhawe & Zahra, 2019; Feld, 2012b; Spigel, 2017). Cities are also geographically bounded EE. In the case of Turin, Colombelli et al. (2017) propose a relational framework for exploring the complexity of the governance design and the evolution of the EE. In addition, most empirical studies use cities to collect data. Culture, infrastructure, norms, and institutions were found to be relevant in 70 European cities using the

regional entrepreneurship development index (REDI) (Audretsch & Belitski, 2017). Boulder and the US National Capital Region are classified as EE clusters to emphasize the cultural significance and evolutionary aspect (Auerswald & Dani, 2017; Spiegel, 2017). Pitelis (2012) suggest that, EE is a mature form of a cluster and industrial district that has evolved through co-creation and co-location. The elements of the cluster are based on the geographical agglomeration, linkages, embeddedness, and competition. They share the objective and vision of the members. However, some argue that through technology-push innovation and digital affordances, place-based EE can be transformed into 'global' EE (Autio et al., 2018).

2.6.4 Evolution

This section is examined in greater depth in paper 2. The interdependence of ecosystem actors is critical to the evolution of EE. According to Hull (1989), two entities such as interactor and replicator are required to explain the successful evolutionary process. An interactor interacts with the entire environment and leads to differentials in evolution, whereas a replicator passes its structure in the evolution process. A replicator is analogous to human genes, and interactors are analogous to human organism. The evolutionary process can be described as variation, selection, and retention (VSR). During the retention stage, the organization has demonstrated consistency over time. It is critical in the VSR process to identify the causal lever that causes the evolution. According to Maruyama (1968), the evolution process has two distinct directions. In nature, evolution and mutation has a counter-effect. This mechanism is a deviation-counteracting mechanism. However, in some cases of evolution, such as cultural evolution, the deviation is amplified. In the theory of industrial evolution, there are two selection processes. Organizational ecologist like Hannan and Freeman (1993) focused on the life cycle of individual firms. Evolutionary economist like Nelson and Winter (1982) focused on the capacity of adaptation for changing the environment (Child, 1972; Nadler et al., 2011).

Some studies differentiated between the life-cycle and the expanded to adaptive life-cycle of EE. Mack and Mayer (2016) attempted for the first time to present an evolutionary model in the EE literature that is influenced by economic geography. The literature on industrial districts and clusters explains how firms in a specific region are born and die. However, there is some ambiguity in explaining the interaction between entrepreneurial ventures and their supporting systems. Some scholars expanded the life-cycle model to include a dynamic life-cycle model that focuses on internal commercialisation of knowledge (Cantner et al., 2020). This model explains the interrelatedness and co-existence between new and incumbents. The dynamic life-cycle of an EE model is illustrated in Figure 7 below.

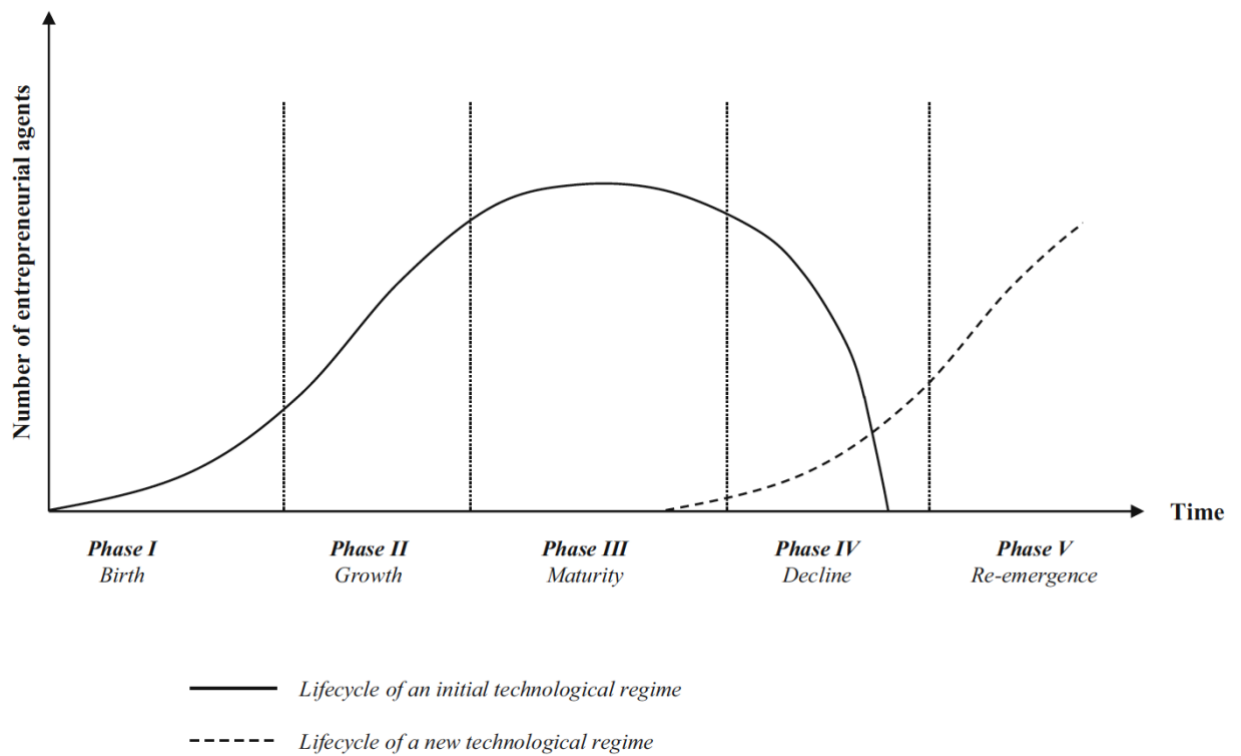


Figure 7 Dynamic life-cycle model of EE (Cantner et al, 2020)

Evolution and spinout is the key discussion on the work of Auerwald and Dani (2017). They introduced the concept of adaptive dynamics and evolutionary economics. Economists have recently begun to connect localized production and innovation systems. The evolutionary clusters, as well as EE at the subnational and regional levels, have emerged in recent years. In the EE context, different stages of the region are described as an evolutionary process. As mutual causal mechanisms of EE, the adaptive model focuses on coevolution speciation, and path-dependence. The evolution of EE has an impact on the adaptive cycle in the region's industry clusters. The adaptive life-cycle model (See. Figure 8) focuses on the feedback mechanisms and self-reinforcing interactions that emerge within complex systems as economic activity self-organizes.

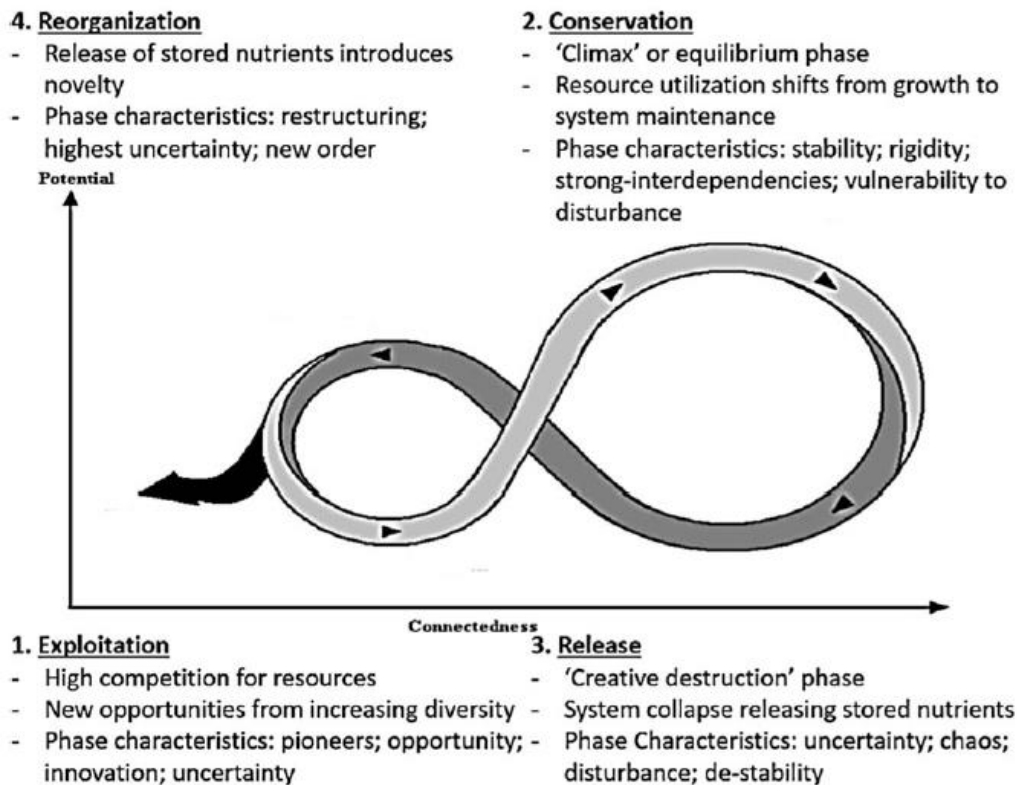


Figure 8 Phase characteristics of the EE (Bengtsson et al., 2000)

Colombelli et al (2017) proposes similar life-cycle of governance in EE, with a birth phase, transition phase, and consolidation phase. During the birth phase, the ecosystem is formed, and local conditions for evolution of governance begin to emerge. This phase requires a high level of adaptability. The governance structure is hierarchical during this phase. Following the birth phase, the linkage and network among the actors drive the evolution of the ecosystem into the transition phase. During the transition phase, knowledge spillovers and capital mobility accelerate the learning process and broaden the actors' connectivity. Path-dependency is one of the characteristics that characterize the evolution of hierarchical governance in the ecosystem to a more relational structure. The interaction of the actors is self-enforcing during the transition phase, and the centrality diminishes as the actors assume the role of an anchor tenant. The final phase is the consolidation phase, in which the ecosystem only has relational and horizontal governance. During this time, spinout takes place. The relational life cycle model is presented in Figure 9 below.

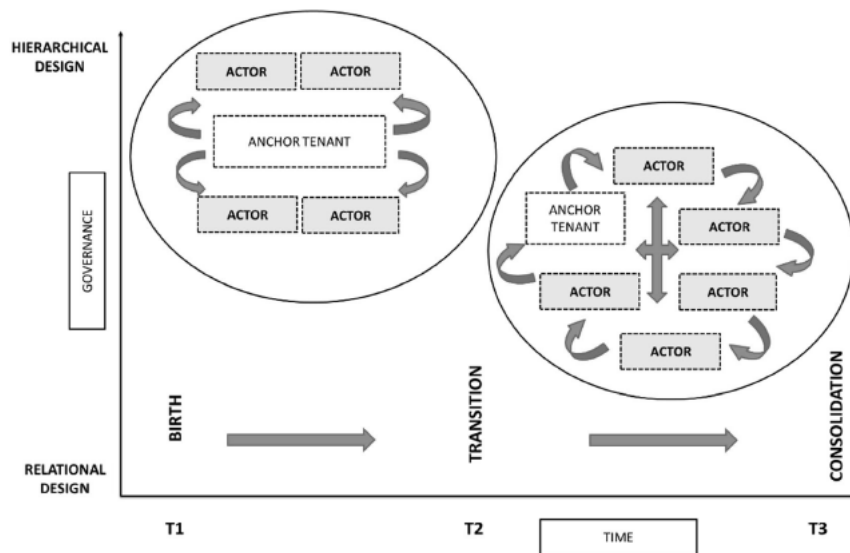


Figure 9 Hierarchical and relational governance of EE (Colombelli, 2017)

Autio et al. (2018) focused on digital affordances that contribute to the dynamic emergence and evolution of EE. Martin and Sunley (2011) argue that ecosystems change over time, resulting in a variety of possible outcomes in their developmental trajectories. The evolutionary logic of EE is similar to that of cluster formation (Braunerhjelm & Feldman, 2008). Some entrepreneurial ecosystem research distinguishes between the life-cycle aspect of the cluster and the complex adaptive system of evolutionary entrepreneurial ecosystem (Kuratko et al., 2015). Future research can address which approach is more viable.

According to studies, the majority of the few studies on the evolution of EEs are focused on a life cycle stages model (Cantner et al., 2020; Colombelli et al., 2019; Mack & Mayer, 2016; Thompson et al., 2018). However, there are some shortcomings in this model's ability to capture the evolution of EEs. The initial EE life-cycle model leads to either death or rebirth via renewal (Mack & Meyer, 2016). This debate is similar to the largely unresolved debate in cluster about whether life cycles or adaptive systems better reflect evolutionary processes (Martin and Sunley, 2011). Clusters can be finite and demolished as a result of technological disruptions (Narula, 2002). As the term "ecosystem" implies, the ultimate goal of an EE is continuous renewal (Malecki 2018, p. 12). A weak EE (Auerswald, 2015) is not synonymous with death and can be renewed. Firms and entrepreneurs succeed in the face of adversity and even build resilience. Under the life cycle thesis, the goal of a strong EE is to avoid shrinking into weakening by generating resilience over time, rather than the destructive phase to perishing (Roundy, 2017). Thus, despite the popularity and effectiveness of the life cycle model in representing evolutionary EE (Malecki, 2018), some scholars regard it as an inapplicable framework because the evolution of an EE is non-linear across phases but rather aligns with an adaptive system (Adams, 2020; Auerswald & Dani, 2017; Roundy et al., 2018). EE sheds light on the spinout literature from an evolutionary standpoint. The research

of Feldman and Francis (2004) focuses on the high spinout rate in advanced EE sectors such as Silicon Valley Route 158, Boston, and Stanford.

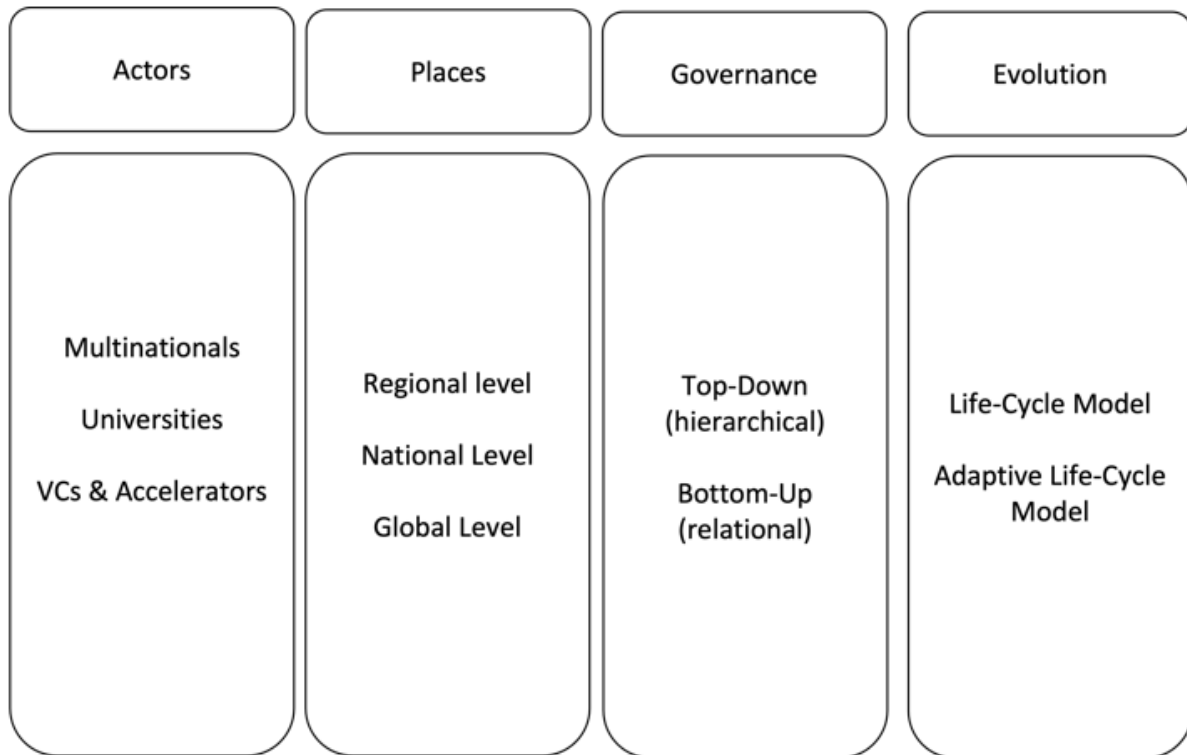


Figure 10 Themes of Entrepreneurial Ecosystem

As per the figure above, the systematic analysis presented in chapter 4 resulted in four predominant themes: Place, Governance, Actors, and Evolution (See Figure 10). I readily established that the number of articles in three of the thematic categories, place, actors and governance, heavily outnumbered those on evolution. The characteristics of each theme have been explained in this chapter. However, there is clearly a distinct paucity of explicit studies on the evolution of entrepreneurial ecosystems. Although some scholars have called for, and placed increased emphasis on the temporality of EE through studies of evolutionary processes and governance across time (Colombo et al., 2017; Spigel and Harrison, 2018), they still represent a significant minority. Therefore, to redress these deficiencies, I have focused my research agenda on theory development that places a heavy emphasis on future studies to better and more comprehensively capture the evolutionary processes of entrepreneurial ecosystems. In the following section, I will present the theoretical framework that I further develop in paper 2 (Chapter 4) and in my empirical study in paper 3(Chapter 5).

2.7 Theoretical foundations and framework

2.7.1 Introduction

The theoretical framework has been constructed to address the gap addressed above as well as serve the aim of this thesis. The objective of this study is to investigate the extent to which the arrival and growth of multinationals (MNEs) influenced local economic development through direct spillovers in the form of spinouts. Specifically, the research examines the impact of FDI in the form of alumni founder spinouts from MNEs in the host region, which may join the local EE agglomeration. Although some studies (for example, Mack and Mayer, 2016; Cantner et al., 2020; Roundy, 2017) have proposed evolutionary frameworks (for example, life-cycle, adaptive life-cycle, complex adaptive system), it is unclear how anchor organisations propel and trigger EE evolution. Thus, the framework is specifically about the role of MNEs in the EE evolution (this is to clearly distinguish the other evolutionary frameworks) and is constituted of the following elements: 1) the impact of FDI 2) MNE as nurturer or inhibitor 3) MNE spinout 4) EE evolution. First, this framework provides insight to the economic impact of FDI and the contributions in the literature most relevant to FDI effects on innovation, productivity growth and new firms creation in local system. Second, it addresses the role of multinationals in an EE, both in terms of positive and negative spillovers are examined. Third, this framework addresses the origin and the role of MNE spinouts. Despite advances in the spinout literature (e.g., Agrawal & Cockburn, 2003; Klepper, 2007), only a few studies (e.g., Ryan et al., 2020; Spigel & Vinodrai, 2020) have highlighted the role of spinouts in the evolution of an EE. Finally, the positive or negative impacts of inward FDI on the evolution of an EE will be investigated. In this thesis, MNE spinouts are used as the measure of spillover. The theoretical framework is illustrated in Figure 11.

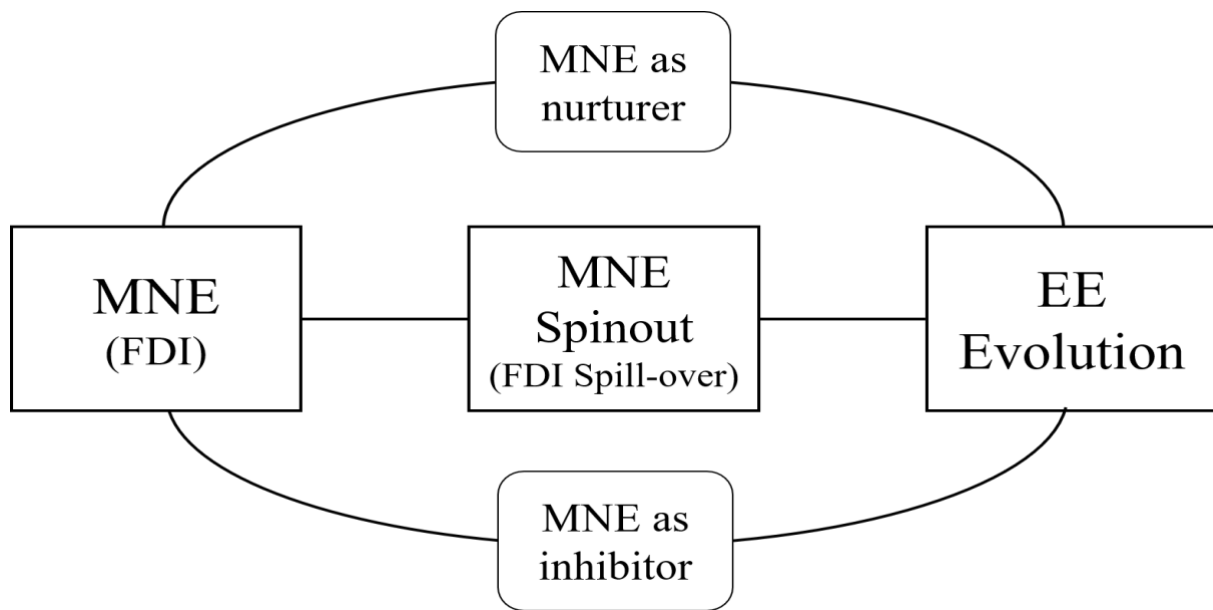


Figure 11 Theoretical Framework

2.7.2 The impacts of FDI (Spillovers)

Spillovers can help to propel and expand the evolution of a cluster, primarily by building on and expanding the accumulation of knowledge (Breschi & Lissoni, 2003; Clarysse et al., 2014; Harima et al., 2020; Ryan et al., 2020; Van De Ven, 1993). Policymakers in developing countries have devised a number of strategies to entice positive spillover (or externalities) from foreign multinational corporations (Moran, 2001). Several studies have focused on co-location and off-shoring firms to track knowledge spillover and discovered that the reliance on the co-location effect is highly heterogeneous across firms, particularly firms with lower global exposure and dispersion of activities (Castellani & Latoratori, 2020).

Governments provide incentives to multinational corporations to locate in specific regions in order to create employment and gain advanced technological knowledge (Berrill et al., 2020; Ryan et al., 2020). There has long been a debate in theory and among policymakers about whether MNEs have a positive or negative impact on the region (Audretsch & Keilbach, 2008; Berrill et al., 2020; De Backer & Sleuwaegen, 2003, Driffield, 2001).

Novel innovation can come from established but highly entrepreneurial multinational companies (Breznitz, 2021). The following are the economic effects of FDI on a host location's economy in terms of 1) innovation, 2) productivity growth, and 3) new firm creation. FDI contributes to regional innovation in several ways. First, FDI has an impact on regional innovation capacity through market competition (Fu, 2008). In comparison to monopolistic companies' lack of innovation and inefficiencies (Geroski, 1990), Schumpeterian scholars argue that monopoly power can incentivize innovation through appropriate returns (Cohen & Levinthal, 1989). Foreign R&D activities may also crowd out local innovation as MNEs can absorb the most-talented workforce

and compete in the market, threatening local firms and SMEs (Aghion et al., 2005; Fu, 2004). Second, MNEs can deliver direct innovation outputs, such as sophisticated technology via R&D labs (Athreye & Cantwell, 2007). Most MNEs maintain three types of R&D programmes: support labs, locally integrated labs, and independent labs (Pearce, 1999). As a subsidiary evolves and upgraded its value chain activities, the lab function may progress from integrated to independent labs, raising the level of technological activity (Athreye & Cantwell, 2007) and even contributing to the radical innovation stock of the host country (Pearce, 1999). Several studies have been conducted to assess the benefits of inward FDI within the region. The most obvious are the benefits of direct job creation and regional development through the concept of ownership advantages (Dunning, 1980, 2000; Dunning & Narula, 1996). Furthermore, inward FDI can increase allocative efficiency, allowing for the reallocation of producers, and may benefit the balance of trade through the inflow of capital (Dunning, 2015). In summary, the importance through positive spillovers of FDI for host economies is reflected by the transfer of international technology that creates local linkages, skill upgrading, and productivity growth (Barrell & Pain, 1997; Driffield & Taylor, 2000).

Nevertheless, debate continues on whether inward FDI has positive or negative impact on new venture creation. While some argue that FDI can enhance local entrepreneurship through spillovers and linkages (Driffield & Love, 2007), others argue that the direct competition from FDI will crowd out entrepreneurs within the region (De Backer & Sleuwaegen, 2003). I now elaborate on both side of this ‘nurture versus inhibit’ debate.

2.7.3 MNEs as *nurturers* of EE evolution

Large enterprises, both indigenous and inward investors, have been shown to serve as breeding grounds for local entrepreneurship in a variety of fields. In particular, MNEs can serve as anchor tenants in an evolving EE (Agrawal & Cockburn, 2003; Clarysse et al., 2014; Colombelli et al., 2019; Mudambi & Swift, 2012; Ryan et al., 2020). They attract skilled employees, improve managerial skills, and provide opportunities for local firms to access global customers (Neck et al., 2004). Some scholars emphasize the importance of multinational corporations in assessing the evolutionary dynamics of EE. They contribute to the growth of EE by acting as incubators and encouraging the formation of high-tech startups in both related and unrelated varieties (Brown & Mason, 2017; Klepper, 2007; Neck et al., 2004; Ryan et al., 2018, 2020; Spigel & Harrison, 2018). Employees' experiences and learnings in these large organisations are likely to spawn new spinout ventures, primarily through the development of variants of a core product (Klepper and Sleeper, 2005). By incubating entrepreneurs, MNEs can catalyse and strengthen an EE's resilience. Furthermore, these anchors are shown to disseminate knowledge via multiple spinoffs of ex-employees in related and unrelated varieties (Ryan et al., 2020). This process, over time, increases heterogeneity in the EE, thereby supporting its long-term competitiveness. Spinouts, in fact, fuel

diversification and the creation of new knowledge, as well as heterogeneity, which ultimately strengthens the resilience of an entrepreneurial ecosystem. As a result, in this positive view as nurturers, MNEs serve as 'knowledge integrators,' interacting with new ventures to generate knowledge spillover based on the ecosystem's 'absorptive capacity' (Bhawe & Zahra, 2019; Buciuni & Pisano, 2018).

2.7.4 MNEs as *inhibitors* of EE evolution

While the majority of the literature emphasizes the positive effects of FDI, critics of globalisation have emphasized the negative effects of FDI on local host economies. For instance, some have demonstrated that co-locating incoming MNEs and domestic firms causes an exodus of talent to MNE labs, causing shortages for indigenous firms (Lamin & Ramos, 2016).

Other scholars investigated the relationship between MNE proximity and the labour mobility of R&D functions and discovered that, while technological lagging firms prefer to locate near the leaders, an increasing presence of R&D focused MNEs will have a negative impact on indigenous tech firms because the multinational absorb the talent within the ecosystem (Livani & Lamin, 2016).

However, the spillover and crowding out effect is too aggregated (broad) and requires a more granular perspective. Thus, MNEs are valuable knowledge sources for aspiring and nascent entrepreneurs in the EE. Furthermore, the concentration of multinational corporations creates the potential for spinouts in both related and unrelated domains (Boschma & Frenken, 2011; Kedron et al., 2019). The resilience of the EE is amplified by this heterogeneity (Roundy, 2017).

2.7.5 MNE Spinouts

The local concentration of MNEs can, when positive spillovers nurture local entrepreneurship, elevate the potential for spinouts in both related and unrelated domains (Boschma & Frenken, 2011; Kedron et al., 2019). Spinouts are new ventures founded by ex-employees of an incumbent firm, and these standalone firms have “no equity relationships with any incumbent” (Agarwal et al., 2004, p. 501). Spinoffs, as opposed to spinouts, are firms in which the parent company has control over the newly established venture. Although there are some differences in the terminology and meaning of spinouts and spinoffs, the focus of this research will be on spinouts in order to extract the direct impact of multinationals in the host regions. The term "spinouts" was chosen in this thesis to emphasize that these companies are founded in both related and unrelated industries to the parent company. Furthermore, this thesis excluded research-based and university-based spinoffs, which are prevalent in spinoff literature. The majority of the literature focuses on vertical spinouts, in which the new firms remain in the same industry, such as automobile (Boschma & Wenting, 2007; Klepper, 2007), tire (Buenstorf & Klepper, 2009), disk drive (Agarwal et al.,

2004), laser (Klepper & Sleeper, 2005), semiconductor (Buenstorf & Klepper, 2009; Cheyre et al., 2015; Ferriani et al., 2012), and information technology (Garnsey & Heffernan, 2005; Grilli, 2010). Vertical spinouts may benefit from increased absorptive capacity as a result of knowledge acquired from parent companies (Adams et al., 2019). The various types of knowledge include both tacit and codified forms of: 1) market (Agarwal et al., 2004; Buenstorf, 2007; Shane, 2000), 2) technology (Franco et al., 2009; Teece, 1986), and 3) industry knowledge such as regulations, competitors, and networks (Chatterji, 2009). Some intra-industry spinouts, however, are less likely to emerge from activities related to the core technology of the incumbent firm (Hellmann, 2007; Yeganegi et al., 2016). Vertical spinouts create intermediate products to connect the functional short comings of the incumbent firms and the customer demands (Alcacer & Oxley, 2014; Arruñada & Vázquez, 2006). Spinout founders benefit not only from “what they know” but also from “who they know” (Adams et al., 2019, p. 5).

The spinout has traditionally been explained using agglomeration precepts since newly founded firms serve as evidence of spillover effect. As a benefit of co-location, Marshall (1920) emphasized transportation, labor market pooling, and knowledge spillovers. According to evolutionary economics theory, clusters emerge as a result of the transfer of capabilities (e.g., human resources, new technology) from the parent firm to the spinout companies. Even if the spinout founders are no longer in contact with their parents, the spinout inherits parental traits (Berchicci et al., 2011; Klepper & Simons, 2000; Phillips, 2005). Firms with advanced technology have been shown to generate a greater number of spinouts, and the spinouts are also located close to the cluster (Agarwal et al., 2007). The motivation of a spinout differs for each founder and is based on prior experience and knowledge gained from the parent firm (Agarwal et al., 2004; Phillips, 2002), ability to form the core founding team (Beckman, 2006; Eisenhardt & Schoonhoven, 1996; Wezel et al., 2006), or even an investment from the parent company often in the areas of R&D and marketing (Klepper & Sleeper, 2005). Spinout firms may find new market opportunities by deviating from the core technology of the parent firm (Klepper, 2009) or by satisfying the needs of different customers (Hellmann, 2007).

The founder of a spinout firm commonly can be greatly influenced by her/his own background, particularly prior experiences. Founders generally exploit the knowledge gained from her/his incumbent firm (Santarelli & Vivarelli, 2007). In some cases, incumbent employees are willing to “bargain a lower wage in exchange for opportunity” to acquire core skills in a company with the aim to spinout (Landoni, 2018, p. 264). Ex-employees draw on deep ‘contextual knowledge’ in addition to codified and tacit knowledge (Adams et al., 2016). Direct experience in production and customer service, for example, is critical knowledge for starting a new venture in industries such as semiconductors and tyres (Buenstorf & Klepper, 2009; Cheyre et al., 2015). The demonstration effect and experiential learning can drive spinouts in the EE (Brown & Mason, 2017).

Entrepreneurial opportunities are often passed on from the parent company during the spinout process (Klepper & Sleeper, 2005). After the startup spinout, the activities evolve in unexpected ways. Diversification, from an evolutionary standpoint, leads to technological change (Klepper, 1996). According to Klepper's (2007) research, which focused on the automotive industry around Detroit, disagreements among founders can lead employees to establish spinouts. Thus, spinout entails heterogeneity because the firms had the capacity to enter a new industry with prior market knowledge (Boschma, 2015). This study, which built on the work of Neck et al. (2004), emphasized that MNEs are another source of spinout in the EE because they attract skilled employees, improve managerial skills, and provide business opportunities for local firms to access global customers. Adaptive capacity is critical for the emergence of a resilient of EE and leads to heterogeneous entrepreneurial activities (Roundy, 2019). Recently, more research is being conducted in the areas of spinout in relation to EEs (i.e., venture capital and technology park) (Cumming et al., 2019), high-tech start-ups (Harima et al., 2020), vascular-related manufacturing (Ryan et al., 2020), and mobile technology (Spigel & Vinodrai, 2020). However, the origins and evolution of EE spinout remain unknown. This research has identified 'evolution' and 'spinout' as the most prevalent calls for research using a thematic analysis proposed by Braun and Clarke (2006). The results of the analysis are shown in Table 5 below.

Table 5 Call for Evolution and Spinout in EE literature (2006-2022)

Content	Quantity	Authors (ABS 3 and above journal only)
Spinout (Spinoff)	5	Stam and Spigel (2016), Cunningham, Menter, and Wirsching (2019), Horváth and Rabetino (2019), Heaton, Siegel, and Teece (2019), Qin, Wright, and Gao (2019)
Evolution & Spinout	25	Cohen (2006), Pitelis (2012), Mason and Brown (2013), Boschma (2015), Alvedalen and Boschma (2017), Audretsch and Belitski (2017), Auerswald & Dani(2017), Brown and Mason (2017), Spigel (2017), Bhawe and Zahra (2019), Colombelli et al. (2017), Colombo et al. (2017), Spigel and Harrison (2018), Theodoraki et al. (2018), Meoli, Paleari, and Vismara (2019), Sperber and Linder (2019), Song (2019), Feldman, Siegel, and Wright (2019), Vedula and Kim (2019), Breznitz and Zhang (2019), Donegan et al. (2019), Johnson, Bock, and George (2019), Stam and van de Ven (2019), Ryan et al. (2020) , Cho, Ryan, & Buciumi (2022)
Total	30	

2.7.6 EE evolution

Growth, by its very nature, implies various evolutionary processes which I have discussed above in 2.6.4 more in detail. As I outlined in that earlier section, the focus of EE evolution is in understanding the emergence of ecosystem over time, which can take a variety of pathways (Maleki, 2018; Ryan et al., 2020). For example, much of the early work on EE research was on how EE emergence could be fostered by government policy (Cukier et al. 2015; Gauthier et al. 2017; Isenberg 2011; Mason and Brown 2013, 2014; Mulas et al. 2016). In contrast to policy-led emergence, the creation and evolution of an EE can be organically entrepreneur-led (Feld 2012) which clearly distinguishes it from antecedent systems, such as industrial clusters and business ecosystems (see Table 4). The focus of my study is on anchor-led evolution: that is, the possibility that large enterprises, both indigenous and inward investors, can serve as the breeding grounds of local entrepreneurship. Specifically, they can also contribute to and trigger an EE's creation and growth by stimulating the spinout of high-tech start-ups in related and unrelated varieties (Brown and Mason 2017; Colombelli et al. 2019; Klepper 1996, 2007; Ryan et al. 2018; Spigel and Harrison 2018) which will be further developed in paper 2. Empirically, the evolution of EE can be traced in terms of both the numbers/origins of entrepreneurial firms (in this thesis- MNE alumni spinouts), supporting institutional infrastructure and growth rates and extent of diversity of the new ventures over time. These issues will be further examined in paper 3.

2.7.7 Summary

This chapter introduced various definitions and laid the foundation for the EE concept. Through thematic analysis, the author identified the core themes of EE: actors, governance, place, and evolution. To trace the lineage of EE, antecedent systems such as industrial districts, clusters, RIS, EEG, and business ecosystems have been investigated. Despite the popularity of the EE concept, there is a scarcity of literature on the evolutionary aspect. Furthermore, the theory's link between evolution and direct effect (spinout) remains undeveloped. As a result, this thesis proposes a theoretical framework. The framework describes the research's origin, context and objectives. It outlines debates about contradictory impacts of FDI on the evolution of EE via MNE spinouts. In so doing, it illustrates the inhibitors and promoters of MNE spinouts. The following chapter will delve into the philosophical underpinnings of this thesis, as well as the research design and methodology employed to shed light on evolutionary EEs.

3 Methodology

The philosophical underpinning of this PhD thesis is critical realism. Social science research deals with complex phenomena and various social objects. Moreover, those phenomena and objects are both socially understood, interpreted, and constructed. Thus, the role of the researcher is to justify the tools and measurements used to investigate uncertain and imprecise theoretical concepts based on his/her ontology, epistemology, and methodology. Ontology raises fundamental questions about the nature of being and reality. Epistemology examines the question of “what do we know and how can we know”? The research paradigm is formed by ontology and epistemology, and it influences research design, data collection, and data analysis. Aligned with critical realism, a retroductive and abductive approach was applied to data collection and analysis. This chapter explains 1) research philosophy and methodology, 2) process of data collection, 3) data analysis, and 4) justifications of each research path (Silverman, 2013) in order to explore the evolutionary EE. The research design framework is described in Figure 12 below.

3.1 Research design framework

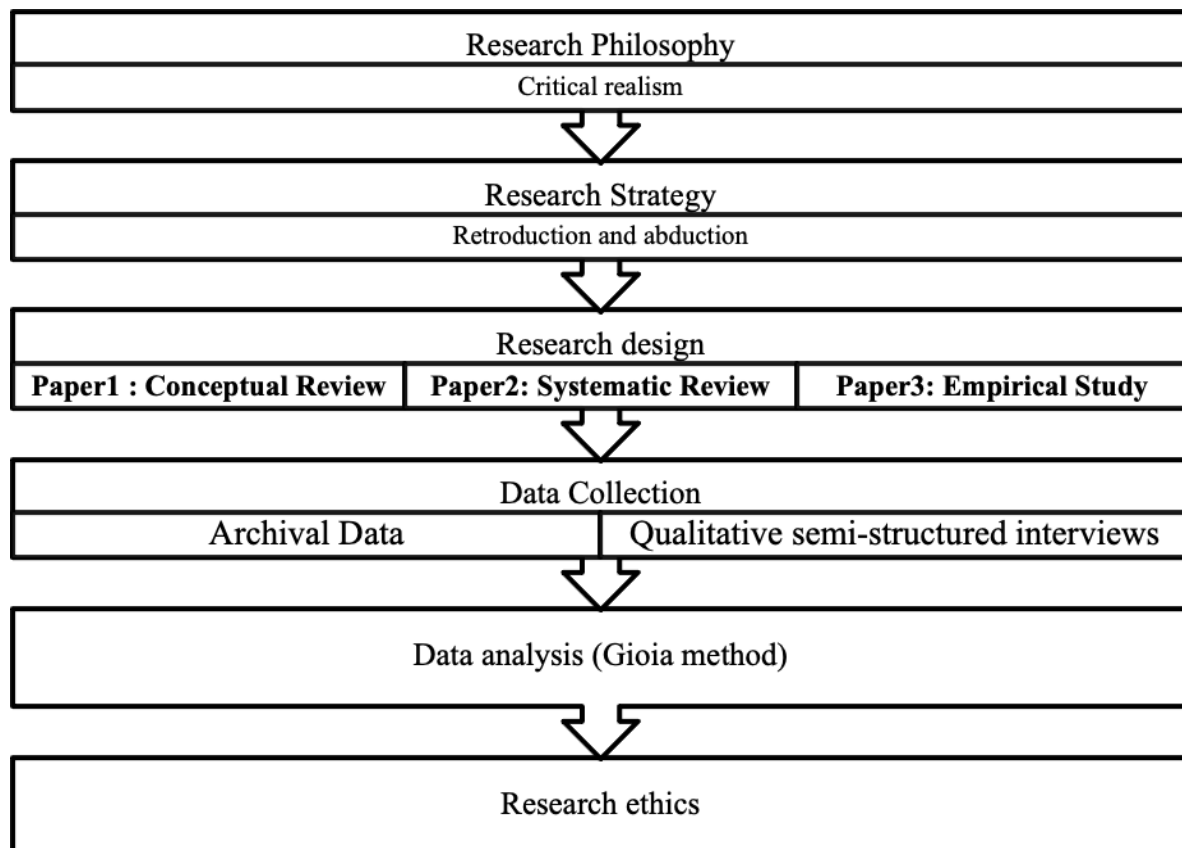


Figure 12 Research design framework

3.2 Research philosophy: Critical realism

This thesis was built on critical realist philosophy. Research philosophy influences the research strategy and design, as well as methods, data collection, and analysis. Critical realism (CR) emerged in the 1970s as a critique of both positivist and constructionist viewpoints. According to CR, reality cannot be reduced to human knowledge about reality (Denzin & Lincoln, 2011). A realist, according to Roy Bhaskar (1998), acknowledges the existence of a reality that exists independently of our perception of it. Social phenomena are context-dependent and can be explained using both causal and interpretive mechanisms (Collier, 1994). Bhaskar provides a reconciliation between explanation (*erklären*) and understanding (*verstehen*) (Welch et al., 2011). Bhaskar (1998) defines CR as a combination of a realist ontology and an interpretive epistemology. Instead of sensory observation, he contended, a transcendental 'causal mechanism' could be used to understand causality. This implies that ontology (the nature of reality) cannot be reduced to epistemology (our knowledge and experience of reality). Reality consists of three domains: 1) the real, 2) the actual, and 3) the empirical. The *real* domain reflects the structures of objects, both physical and social, with capacities for behaviour ('mechanisms'). These mechanisms may or may not trigger events in the *actual*. These events may or may not be observed in the *empirical*. Hence the structures are non-deterministic and can initiate and constrain events through their mechanisms (Archer, 1995; Sayer, 2004). Causal mechanisms refer to the power of objects, structures and entities. The relationship between agency and structure in CR was developed as an 'analytical dualism', meaning that social structures exist independently of human activity (Mutch, 2007).

Another aspect of CR is the concept of the stratification of objects. Structures can be decomposed or combined into assemblages (DeLanda, 2006). Objects have an intrinsic causal power - whether physical, human or social – and objects and causal powers are internally related to the mechanisms (Sayer, 1992). Causative mechanisms can only be produced and observed in a closed, experimental system. The relationship between a causal mechanism and its effects, on the other hand, is contingent and external in the social world (an open system). Thus, in an open system, actualizing a causal mechanism is determined by conditions that may not be empirically observable. Furthermore, there is no symmetry between explanation and prediction, implying that explanations must take into account the spatiotemporal context in which causal mechanisms operate (Sayer, 1999). As a result, causation entails looking for patterns in events and determining the mechanism underlying the context.

To expand knowledge, Welch et al. (2011, p. 748) argued that social scientists must "understand the nature of the objects and cause-effect relationships that are not consistently producing regularities in an open system." Bhaskar (1998) rejected determinism and reductionism and credited human agency with causal power. He also criticized reductionism, which is based

solely on human intentions and agency. Because social structures and human activities interact, an explanation that includes human intentionality and the actor's position in the social world is critical to comprehending the phenomenon (Bhaskar, 1998).

CR does not align with a specific research methodology because it provides a specific ontology and epistemology (Zachariadis et al., 2013). Sayer (1992, p. 243), on the other hand, argued that uncovering causes necessitates an intensive research strategy, such as a qualitative, in-depth study of “individual agents in their causal context.” Case studies are ideal for developing causal explanations and exposing generative mechanisms, whereas "extensive" large-N studies are likely to have poor "explanatory penetration" (Danermark et al., 2019).

3.3 Research strategy: Retroduction and abduction

The assumption of a purely inductive or deductive process of theory development is challenged by CR. An explanation is frequently initiated by a surprising contrast and is triggered by the realization that the observed outcome differs from the predicted outcome of the phenomenon (Lawson, 2003). This can be achieved by asking provoking questions, such as “why not X?” This question is asked when the initial thought of domain observation was not well understood, or new causal factor is activated, or existing mechanisms need to be distilled. This is an abductive process where the initial point is “a perceived mismatch between an empirical observation and an existing theory that leads to redescription or recontextualization of the phenomenon” (Welch et al., 2011, p. 478). Consequently, theorising is a process of conceptualisation (Sayer, 1992).

Retroduction, like CR, relies on reasoning and imagination to construct a model of the structures or mechanisms that creates observed phenomena (Blaikie, 2007). Retroduction is similar to abduction in that it goes beyond the empirically observable to acquire knowledge by inquiring and conceptualizing the phenomena (Meyer & Ward, 2014). According to Bhaskar (1998, p. xvii), "theoretical explanation proceeds by a description of significant features, retroduction to possible causes, elimination of alternatives, and identification of the generative mechanism or causal structure at work". In retroduction, a researcher takes an empirical observation and hypothesise the possible mechanisms that explain a particular outcome (Danermark et al., 2019; Sayer, 2004). There are several benefits in a retroduction approach: 1) it assists in identifying mechanisms without being deterministic, 2) it allows the researcher to hold the structure and actions distinct while acknowledging the role of social action, and 3) it is more concerned about the real world rather than statistical reporting which reflect the phenomena without context (Bygstad et al., 2016). Hence, retroduction is a ‘thought trial’ for researchers in which various explanations are proposed that describe the causal mechanism - that must exist to produce the observed events - within the social structure (Weick, 1989). Both abduction and retroduction are often used interchangeably as an

iterative process during data collection and data analysis, such as corroborating interviews, high order coding, case analysis, and process modelling (Peirce, 1965; Van Maanen et al., 2007; Wynn Jr & Williams, 2012).

The initial aim of this thesis was to explore the impact of FDI multinationals on the Dublin EE. Spinout was selected to measure the direct impact of multinationals. In addition, in pilot interviews, I inquired about the learning experiences of ex-MNE founders that influenced the spinout. This was constructed through ecosystem actors and elements leading to the emergence of ex-MNE spinout founders. An in-depth search of the founders using structured search of databases such as LinkedIn, TechIreland, and Orbis Europe, on the other hand, yielded a small number of spinouts. Only 45 spinout founders were active as of the end of 2020, out of more than 50,000 employees from Internet companies. As a result, the interview questions were changed to 'why are there so few MNE founders?'. The findings from the interviews were categorized and coded to extract the themes and explore the possible similarities of different ex-MNE spinouts (Maxwell & Miller, 2008). This process signified a constant discussion between the data analysis and the emerging theory that resulted in refined theoretical ideas ("systemic combining") (Dubois & Gadde, 2002, 2014). Rather than adopting positivist and interpretivist philosophies, the abstraction employs retroductive analysis (Zachariadis et al., 2013). As a result, the empirical study (Paper 3) consistently employed a CR viewpoint.

3.4 Methodology: Case study

In CR, methodological approaches emphasize the 'contextualised explanation' to account for why and how events occur (Welch et al., 2011). To understand how the result in a specific case was produced (e.g. "A led to D through B and C") requires working backwards from events (explanation of effects-of causes) (Mahoney & Goertz, 2006). 'Process tracing' is used as a technique to identify the intervening causal process between two variables (George & Bennett, 2005; Gerring, 2008; Hall, 2006). It entails a "careful construction of a causal chain of evidence", such as non-comparable observations and not from a uniform population (Welch et al., 2011, p. 749). This approach provides a more robust explanation power than the positivist linear model approach (Elliott, 2005; Gerring, 2008; Roberts, 1995). A 'case study' methodology connects and combines both worlds of the particular (historical) and general (theoretical) in constructing causal chains. The general pattern connects the discrete steps in an explanatory narrative (Roberts, 1995, p. 54). Theories can be reassessed and refined through the iterative process. As a result, theories must be based on social context and time (Abbott, 1998).

The goal of CR is not to discover general laws and predict outcomes; rather, it is to comprehend the underlying mechanisms that have produced the phenomena of interest (Bygstad et

al., 2016). While mechanisms are not observable by definition, their effects can be observed and thus provide a good explanation of how mechanism function can be elicited. Understanding the various layers and relations among the components (see E, M, S in the Figure 13 below) is critical to reveal the synthesis (see dotted lines in the figure). The layers are events, mechanisms and structures. Contrary to positivist research, CR focuses on uncovering the mechanisms that produced the events rather than investigating the regularities of these events. Thus, layered ontology is the key to CR-aligned methodology. A thorough investigation is required to provide a theoretical description of mechanisms of CR research design. This allows the researcher to analyse the interplay between the ontological layers systematically while also considering the temporal evolution of the structural layers and their components (Sayer, 1992). Consequently, the methodological question is as follows. *"How do we identify mechanisms since they are unobservable?"*

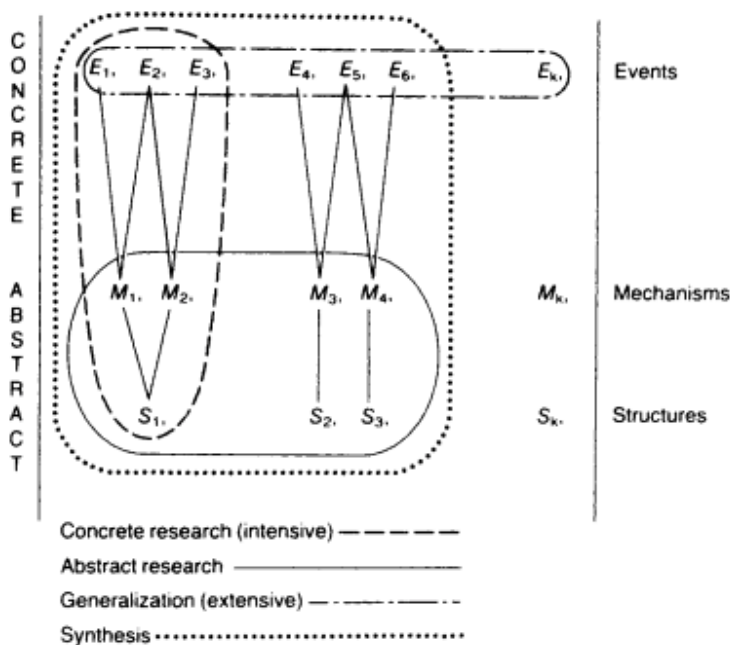


Figure 13 The layered ontology of critical realism and research strategies (Sayer, 1992)

CR is based on abduction and retroduction. As a result, the Gioia method of abstraction to analytical categories has been widely used (Fletcher, 2017; Oliver, 2012). Gioia methods have been commonly used in data collection and analysis among critical realists (Corley & Gioia, 2011; Gioia et al., 2012; Maxwell, 2012; Yeung, 1997). CR methodology includes several steps to approach the domain of 'real', including the identification of demi-regularities, abduction, and corroboration. Demi-regularities are identified during the abstraction process. Abstractions of the 'empirical (observed events)' underline how actors strive and envisage the domain of the 'actual', describing what occurred (Wynn & Williams, 2012). After recognising demi-regularities, abduction is applied to explain the data collected at the theoretical level using an iterative process (Fletcher, 2017). The

distilled findings have been reflected with the existing literature, and the events are interpreted from the concepts (Danermark et al., 2019).

After applying the abductive measures, corroboration was used as a final means to confirm the mechanisms by examining the competing and alternative explanations of the phenomenon (Danermark et al., 2019; Wynn & Williams, 2012). Corroboration, according to Sayer (1999), aims to reflect the 'real' as much as possible. In explaining the EE phenomenon, various data sources were used to define the roles of multinationals and the founders' decisions. This research applied the qualitative research method and implied theoretical concepts from the data due to the lack of existing research (Eisenhardt, 1989; Eisenhardt & Graebner, 2007). An Abductive approach was employed to iterate the observed tendencies with current theory and upgrade abstraction.

3.5 Research setting

Qualitative research has been identified as the most effective method for developing a comprehensive understanding of entrepreneurship and the context in a temporal ecosystem (Cloutier & Langley, 2020; Karatas-Ozkan et al., 2014; Klag & Langley, 2013). The EE literature, in particular, calls for a more longitudinal and dynamic approach to studying the evolution of EEs (Cao & Shi, 2020; Cho et al., 2021; Ryan et al., 2020).

The evolution of Dublin EE is introduced below to capture the context of the study. The Finance Act of 1986 encouraged private sector investment in urban renewal. The Finance Act of 1987 provided for a 10% corporation tax rate for companies establishing operations in the Dublin Docklands Area (DDA), a special economic zone. This regulation successfully attracted the world's top financial institutions and global insurance companies, along with the high-tech hardware and software companies such as Intel and Microsoft, and leading legal and accountancy firms. While the current tax rate is 12.5%, foreign multinationals pay an aggregate effective tax rate of 2.2% - 4.5% on the profits 'shifted' to Ireland (i.e., in the case of setting up a global HQ in Ireland). Dublin EE was chosen as a case study, with 16 of the top twenty global tech giants establishing international headquarters there (IDA, 2020).

After the dot-com bubble collapse in the early 2000s, the Industrial Development Agency (IDA) Ireland attracted multinational internet companies¹ specifically, with the support of the Irish government, from Silicon Valley to Dublin. The development plan of the DDA has attracted technology, amenities, tourism, education, transport, business and retail activity, and employment. Following the initial arrival of Salesforce in 2000, tech-giant Google opened EMEA Head Quarters

¹ Internet companies generate revenue through online sales, financial transaction fees, paid advertising, cloud services, and a host of other business lines (Investopia, 2021).

in Dublin in 2003 with 100 employees. After fifteen years, the EU headquarters is now Google's most important branch outside of the US, employing over 8,000 people from more than 70 countries. In 2018, 40,000 people worked in the area, and 14,000 households called DDA home (Cantwell, 2014). Google's relationship with Ireland continues to grow; a second €150 million data centre was approved for development in Dublin in 2008 (IDA et al., 2018). Other tech giants such as Facebook quickly followed. According to a report in *The Irish Times*, Facebook alone hired over 1,000 people in 2018 (Bohan, 2019).

As of 2018, Ireland was ranked first in the world in terms of inward FDI (Cantwell, 2014). According to a report by the International Development Agency (IDA) (2019), Ireland's success in attracting global companies can be attributed to three major factors. Firstly, companies have easy access to a young, high-skilled workforce; Ireland's median population age is 35, the lowest in the EU. Second, Dublin is one of Europe's most diverse and international cities, with over a thousand global firms operating there. Third, the corporate tax rate is among the lowest in Europe, with a 12.5 per cent fixed rate. Ireland also has a double taxation agreement with 69 countries.

In 2020, more than 146,000 people were employed by 900 Internet companies in Ireland, with more than 80,000 of these working in Dublin alone (IDA, 2020; Enterprise IRELAND, 2019). This is due to a lower corporate tax rate, but it also has to do with the concentration of highly skilled labour in Dublin. Every year, approximately 4,000 students graduate from an Irish university with a degree in computer science and engineering. The Irish government intends to increase this number to 5,000 by 2022, according to the Technology Skills Report 2020 (IDA, 2020). However, it is unclear how much the MNEs contributed to the growth of EE by laying the groundwork for the emergence of new ventures.

3.6 Case study and case selection

3.6.1 Case study

Due to the exploratory nature of this thesis, a case study research method was selected. A case study is ideal for this thesis because it captures a complex social phenomenon and provides answers to the 'how' and 'why' questions (Flyvbjerg, 2006; Yin, 2011). In the 1960s, the distinguishing feature of a case study was the collection of data on various variables for each case or the placement of contextual data on individual circumstances. In recent years, positivist scholars have regarded theorising with a case study as confusing due to the problem of generalisation and prediction (Burgess, 1927; Platt, 1992). They also questioned the casual homogeneity where the causal factors operate in the same way for all cases (Ragin, 2000, p. 51). However, Ragin (2000) proposed 'multiple conjunctures' for case study research. Rather than measuring the 'net effect' of a controlled variable, the researcher seeks to account for the case conditions. Each effect may vary

depending on how each variable is configured in a combined case. For instance, the combination with A and C, B may cause Y, but in other circumstances, Y may only occur in the absence of B (in Boolean algebra as $Y=(A \text{ AND } B \text{ AND } C) \text{ OR } ((\text{NOT } B) \text{ AND } D \text{ AND } E)$) (Welch et al., 2011). To understand the effect of B, the researcher has to understand the temporal context. Therefore, generalisation involves the "careful setting of scope" (Byrne & Ragin, 2020, p.9).

Theorising in a case study is impossible through clear induction or deduction; however, it can be achieved via retroduction and abduction. The purpose of an emancipatory explorative case study is to understand why things are the way they are (Collier, 2005). According to Mintzberg's (1979) seminal article, a rich patterned description provided a more general and holistic view of the phenomena. Identifying the most plausible explanation of why the EE phenomena emerged can shed new light on its genesis and evolution.

3.6.2 Case selection

The rationale of the case selection is essential to establish rigour in the methodology. A purposeful case selection often achieves validity and reliability to the extent that the case accurately represents the studies phenomena (Lincoln & Guba, 1985). The case in the empirical study was selected purposefully to reflect the EE phenomena. This thesis examines a case of internet companies of Dublin EE that was selected based on the location and economic conditions that represent the FDI based region. According to Yin (2009), the rationale for selecting a single case is when the case: 1) represents a critical case, 2) is unique and extreme, 3) is typical or representative of a specific phenomenon, and 4) is revelatory. The case was selected because of the unique and critical context of the EE phenomenon. The context is described in the research section in more detail. The context of the research justifies the case selection (Bartlett & Vavrus, 2016). In particular, the study of globalisation tends to emphasize historical and multi-scalar research, with regional analysis to examine the conditions for a particular phenomenon (Taylor et al., 2013).

3.7 Data sources

3.7.1 Archival data

The interview requires a proportionate understanding of the context of the ecosystem in both regions. Setting the industry boundary is critical for selecting interview candidates when conducting market research. Thus, market research with secondary data is necessary to understand the context (Corley & Gioia, 2004). The data was gathered in four stages: 1) comprehending the Dublin EE and the multinationals, 2) defining the multinationals' industry boundaries, 3) mapping out the internet-based multinationals and examining their activities, and 4) searching for ex-MNE spinout founders.

3.7.1.1 Multinationals

First, over 487 news articles were analysed to search for significant events and founders, as well as 329 newsletters and 48 public reports from government agencies and professional associations to gain knowledge about the industry and policies. Enterprise Ireland and IDA are government agencies that support the firms operating in Ireland. The activities of internet companies are supported by professional associations such as the Irish Computing Society and the American Chamber of Commerce. Additionally, industry classification, financial data and the subsidiary status of 35 multinationals were identified through ORBIS database search. This sparked an interest in the sectors of multinational technology firms in Dublin. This procedure also uncovered various entities representing the European Headquarters or Europe, the Middle East, and Africa (EMEA). According to the NACE Rev 2 industry criteria, the majority of the tech multinationals were classified as 'other information technology and computer' (code: 6209). Furthermore, data on the EE, such as tech ecosystem maps and sector categorization, were gathered from the IDA website. Figure 14 illustrates the Dublin Tech map which includes most of tech-multinationals in the region.

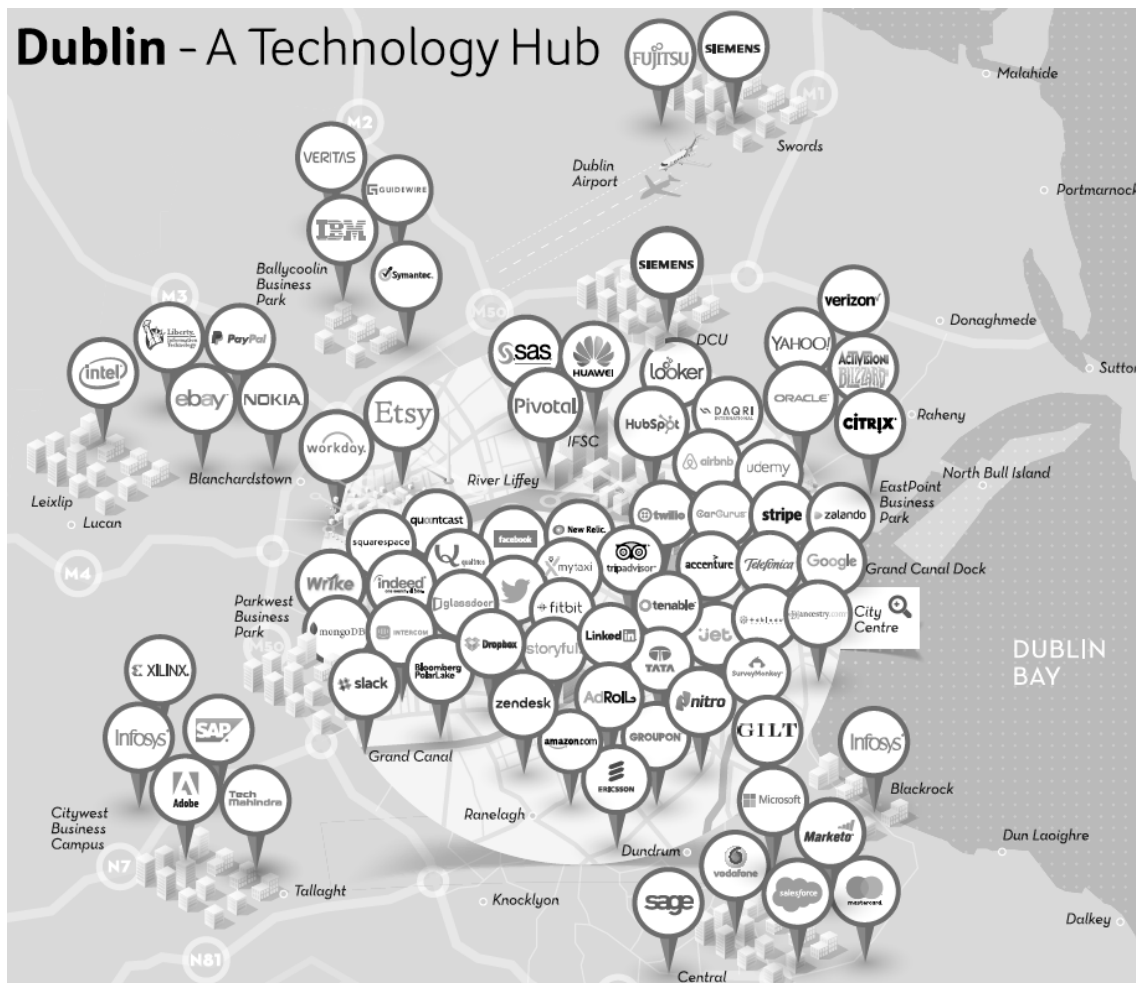


Figure 14 Dublin Tech map (IDA Website)

3.7.1.2 Boundary setting – Internet companies

The search yielded 35 internet-based multinationals with a presence in Dublin (IDA, 2020). To establish industry boundaries, data from multinational corporations was collected from various databases, including the OECD, ORBIS Europe, Enterprise Ireland, and IDA. Initially, the boundary was chosen to be ICT companies as classified by the OECD. However, software and telecommunications infrastructure firms were barred from capturing the Dublin context described above. As a result, internet (based) companies were set as the boundary. *Internet companies* generate revenue through online sales, financial transaction fees, paid advertising, cloud services, and a host of other business lines (Boolmenthal, 2020), and include platform, cloud services, and online retail companies.

Documents containing the spinout process were collected which served as a secondary source of information about the spinout mechanism and its evolution. These also served as tools for interacting with the informants (Forster, 1994). The search for founders was divided into three stages: 1) a web search, 2) a company database (Techireland.org), and 3) a social media search (using LinkedIn premium search). First, the web search was conducted with various search strings, such as "ex- (company name) AND founder", "former (company name) AND CEO", "multinational AND founder", etc. This search led to the identification of twelve founders. Second, Techireland.org and 1000.ie were searched because they contain the largest dataset of multinational companies in Ireland, as well as the largest dataset of global companies and startups (2,760 startups and 385 multinationals)². Thirty-five multinational firms were classified as internet companies. The founder profiles of 2,760 startups in TechIreland.org identified 15 additional founders. Third, an in-depth search was conducted using LinkedIn premium search function. The LinkedIn premium search identified 43,000 potential founders and CEOs in Dublin with the search string "Founder AND Dublin" OR "CEO AND Dublin". From this search, a filter was applied to identify their previous employment history in multinationals. The refined search yielded 767 additional founders (797 in total) from the thirty-five internet MNEs mentioned above. The LinkedIn results were manually verified and cross-checked against the previously identified founders. The following ex-MNE founders were excluded: 1) sole entrepreneurs, 2) multinationals based outside of Ireland, and 3) less than one year of working experience to ensure the reliability and transferability of knowledge spillover. Lastly, data duplication from the three steps was checked, and 36 spinout companies were identified, including 36 founders and nine co-founders who previously worked in multinationals. Figure 15 below illustrates the data search process.

² TechIreland.org Sector: Agri/Food, Consumer/eCommerce, Green/Energy, Health/Medical, Fintech, Education, Enterprise Solutions, Industrial Technology, Telecom Tech, Social Media/Advertising, Security/Safety, Entertainment/Sport, Travel

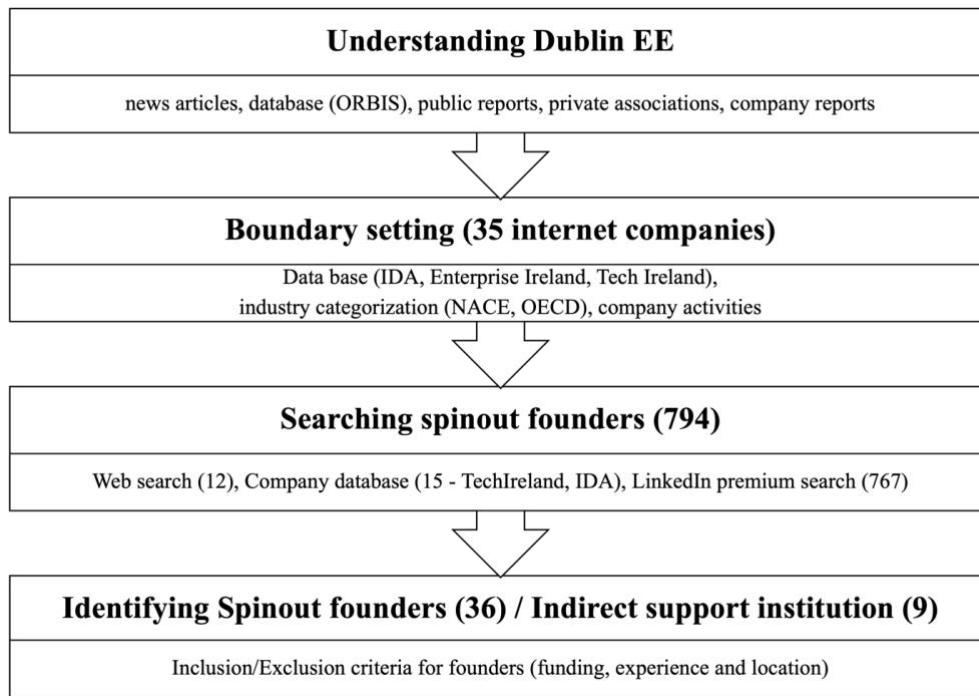


Figure 15 Data collection process

3.7.2 Interviews

In the empirical paper, interview selection was based on a specific logic. This study looked at the entire list of actors in Dublin Internet EE (ex-MNE founder, VCs, accelerators, government agencies). From those, thirty-six interviewees - 27 founders (including dissolved and exit founders), four VCs and angel investors, three accelerators, and two government institutions - have responded to the interview invitation (See Table 6 below).

Table 6 Summary: primary and secondary data collection

	Founders (active)	Founders (exit/dissolved)	VCs	Acc	Gov't	Total
Interview	23	4	4	3	2	36
Archival data	13	1	2	1	2	19
Total	36	5	6	4	4	55

*VC = Venture capital / Acc = Accelerators / Gov't = Government agencies

The rationale for the inclusion and exclusion criteria of the founders are as follows. First, since the interview questions were aimed to capture the learning experiences while working in multinationals, founders with MNE working experiences of more than one year were chosen. Second, in order to assess the scalability of the ex-MNE companies, only companies that received

funding were included and sole-employed agencies, coaching, and consulting were excluded. Lastly, only companies that was headquartered and maintain the operation in Dublin were selected to capture the context.

In 2019, three pilot interviews were conducted to improve the quality of the research design and the relevance of the research questions (Saunders, 2011). The pilot included three ex-MNE founders. The founders from the pilot study were ex-MNE founders; however, they were not from Internet companies - the boundary was later set in the secondary data collection phase. Interestingly, the pilot interviews highlighted the importance of organisational learning in the multinational as it influenced the founding process. Preliminary findings from the pilot interviews identified mixed messages regarding the performance of the ecosystem. Some entrepreneurs valued their prior work experience in an MNE as it encouraged the spinout. They acquired global client experience and the ability to read the context in which organisational decisions were made. The MNE's high-profile networks aided spinout founders in obtaining easy access to capital. Others argued that the Dublin EE was hollow for a variety of reasons. Because job security is important and there is a high cost associated with venture failure, potential entrepreneurs stay in high-paying MNE positions. Second, MNEs tend to focus on lower-level activities such as operations, customer service, and finance, resulting in less knowledge accumulation to launch a new venture.

During the initial primary data collection period, twenty-seven founders were interviewed (This includes three interviews via email). To broaden the context of the Dublin EE, two angel investors, two venture capitalists (VCs), three accelerators, two government investment agencies, ex-MNE founder networks, and private associations were interviewed after the initial data collection period. The list of interviewees has been anonymized in Table 7 below.

Table 7 Interview List

ID	Current position	Prior experience	Sector	Duration (min)	Mode
F-1	Founder	Google	Health	30	Interview
F-2	Founder	Google/Twitter	Ecommerce	50	Interview
F-3	Founder	Google	Enterprise Solution	-	Email
F-4	Founder	Google	Ecommerce	35	Interview
F-5	Founder	Zendesk	Retail	30	Interview
F-6	Founder	Groupon/ Salesforce	Brand management	-	Email
F-7	Founder	Twitter	Data security	30	Interview
F-9	Founder	Salesforce	SaaS	30	Interview

F-10	Founder	Twitter	Media	30	Interview
F-11	Founder	DocuSign/eBay	Data security	35	Interview
F-12	Co-founder	DocuSign			
F-13	Co-founder	Groupon	SaaS	35	Interview
F-14	Founder	Google	Health	30	Interview
F-15	Founder	Google (Fitbit)	Travel	25	Interview
F-16	Founder	Google,Facebook	HR	-	Email
F-17	Founder	Intercom	HR	30	Interview
F-18	Founder	Intercom	Fintech	30	Interview
F-19	Founder	Google	Food	30	Interview
F-20	Founder	Facebook	Fintech	30	Interview
F-21	Founder	eBay	Cleantech	30	Interview
F-22	Founder	Stripe/Zalando	SaaS	30	Interview
F-23	Founder	Google	Health	30	Interview
F-24	Founder (acquired)	Google	Retail	30	Interview
F-25	Founder (acquired)	Google/eBay	Pest control	35	Interview
F-26	Founder (dissolved)	Google	Marketing	30	Interview
F-27	Founder (dissolved)	Google	Marketing	30	Interview
A-1	Accelerator	-	IT	30	Interview
A-2	Accelerator	Facebook	IT	30	Interview
A-3	Accelerator	-	IT	30	Interview
V-1	VCs	Google/Facebook	IT	35	Interview
V-2	VCs	-	IT	35	Interview
V-3	Angel investor	-	IT	30	Interview
V-4	Angel investor	-	IT	30	Interview
G-1	Government agency	Facebook/Google	Tech	35	Interview
G-2	Government agency	-	Tech	40	Interview

Before the interview, the interviewee was informed about the research context via instant messages in business social media platforms (LinkedIn, Facebook). Due to COVID, the majority of the follow-up interviews were conducted via Zoom with the interviewees' consent, were

recorded, and then transcribed. Furthermore, when transcribing the recorded interviews, the tone of the interviewee's responses was also noted within the transcript to enhance the meaning of the responses.

The interviews were in-depth, and semi-structured to capture the context of the low number of MNE alumni spinouts. In-depth interviews were employed to understand the mechanisms from open-ended responses of the interviewees. The semi-structured interviewing style was also adopted to understand the interviewees' personal experiences and capture the different organisational contexts (Saunders, 2011). An interview guide was developed, and while some questions were omitted and added during the interview process, the interviewer remained consistent with the central themes of the research.

Furthermore, the order of the questions was adapted, allowing for more free-flowing interviews and rich personal experiences. In addition, interviewer asked for a more detailed explanation of some of the responses of the interviewees. The majority of the interviews were conducted between January and July 2020 and April and June 2021. The interpretation of the qualitative interview data was an iterative process of data collection and analysis. In 2021, the interviews were mostly follow-ups. To ensure data security, all interview recordings are encrypted and securely stored in according to GDPR.

Furthermore, they are all backed up in encrypted cloud storage that is supported by TCDs IT Department. The interviews were limited to an hour in length in order to allow the interviewee to focus on the pertinent topic. In addition, several follow-up interviews were conducted. NVivo software was used to organize the transcript after conducting the interview. During the coding process, the software was also used to summarise the codes. The overall interview schedule is introduced in Table 8. Finally, Table 9 illustrates the data collection period.

Table 8 Interview schedule

Interviewee	Purpose	Questions
Founders	Icebreaking	- Do you miss the free food in the cafeteria while you were working in the multinational?
	Motivation	- Why did you quit and start your own business? -Where was the business idea from? What was the spinout process?

		-Why did you leave the multinational? -Did you have a chance to present your idea in the multinational?
	Founder numbers	-Why do you think there are so few ex-MNE founders like you? -What makes it so hard to leave?
	Snowballing	-Do you know any other ex-MNE founders?
Supporting organisation (VCs, accelerators, government agencies)	Founder numbers	-Why do you think the numbers of ex-MNE founders are so low?
	Interconnectedness of the Dublin EE	-What is missing in Dublin EE?
	Founder's motivation	-What aspect do you prefer from the founders if you are investing/supporting?

Table 9 Data collection period

Year	Data collection	Interview	Detail
2019-2020	Archival + interview	Founder interviews	Motivation for starting a business/ Why so few?
2021	Ex post expert interview	VCs, Accelerators Government agency	Data triangulation: founder list and why so few?

3.8 Data analysis

For the data analysis for empirical study (paper 3), Gioia method was applied that provides a two-phase process to achieve systematic data reduction (Alaassar et al., 2021; Gioia et al., 2013). When analysing and manipulating data collected from organizations and individuals, there are some contextual challenges. As a result, “sensemaking” was critical in order to contain the data's richness, dynamism, and complexity (Webb & Weick, 1979; Weick, 1995). Furthermore, sensemaking lends support to the idea that different theories can emerge from the same data. Closing the gap between theory and data can begin at either end or iteratively between the two. Instead of applying the purely inductive reasoning and grounded theory proposed by Glaser and Strauss (1968), this thesis uses interpretive sensemaking that involves in theory building. The theorising process consists of both inductive and deductive methods (Noon et al., 2000).

Qualitative studies argue that it is artificial to construe the interview and the analysis since they proceed collectively (Golden-Biddle & Locke, 2007; Langley, 1999; Lincoln & Guba, 1985). In that it captures specific terms, codes, and categories, first-order analysis is similar to the open coding process proposed by Strauss and Corbin (1998). Corley and Gioia (2004) stressed that it is possible to “get lost” when categorising primary data initially as the number of categories tends to multiply and become too large and confusing.

The analysis began with an examination of the transcripts of the interviews. For organizational purposes, the transcripts were imported into the NVivo program. Then, for each response relevant to the interview question, a specific node was assigned so that it could be identified and coded later. Reading, listening to, and interpreting the transcripts repeatedly to verify the relations between the first-order concepts ensured adherence to the response terms. In the open coding phase, 32 nodes were constructed. Each of these nodes was checked again for duplicate meanings. Also, when terms were reflected in the same context, they merged. A high rental price, for example, was combined with a high housing price to reflect a high cost of living. When analysing the data, it became apparent that some interviewees were using 'function' and 'activity' and 'low-value job positions' interchangeably; as such, these terms were integrated as signified in the node 'low MNE activity'.

After excluding the duplicated nodes, a total of 10 first-order codes were created and finalised. Also, the nodes were aligned according to the most frequently mentioned in the interviewees. For triangulation, I conducted follow-up interviews with founders to confirm which nodes were the most important factor for 'Why so few?' questions. To increase credibility and reliability, members of supporting organizations, such as VCs, accelerators, and government officials, were asked follow-up questions about ‘why so few?’ This alignment was critical, considering the frequency of the nodes and the importance of the context.

Gioia et al. (2013) highlighted that once the first-order analysis is completed, it is possible to identify the similarities and differences between the different categories, similar to the axial coding process. This process reduces the categories to a manageable number. Once the first-order analysis is completed, the interviews with the founders were bundled or labelled into themes. During this stage, the researcher acted as the 'knowledgeable agent,' searching for theoretical themes using gestalt analysis (Gioia & Chittipeddi, 1991). The codes were bundled into five second-order themes during this phase. This was accomplished through iterative and abductive reasoning, meaning that the themes and bundling process were probed and questioned. After the second-order analysis, the extracted themes were compared to the theoretical explanation. The relevant themes were then summarised into aggregate dimensions. The same reasoning was applied to identify the aggregate dimensions. Table 10 illustrates the summary of the first-order analysis.

Table 10 Summary of Analysis

1st Order Concepts
High local cost “You meet lots of young talented people, but they're paying crazy rent. And you know what happens to them, they go and live in Barcelona, or the Canary Islands or somewhere that's cheaper to live, and they're still working for an Irish company, perhaps, but they're not living in Ireland, or Dublin anyway. So that's that. It's just a simple fact of life in Ireland.” (F-1)
Meagre early-stage capital “But there is a kind of expectation that there's some follow-on funding there, which often isn't, isn't available. And so after that, initial angel investment we got, you know, we ran out of money, you know, put money in ourselves, and we got a strategic investor from France to put money into the company.” (F-3) “I suppose in terms of investment. And then the second problem with that is, I don't think there's any venture capital firms in Ireland at all, I think they masquerade as venture capital firms. And what they actually are private equity growth firms, is they're investing in businesses that are that are what I would class as late stage, these businesses are proven. If strong revenues in the multi Indian in maybe 10 million plus, before an Irish VC gets involved. That's not venture capital. That's, that's, I mean, that's private equity.” (F-12)
Paltry incubators, mentoring and role models “Here are there are some places like you should be and so on the deNovice, the centre and NOVA UCD. And there are startup phones there. But they tend to focus on super, super big, lofty ideas around AI and, you know, renewable energy and so on very unattainable. And for most entrepreneurs.” (F-14) “I have a really strong sense that we are that we are able to build great companies here in Ireland, and in great companies here in Europe, there are definitely impediments like, like this the whole way the tax system is set up isn't does not really incentivize entrepreneurship. But, but definitely, I feel like Europe is Europe is not bringing much to the party on tech at the moment, all they're doing is bringing a bunch of annoying legislation. US is bringing innovation, China's bringing in innovation, and Europe is bringing legislation. And, and I do think Europe needs to start really stepping up and being more at being seen more as a place of innovation.” (F-16) “You know, it's kind of two different parts that I think there is a small business culture and so you know, going out and doing your thing, or whatever. But there isn't the second-generation success stories of founders who were massively successful and invested in other stuff. And that's changing a bit now with quite a few Irish unicorns emerging. So you hope that they start to put money and expertise into more our founders.” (F-11)

“Again, success breeds results, right. And that's actually part of why I'm doing it here is, I believe that, you know, the first one will work and second one will work but maybe the third one will do it. For the fourth one, we'll do it, you know, so you have to adjust yourself, then start over and go. I'm just committed to creating a global success story from our doorstep and will encourage us to actually invest in other people with the same ambition.” (F-14)

Tax relief / capital gains tax disincentives

“And there isn't there you don't get upfront investments from the tax, the tax code, that underpins the investment environment needs to be improved to allow more investment in small companies at an early stage. So that there isn't so much risk and financial pain for an investor. You can't blame the investors. But that situation has led to there's just a lot of people who are you might call them tire kickers, they're kind of sniffing around looking for something easy. And they might say, oh, I'll give you 10 grands, but I want 15 or 20% of your company. And you know, this is not very useful for a startup like theory stage, you want a proper investment 50 to 100 250 for reasonable expectations of equity. And it's hard to find that type of investor, you know, you'll get 25 or 50 from enterprise Ireland, you might spend a lot in year to 18 months and then beyond able to find anything after.” (F-1)

Low-order (customer-facing) MNE activities

“And I'm not sure that the multinationals here when you look at the skill profile that that many of the people that are actually working here have actually got the core product technical skills to actually build leading solutions.” (F-12)

“And so, you, you traditionally then have these jobs, which are very much based on and folks who are either A in Project programme management when an engineering or folks then who are basically on the sales side of things are working on the softer sides of business, and they typically don't lend themselves to people who would spin out and found on businesses that are product related based and rather than so I that's one big element, the roles in Dublin they don't actually live themselves.” (F-7)

Centralised intrapreneurship

“And I think within Google itself, I was part of there is a lot of Google for entrepreneur's work happens within there. But it's, it's more a PR exercise of being part of the Dublin community than driving entrepreneurship. And so, I was involved with helping and put on like startup weekends, the Startup Grind was on every week. So, I used to host stuff, I used to be the guy who helped the guys get the room and arrange the access and all the security badges. So, I was attempting from winning Google to be part of that ecosystem, and kind of been like meeting people and trying to build a network etc. but in general, trying to encourage people in there to be part of it

was very little, then area 21 started. So, it's a big thing in Google in the US where you can pitch a business, and then Google may move you into an in-house incubator, but all of that in San Francisco is really hard to reach. It's very difficult to get anywhere nearby. And so, unless you really have the opportunity to push yourself and then they're not really driving you to do that.” (F-7)

Retention incentives (stock option)

“But the RSU is a huge factor from a retention perspective, but also a total comp perspective. Like, you look at the tech companies that are in Dublin, and the amount of capital that's coming in, that's coming into, you know, Dublin households because of RSU is just phenomenal, and the Exchequer is benefiting massively from that as well. Because RSUs r, are effectively cutting tax at the marginal rate. Ultimately, yeah, 120,000. By the time, by the time the tax gets out that and your daily expenditure of childcare and all that, you know, you know, yourselves guys, that stuff goes, that's just, you know, it's like any kind of salary is ephemeral. And, you know, you get used to it, you get used to it, but the RSUs, that's a meaningful thing.” (F-16)

Handsome remuneration

“And my biggest problem is that a lot of the people that I know who started out in Twitter, and that have left Twitter have gone to other multinationals. And there are people now as I say that I've never known known a job where they've got fresh avocado in the morning. There are people now who are probably in the middle of their careers that literally started out with Google or Apple 15 years ago, that would never ever leave those companies. And it is like having a prize crown jewel of these talented Irish people locked away in another Museum in another country.” (F-7)

Strong repatriation pull

“One is that because Dublin tends to be the European headquarters, it tends to have an overwhelming number of staffs that aren't indigenous, right, so they aren't from Ireland in the first place. So that when they are there, you'd be surprised how many of them aren't actually necessarily happy to be in Ireland, either. So, a lot of people that work in Google, if they had their say, would be working in their domestic market. So, all the French people working in Google Ireland, and in Facebook, Ireland, if they give the option opportunity, they would say, No, I want to do the same job. But I want to be located in France” (F-13).

“Even a majority of ex-Googlers in Dublin, I would say are international folks not as Irish folks. And if they've international folks leave Google and start a business, they typically return to the cities or ecosystems where belonging. So back to Berlin, they might go to, you know, our to back even to the states and some of these folks, and they go, we'll take it there.” (F-7)

Mobile early-career employees

“I mean, the attractiveness of these companies is that it's really stable, like they pay really well. It's great experience to have on your CV. It doesn't necessarily attract potential founders. I mean, I suppose a lot of I don't know what your research has shown, but there's probably people who go there, you know, if they're entrepreneurial, or if they're going to start a business they do, what's your earlier like, they do it in their 20s, or they do it straight away out of college, and maybe then they get a job if it doesn't work, but they go back to it.” (F-6)

“Or they're after they're at the point that they're right there at the right point in life, age wise. But they can't really take the risk, because they won't have anywhere to live if things go wrong. You probably know from your research that most successful startups are actually not performed by young 20-year-olds, they're actually formed by older people. I'm 42. And so I'm not. Yeah, I think I'm kind of in the age, in that age bracket of the older founder.” (F-1)

After the 2nd order coding process, I discovered that the nodes could be categorised into multi-level, meaning that the nodes were used from institutional level (infrastructural barriers, insufficient supports) to the organisational level (sparse innovation), and the individual level (high local cost, tax relief and capital gain tax disincentives, meagre early-stage venture capital, paltry incubators & role models). Detailed findings of the coding are shown in Chapter 6 (Paper 3).

3.9 Research Ethics

This thesis adhered to TCD's ethics guidelines as well as the GDPR guidelines. Before the interview, all interviewees were given information leaflets and an interview consent form. The leaflet contained information about 1) research project, 2) background and motivation for the research, 3) methods and duration of the research interview, 4) possible risks, and 5) use and storage of the data. The information was made available in both soft and hard copy, and it was reiterated. Each interviewee provided an understanding of the same just before the interview began. Once participants agreed to be interviewed, signed consent was obtained via encrypted softcopy. Prior to data collection, all participants agreed to maintain confidentiality in reporting the results, except when the participants agreed to be identified by name in the text or through direct quotations. In such cases, quotes were shown to the participants for approval. Almost all results have been reported in aggregate form, with the names of individuals and firms obscured. The documents, such as the interview articles used, were either freely shared with me by the participants or were publicly available.

4 Paper 1: Complementary Frameworks for Examining Global Innovation: Aligning GVCs, Industrial Clusters and Entrepreneurial Ecosystems

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Abstract

This chapter discusses the importance of production clusters and entrepreneurial firms to continuously generating innovation if they are to sustain their long-term competitiveness in today's global economy. The study of the complexity brought about by globalization has been investigated by the global value chain (GVC) framework, which has improved the understanding of how clusters and firms compete globally. However, neither the cluster theory nor the GVC framework address firms' innovation through an explicit dynamic perspective and dedicate only partial attention to the role of entrepreneurial ventures. This chapter draws on elements from the developing entrepreneurial ecosystems literature to complement the cluster-GVC perspective and offer a finer-grained approach to the study of innovation in the global economy.

Keywords: Innovation; Global Value Chain (GVC); Entrepreneurial Ecosystems; Industrial Clusters

1. Introduction

The rules of the game for global innovation are in a perpetual process of change and adaptation. One recent realization is that in order to generate innovation and survive in today's volatile economic scenario, it is fundamental for industrial clusters to tap into global value chains. Conceived in the late 1990s as a new approach to investigate the ongoing global fragmentation of production (Gereffi, 1999), the global value chains framework (GVCs), has had contrasting effects on the competitiveness of industrial clusters. On the one hand, the spread of GVCs has increased the competitive pressure on industrial clusters and their firms, adding new low-cost competitors to the competitive landscape. On the other, however, GVCs have provided traditional industrial clusters with the opportunity to participate in the global economy, acquire new competencies, gather innovative inputs, and ideas. As a result, instead of being seen as two alternative forms of industrial organizations, we contend that GVCs and industrial clusters are two sides of the same coin, whose boundaries are increasingly intertwined, constantly changing over time and across space.

Understanding how firms in production regions develop innovation in a context of GVCs requires a dynamic perspective and an assessment of the factors underpinning the generation of new products, processes, and entrepreneurial ventures in both traditional industries and unknown technological spaces. The idea of evading the 'specialization trap' by absorbing or developing new competencies in novel technology domains stems from a pivotal concept in economic geography: the evolutionary nature of economic systems (Frenken, 2006; Klepper, 2002; Martin and Sunley, 2015). However, to date, there has not been any systematic attempt to assess the development of new competencies and the generation of innovation at the intersection of industrial clusters and GVCs through an explicit dynamic perspective (Ács et al., 2014). In recent years, the ability of a production region and its firms to evade technology ensnarement and to generate innovation in the global economy has found support in the emerging form of entrepreneurial ecosystems (Ács et al., 2014; Ács et al., 2017; Autio et al., 2014; Isenberg, 2010; O'Connor et al., 2018; Spigel, 2017; Stam and Spigel, 2017). Entrepreneurial ecosystems thinking is founded on the assumption that entrepreneurs are responsible for pushing the boundaries of a given production region towards new geographical and technological trajectories.

In this chapter, we contend that the emerging entrepreneurial ecosystem literature can help us shed further light on the way innovation is carried out in the global economy. By adding an explicit focus on entrepreneurs as the triggers of local innovation development, often from global connections, the entrepreneurial ecosystem framework can strategically complement and advance the study of innovation in clusters and GVCs. Specifically, by proposing a new approach to investigate how innovation develops across countries, we emphasize the role played by

entrepreneurs and entrepreneurial venture in facilitating the integration of local and global knowledge and mixing them into new products, processes, or business models. Entrepreneurs, in this context, are the glue that sticks together the different inputs, resources and ideas that are necessary to generate innovation and ultimately integrates local innovation systems into GVCs. We conclude the chapter by setting out a research agenda for this new approach to global innovation.

2. Innovation in Global Value Chains

Over the past twenty years, the development of the Global Value Chains (GVCs) analysis has profoundly changed the way scholars, practitioners, and policymakers assess and understand the global economy. Conceived in the 1990s on the cusp of the last wave of globalization, the GVCs framework has introduced a new approach to the study of inter-firm transactions across borders and more generally in the organization of the global economy. One of the major novelties introduced by the seminal work of Gereffi on *Global Commodity Chains* (1994) was the attempt to make sense of the growing integration of the global economy through an original lens of analysis, the value chain. Back in the 1990s, the concept of value chain was not new per se, as it had been already introduced by the works of Michael Porter (1985) and Bruce Kogut (1985) in the previous decade. Gereffi's original contribution, however, originated from his analysis of the organization and governance of commodity/value chains across countries, hence introducing a radically new approach to the study of the international economy. This specific aspect of GVCs analysis stemmed from, and was enabled by, the understanding that the global integration of markets was no longer limited to multinational corporations' foreign direct investment (FDI), but rather from the increasing spreads of global production networks, where inter-firm transactions were only partially coordinated through equity forms of governance (Gereffi et al., 2005).

As the value chain gained momentum as a new lens of analysis, new methodological and theoretical dilemmas arose. Among them, the need to quantify the economic value generated and distributed in GVCs and the comprehension of the micro-dynamics underpinning firms' interactions and performances in GVCs emerged as two of the most pressing dilemmas. Especially in the field of business studies which, unlike economic studies, looks at the role of specific economic agents in influencing and shaping macroeconomic trends, the lack of reliable data about the value created in GVCs and the performances of the agents participating in them emerged as a substantial methodological limitation. Overall, while the use of the GVCs framework has permitted a focus on the meso to explain the macro phenomena characterizing the global economy, our understanding of how micro-dynamics influence GVCs remains largely uncertain to date.

Small firms do not all compete in the same way within ever more complex production architectures. According to the existing trade literature on heterogeneous firms (Bernard et al., 2007; Melitz, 2003; Melitz and Redding, 2015), larger and more productive firms tend to perform

better in international markets. However, economic crises shape the relative performance of multinational companies (MNEs) as well. Manello et al. (2016) show that small firms are generally less efficient along the value chain but given their higher flexibility are better able to react to the crisis. Overall, the diffusion of GVCs has had contrasting effects on the performance of small firms in the global economy. On the one hand, the sophistication of value chains has created higher entry barriers for smaller firms, especially for those lacking previous international experience (e.g. Majocchi et al., 2005; Schweizer, 2012). On the other hand, the global fragmentation of value chains has opened up new opportunities for small firms, supporting their international expansion in new sectors and markets and enhancing their innovation potential by linking them to new sources of knowledge (e.g., Montalbano et al., 2018; Reddy et al., 2020; Ryan et al., 2020). Agostino et al. (2020) argue that SME participation in GVCs leads to greater efficiency, although this gain is especially noteworthy for suppliers in relational GVCs. Brancati et al. (2017) find relevant heterogeneities in how GVCs participants fared in the 2008 economic recession. While high-skill relational suppliers display a significant propensity to engage in innovative activities and R&D projects, other modes of GVCs participation have no premium compared to domestic companies. This heterogeneity is also reflected in differential productivity and sales growth.

The analysis of how entrepreneurial firms pursue innovation and upgrading across borders is not new in the GVCs field of study. Examples of such analysis can be found in a specific branch of GVCs studies which looks at 'decent jobs' in GVCs and the upgrading of small suppliers in developing countries (e.g. Giuliani et al., 2005). Of particular interest for the analysis proposed in this chapter is the second branch of studies which addresses the upgrading trajectories of clusters and entrepreneurial firms in GVCs (e.g., Amighini and Rabellotti, 2006; Chiarvesio et al., 2010; Humphrey and Schmitz, 2002). These contributions have the merit in advancing the understanding of the interrelation between local or district firms and GVCs, paving the way for a milestone in the development of this specific branch of study, notably the publication of *Local Clusters in Global Value Chain* by De Marchi, Di Maria, and Gereffi in 2018. Common to in all these contributions is the attempt to investigate the linkages connecting local production territories to GVCs and their impact on the evolution of local clusters and GVCs.

As the GVCs and cluster frameworks are becoming more and more interrelated, understanding the implications for regions' and firms' competitiveness has become a central research topic in business, economics and regional studies alike (Cano-Kollmann et al., 2016; Lorenzen and Mudambi, 2013; Mudambi et al., 2017; Turkina and Van Assche, 2018). Of particular importance, in this growing research stream is the analysis of the geography and mechanisms of innovation development across borders (Saliola and Zanfei, 2009). Although still quite underdeveloped in GVCs, innovation has received growing attention in recent times, particularly thanks to the endeavours of business scholars (e.g., De Marchi et al., 2020; Kano et al., 2020). Key in the current

debate on innovation in GVC is the understanding of the impact of the coordination of pre-production and production activities on firms' innovation capabilities. Two lines of reasoning have emerged: on the one hand, scholars, like Dedrick, Kraemer, and Linden (2010) and Vivek, Rickey, and Dalela (2009) argue that the disentanglement of R&D and production functions has little or no impact on firms' innovation potential. In fact, by delegating low value-adding activities to global GVCs partners, leading firms' free up resources which they can devote to innovation activities. We refer to this strategy as the 'innovate here produce there' model (Buciuni and Finotto, 2016). Opposing this view is the co-location argument, which sees the geographical proximity of R&D and production as a fundamental aspect of firms' innovation strategy (e.g., Buciuni and Finotto, 2016; Ketokivi and Ali-Yrkkö, 2009; Pisano and Shih, 2012). The 'co-location effect', however, is heterogeneous across firms. As argued by Castellani and Lavoratori (2020) the impact of co-location of firms' innovation capabilities effect is stronger when firms have limited international experience and geographical dispersion of operations.

Although sustaining opposite arguments, both the 'innovate here produce there' and the co-location logic contribute to explain the dynamics underlying innovation development at the intersection of GVCs and local production systems. As these two systems are increasingly becoming intertwined, the study of innovation dynamics will require addressing them both through a converging research perspective (Scalera et al., 2017). We proceed in this chapter to examine cluster theory as a link from GVC to the evolution of global innovation from entrepreneurial activity.

3. Industrial clusters under globalization

Clusters are agglomerations of firms and institutions where sharing and dissemination, of knowledge occurs (Buciuni and Pisano, 2018; Dyba et al., 2020; Porter, 1998; Pitelis, 2012). Production of both goods and services has significantly changed since the 1980s, and traditional models of industrial organizations have evolved into new paradigms. The challenges for the 'classical' industrial clusters model and the emergence of new models of industrial organizations have been accelerated by the international fragmentation of production (Arndt and Kierzkowski, 2001) and the diffusion of globally dispersed value chains (Gereffi et al., 2005). Central to the classical logic underlying the GVC framework is the role of lead firms, in this case, MNEs, in stimulating and shaping the global fragmentation of production with their growing use of lower-cost foreign suppliers, which specialize in specific production stages. The specialization of locales in discrete phases of production is one of the main implications of the GVCs framework, which aims to provide a finer understanding of the spatial and structural dimensions of global networks.

On the one hand, the GVCs framework seems to augment the classical logic behind localized production regions: activities along production networks are now routinely done by companies specializing in narrower sets of activities, from high-level R&D to design, manufacturing and assembly techniques. Further, the detailed codification of each task coupled with the rapid advancement of ICT, decrease in transportation costs and political processes creating a much more open trade system, mean that these diverse tasks no longer need to be co-located (Gereffi, 1999). Followed to its logical end, increased global fragmentation suggests that since each stage necessitates different capabilities, each locale should specialize in a narrow set of activities in order to become world-class and an innovation hub (Breznitz, 2007). These developments led different locales, such as China, Taiwan, and Israel, to specialize not only in specific industries, such as semiconductors, but also in particular stages of production in these industries, such as R&D, fabrication, or assembly (Breznitz and Murphree, 2011). As a result, while the intersection between MNCs and new global producers forged a new model of industrial organization – more narrowly specialized in specific stages or phases of production – numerous traditional production regions in Western economies faced a situation of eroding competitive advantage. As a result, many of them have either declined or evolved to have a more narrowly stage-specific focus, hence supporting a tendency towards a specialism around firms' activities in the production region. This represents a vulnerability to either technological disruption or cheaper production-region options from emerging economies around the same specialism.

The competitiveness of production regions in a world of GVCs has been incrementally investigated in recent years and has advanced our understanding of the interplay between local and global dynamics (e.g. Buciuni et al., 2014; Buciuni and Pisano, 2018; De Marchi et al., 2017; Perri et al., 2017). Recently, a significant proportion of these studies have focused on firms' strategies and operations management, hence complementing a research domain traditionally dominated by scholars interested in industry-wide dynamics, such as industrial districts, clusters, and production networks. By adding a more explicit focus on the role played by individual firms in bridging the local and global dimensions, business scholars have enriched their research field too with a more holistic and systemic approach.

Large enterprises within clusters can serve as breeding grounds of local entrepreneurship by playing the role of incubators and stimulating the spin-out of high-tech start-ups of related and unrelated varieties (Brown and Mason, 2017; Colombelli et al., 2019; Klepper, 1996, 2007; Ryan et al., 2018; Spigel and Harrison, 2018). As such, large firms act as 'knowledge integrators' within the entrepreneurial ecosystem, facilitate the codification and absorption of new knowledge at the local level, and provide connectivity to new global market opportunities for indigenous firms or aspiring entrepreneurs (Bhawe et al., 2019; Buciuni and Pisano, 2018). Large, often anchor, firms have been shown to profoundly affect the dynamics of a cluster (Buenstorf and Klepper, 2009;

Feldman, 2003; Giblin and Ryan, 2012). These large firms can be inward investing MNEs that may incubate (Acs et al., 2013; Neck et al., 2004) or squeeze out entrepreneurship in a local economy (Audretsch and Keilbach, 2008; Berrill et al., 2020; De Backer and Sleuwaegen, 2003). While undeniable that clusters may provide opportunities for entrepreneurs to emerge and flourish (Delgado et al., 2010; Feldman et al., 2005; Klepper, 1996, 2007; Porter, 1998; Rocha and Sternberg, 2005) cluster theory is more focused on extant firms and their relations. It does not situate the entrepreneur and entrepreneurial origins and activity as its core orientation (Acs et al., 2017; Spigel and Harrison, 2018).

Curiously, however, there has not been any systematic attempt at investigating the heterogeneous evolution of production regions and GVCs from a dynamic perspective. While dynamic perspectives are well established in cluster theory (Klepper, 1996, 2007; Martin and Sunley, 2012) they are constrained by the finite concept of life cycle. This implies eventual decline and termination, albeit often delayed (Narula, 2002). A parallel field to cluster theory endeavoured to introduce the notion of evolution into economic geography (Boschma and Frenken, 2006; Martin and Sunley, 2015; Kogler, 2015). But this field fell short in failing to take account of micro-level dynamics as the principal driver of a region's economic evolution (Boschma and Frenken, 2011; Kedron et al., 2019). The use of real-time longitudinal data remains uncommon, thus making it difficult to track the evolutionary paths of industrial clusters over time and across space; on the other hand, while a more explicit focus on firm-level analysis has been added, the bulk of studies tend to focus on leading firms as their prime unit of analysis (Buciuni and Pisano, 2018; Morrison, 2008). Despite the obvious appeal of the life cycle orientation in cluster theory, its linearity prevents any sense of being recursive as is the case with an adaptive complex system (Adams, 2020; Auerswald and Dani, 2017; Kuratko et al., 2015; Roundy et al., 2018). In the context of industrial clusters, where the generation of new entrepreneurial firms has long been deemed a key mechanism for the emergence of agglomerated industries and the generation of innovation, this emerges as a substantial limitation in this specific research field. Recently, however, a new body of research and policy has emerged that endeavours to rectify this deficiency by placing the study of entrepreneurial firms centre stage in the evolution and innovation dynamics of industrial clusters. This field of 'entrepreneurial ecosystems' considers the key role played by new enterprises in the capacity of industrial regions to generate innovation and compete in today's global economy.

4. The Emerging Contribution of Entrepreneurial Ecosystems

Successful local economies preserve their competitiveness over time by continuously refining and reshaping their knowledge base, and technological boundaries (Buciuni and Pisano, 2018). Those local economies that fail to 'reinvent' themselves are prone to suffer from what Krugman

refers to as the 'specialization trap'. Excessive specializing in a narrow set of economic activities exposes the region to calamities of technological disruption (Narula, 2002; Williams and Vorley, 2014). To survive and prosper, mature local economies have been left with little option but to evade the 'specialization trap' through relentless evolution, adaptation of competencies, and acquisition of knowledge to become productively active in new related or unrelated technological domains (Boschma, 2015; Kedron et al., 2020; Klepper, 2002; Kogler, 2015; Martin and Sunley, 2015; Murmann and Frenken, 2006).

In recent years, local economies have sought succour in the emerging form of entrepreneurial ecosystems (Ács et al., 2014; Ács et al., 2017; Autio et al., 2014; Isenberg, 2010; O'Connor et al., 2018; Spigel, 2017; Stam and Spigel, 2016). Entrepreneurial ecosystems are adaptive and evolutionary. An entrepreneurial ecosystem can mutate from a pre-existing system such as an industry cluster (Autio et al., 2018; Pitelis, 2012) or set of co-located clusters of varying vintages, through technological convergence in related and unrelated branches (Auerswald and Dani, 2017). For instance, Ryan et al. (2020) empirically illustrated how a strong, resilient entrepreneurial ecosystem could emerge from the metamorphosis of an antecedent industrial cluster, primarily via MNE spinouts, and lead the evolution of an entire production region through the generation of innovation. However, they are neither industry nor technology-specific (Auerswald and Dani, 2017; Autio et al., 2018); in fact, their sustainability and evolution hinges on agnostic heterogeneity (Autio et al., 2018). In contrast to other theories (e.g. clusters) where firms and institutions are the essential foci, 'entrepreneurs' are placed front and centre in the entrepreneurial ecosystem concept (Alvedalen and Boschma, 2017). Entrepreneurial ecosystems thinking is founded on the assumption that entrepreneurs are responsible for pushing the boundaries of a given economic system towards new geographical and technological trajectories. Entrepreneurs represent the agents of new knowledge, competence extension, and transformation. This triggers and enables innovation development and facilitate new introductions into the market (Schumpeter, 1911; Shane and Venkataraman, 2000).

The entrepreneurial ecosystem perspective represents a more holistic and finer-grained approach to studying the evolution of a production region and its underlying mechanisms (Audretsch and Belitski, 2017; Cohen, 2006; Isenberg, 2010; Stam, 2015; Stam and Spigel, 2016; Stam and van de Ven, 2019). An entrepreneurial ecosystem generally operates on a grander scale and scope than a conventional industrial cluster and is commonly industry and technology agnostic (Auerswald and Dani, 2017; Autio et al., 2018; Malecki, 2018). Among the features that define the entrepreneurial ecosystem framework, the notion of sustainability has been at the core of this novel research discipline since its early developments (Cohen, 2006). An ecosystem's sustainability derives from the introduction of heterogeneous variation and adaptation that can extend an entrepreneurial ecosystem's lifespan (Boschma, 2015; Colombelli et al., 2019; Malecki, 2018;

Roundy et al., 2018; Ryan et al., 2020; Spigel and Harrison, 2018). As a result, the resilience and long-term competitiveness of an entrepreneurial ecosystem spring from coherence around specialism in its early existence (Roundy et al., 2018; Spigel and Harrison, 2018) and heterogeneity from the later diversity introduced by new firm formations across multiple technologies (Malecki, 2018). The combination of these two dynamics is what generally leads to the development of new technological solutions and new entrepreneurial ventures in both related and unrelated industrial domains.

An entrepreneurial ecosystem is rooted in place with a relatively distinct geographic boundary within which is contained mutually dependent components (Adams, 2020; Auerswald, 2015; Brown and Mason, 2017; O'Connor et al., 2018; Stam, 2015). However, even under conditions of localness, global connectivity is important for the success of local entrepreneurial ecosystem under the auspices of modern globalization. The successful local ecosystem can serve as a global pipeline for entrepreneurs in the region. However, most empirical studies on entrepreneurial ecosystems to date have focused on a single region (Adams, 2020; Cohen, 2006; Spigel, 2017). Few scholars have emphasized the importance of inter-regional, global linkages (Alvedalen and Boschma, 2017; O'Connor et al., 2018). The entrepreneur can play a dual role internally conferring innovation within the ecosystem and externally for driving cross-border innovation is critical. Diverse empirical case studies from Tel Aviv to Santiago show that attracting transnational entrepreneurs can enhance the ability to acquire resources that are limited in purely indigenous entrepreneurial ecosystems (Harima et al., 2020; Schäfer and Henn, 2018). Some scholars (Malecki, 2018; Mason and Brown, 2014) have broken new ground and emphasized the importance of global linkages. Others have indicated the role of multinational enterprises (MNE) in anchoring the entrepreneurial ecosystem and incubating local entrepreneurship by born global entrepreneurs. MNEs can act as drivers of entrepreneurial ecosystem and attract highly entrepreneurial individuals who form a dynamic resource exchange within the cross-border and inter-regional boundaries (Autio and Cao, 2019; Bhawe and Zahra, 2019). Ryan et al. (2020) illustrate how embedded MNEs that become centres of excellence for R&D can incubate high-tech entrepreneurs with a born global mentality. In order to gain deeper insight into the processes of global innovation, it is useful for future research to understand the external mechanisms that enable valuable resources and knowledge to flow into, and out of the ecosystem, thereby promoting its evolution and continued sustenance from global connections.

5. Concluding remarks: Towards a New Research Perspective

The literature review conducted in the previous sections has highlighted the importance of investigating processes of global innovation through a multidisciplinary perspective. Drawing on

industrial clusters, GVCs and entrepreneurial ecosystems, this chapter underscores the need for mixing elements from different disciplines in the study of a complex phenomenon like firms' innovation in today's global economy. Particularly for production regions and firms, whose sources of competitive advantage still hinge on their ability to arrange and orchestrate complex value chains which are influenced by the ever-changing rules of globalization, drawing on a single lens of analysis might not suffice. Recognizing this constraint, in recent years, we have witnessed the growing intersection of two separate yet interdependent theoretical frameworks — notably industrial clusters and GVCs — and the genesis of a well-defined body of studies. Central to this new line of research is the analysis of the competitiveness of clusters and firms in a context of GVCs. Innovation, however, has only received partial attention to date, hence suggesting the existence of a substantial room for further research. Existing research has mostly investigated the relationship between pre-production and production activities in GVCs, and whether their separation or co-location affect firms' innovation strategy and capabilities.

Despite advancing our understanding of the dynamics sustaining firms' innovation in the global economy, neither the cluster theory nor the GVCs framework propose an explicit focus on the micro dynamics underlying innovation. Mostly concerned with a meso level of analysis, both these research approaches have seldom investigated the role of entrepreneurial firms in innovation development. While we recognize that a growing number of studies lately have been adding an explicit analysis of the way leading firms compete at the intersection of GVCs and local clusters, little is still known about how entrepreneurial firms participate in and contribute to global innovation development. Entrepreneurial firms have been shown to be at the forefront of industries' evolution, generating innovation in new market niches and technological domains that larger firms generally overlook.

A second and related area for further research in the study of innovation concerns the use of a more dynamic perspective. Innovation is, in fact, a dynamic phenomenon, the development cycle for which might last several years and include numerous actors in multiple geographical locations. As a result, we contend that the understanding of innovation development in the global economy requires a dynamic perspective that can allow tracking and assessing the micro dynamics underpinning innovation over time and across space. To date, very little research in cluster and GVCs studies has assessed firms' competitiveness and innovation through a real-time longitudinal approach, hence limiting our understanding to a rather static research perspective.

Both the need for a finer-grained level of analysis and a more dynamic perspective of innovation development can be tackled through the use of a relatively new lens of analysis, the entrepreneurial ecosystems framework. Central in this research approach is the role of entrepreneur as triggers of innovation development and engines of industries' evolution. The use of entrepreneurs as prime unit of analysis allows the comprehension of the micro-dynamics whereby a production

cluster can evolve into new technological domains and generate innovation in novel market niches. Through spinoffs and spinouts, entrepreneurs use local knowledge and mix it with new competencies and ideas to generate innovation. While local knowledge is typically embedded in long-established cluster firms, new innovative inputs can come from the global economy and are transferred into local production systems through GVCs. Mixing local and global knowledge, entrepreneurs can be seen as the glue that sticks together different pieces of knowledge and gives shape to innovative business models, products and processes.

Overall, while drawing on the expanding entrepreneurial ecosystems literature can enhance our comprehension of how innovation unfolds in today's global economic scenario, we by no means suggest that this research framework should supersede the use of cluster theory and GVCs. Rather, we contend that it is only by using these three distinct lenses jointly and judiciously that we can fully grasp the complexity underpinning innovation in the global economy. The recent combination of cluster theory and GVCs has enabled a finer analysis of the geographical and organizational arrangement of industrial processes in today's economic landscape; the addition of the entrepreneurial ecosystem framework offers a complementary perspective to investigate the underlying dynamics of innovation development across countries.

6. References

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5 Paper 2: Evolutionary Entrepreneurial Ecosystems: A Research Pathway

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ABSTRACT

The recent widespread interest of policy in entrepreneurial ecosystems has been complemented by a burgeoning academic research output. This research to date may be broadly categorised as focusing on place, actors, governance and evolution. Of these groupings, evolutionary processes have been paid least attention despite their centrality to a dynamic ecosystem phenomenon that evolves from an origin through processes of growth, adaptation and resilience. To redress this imbalance, we frame a future research agenda on evolutionary processes of entrepreneurial ecosystems. Foremost amongst these are the competing lens for the evolutionary processes; the appropriate and evolving geographic scope and boundaries of the ecosystem; and the evolving visible or invisible modes of governance. Methodologically, we call for greater use of longitudinal studies of such evolutionary processes.

Keywords: entrepreneurial ecosystem, evolution, governance, adaptive, lifecycle, longitudinal, review

PLAIN ENGLISH SUMMARY

Entrepreneurial ecosystems are by their nature evolutionary, a consideration surprisingly under-emphasised in a burgeoning literature. The allure of entrepreneurial ecosystems' potential has captured the interest of a broad swathe of researchers across a variety of fields, and policymakers hankering after the elixir for local economic growth. But with the increased volume of literature has come a fragmentation in the field that has shifted the research agenda away from its core foci in building a theory with concrete policy utility. To recover territory, we conduct a systematic literature review that first illustrates this exponential growth in the EE literature and some fragmentation. We then employ thematic analysis to create four fundamental categories that constitute the underpinnings of the EE concept: place, actors, governance and evolution. Of these the least explored is the evolutionary dynamics and processes. We advocate for a greater emphasis by researchers on these evolutionary dynamics of the EE and present a roadmap for future research across multiplex dimensions of these processual phenomena.

1. Introduction

Successful local economies continuously refine and reshape their knowledge base and technological boundaries to preserve their competitiveness over time (Buciuni and Pisano 2018). This has emerged as an essential condition for their future prosperity and long-term sustainability. Others that fail to 'reinvent' themselves may fall into what Krugman refers to as the 'specialization trap'. Excessive specializing in a narrow set of economic activities is deemed detrimental to the long-term competitiveness of a mature regional economy (Hassink and Shin 2005; Narula 2002; Williams and Vorley 2014) as this makes them vulnerable to others' comparative advantages. To survive and prosper, mature local economies have been left with little option but to evade the 'specialization trap' through relentless evolution to become productively active in new related or unrelated technological domains (Boschma 2015; Kedron et al. 2019; Klepper 2002; Kogler 2015; Martin and Sunley 2015; Murmann and Frenken 2006). The evolution of an economic system hinges on its ability to absorb and develop a heterogeneous set of competences which serve as the foundations of economic complexity (Hidalgo and Hausmann 2009). By adding new forms of knowledge to the existing base of competences, regional economies can improve their economic complexity, expand in new technological and industrial spaces, and ultimately increase their likelihood of evading the 'specialization trap'.

In recent years, the ability of a territory to evade technology ensnarement and adapt to the vicissitudes of the global economy has found support in the emerging form of entrepreneurial ecosystems (Acs et al. 2017; Ács et al. 2014; Autio et al. 2014; Isenberg 2010; O'Connor et al. 2018; Spigel 2017; Stam and Spigel 2016). Entrepreneurial ecosystems are considered by some to be neither industry nor technology-specific (Auerswald and Dani 2017; Autio et al. 2018); in fact, their sustainability and evolution hinges on agnostic heterogeneity (Autio et al. 2018). Entrepreneurial ecosystems thinking is founded on the assumption that entrepreneurs are responsible for pushing the boundaries of a given economic system towards new geographical and technological trajectories. Entrepreneurs represent the aggregators and codifiers of new knowledge and competences, the triggers and enablers of innovation development, and the architects of new introductions into the market (Schumpeter 1911; Shane and Venkataraman 2000).

Entrepreneurial ecosystems are by their nature dynamic and evolutionary, having an origin or antecedent and transitioning over time (Spigel and Harrison 2018). Firms, industries or even clusters within a local economy are subject to the finite nature of life cycles and eventual demise. For ecosystems, however, expiration is not inevitable. Rather, the evolutionary processes of adaptation and mutation induce the diversity and heterogeneity that facilitates the sustainability and perpetuity of an ecosystem (Malecki 2018; Roundy 2017). However, there is scant knowledge of how these evolutionary processes of entrepreneurial ecosystems are manifest (Alvedalen and Boschma 2017; Cavallo et al. 2019; Spigel and Harrison 2018). From its conception (Cohen 2006),

the academic literature on entrepreneurial ecosystems makes an implicit acknowledgement of the evolutionary imperative (Motoyama and Knowlton 2017; Pitelis 2012). However, explicit studies of the evolution of entrepreneurial ecosystems are rare, or better considered more as expositions of industrial clusters' life cycles (Cantner et al. 2020; Mack and Mayer 2016). Much remains to be known about the antecedents and dynamics underlying the birth and evolution of local economies in the guise of complex entrepreneurial ecosystems.

As is common with emerging fields that exhibit early promise, a slow start to research on entrepreneurial ecosystems initially was then followed by a great upsurge in research output, in this case, triggered by a critical published piece that attracted wide attention (Isenberg 2010). Academic researchers across a variety of fields and policy makers seeking the elixir of entrepreneur-led local economic growth turned their attention to the EE concept. Over a short number of years there emerged an enlarged volume of output then became cluttered and veered down unhelpful research alleys that inhibited theory development. Fragmentation and diffusion of research away from the core principles mitigated against theorising. We propose that there is now the need for entrepreneurial ecosystems' literature development to take stock, re-categorise the research to date and get back on track through a re-focus on the key tenets of the framework. For instance, we contend that some entrepreneurial ecosystems research has by parts, become at extremes either overly narrow (universities and accelerators as entrepreneurial ecosystems) or excessively broad (entrepreneurial ecosystems on a global scale via digitalisation) thereby hampering theory development. Recently there have been a number of systematic literature reviews on entrepreneurial ecosystems that have endeavoured to refine and shape the emerging field and provide directions for future research in the quest for a more general theory (Alvedalen and Boschma 2017; Brown and Mason 2017; Cao and Shi 2020; Cavallo et al. 2019; Hakala et al. 2020; Malecki 2018; Stam and Spiegel 2016) (See Table 11 below). Despite some inconsistencies in measurement, all show similar patterns of exponential growth in EE literature post-2015. However, there is no review article specifically on the evolution of entrepreneurial ecosystems to date.

Our aim, therefore, in this paper, is to reflect on and assess developments to date in the furtherance of the still under-theorised concept of entrepreneurial ecosystems. We in particular advocate for increased emphasis by researchers on the evolutionary dynamics and processes integral to the understanding of entrepreneurial ecosystems. To that end, we suggest in this paper that a number of crucial evolutionary aspects remain unresolved for entrepreneurial ecosystems. Foremost amongst these are the appropriate and evolving boundaries of the ecosystem; the internal and external sources of new knowledge and the actors blending them with the existing knowledge base, and whether the entrepreneurial ecosystem's evolution is guided by the visible hand of Government or is it less visibly anchored by large corporations, often MNEs, or institutions such as local universities. Additionally, shedding light on the intersection between local and global knowledge

circuits will be a fundamental element of a new effective research approach. We frame the future research agenda around critical debates in need of further resolution: (1) entrepreneurial ecosystems as life cycle versus complex adaptive systems; (2) evolving boundaries of entrepreneurial ecosystems; and (3) governance of evolutionary entrepreneurial ecosystems. Additional to theory development considerations, there are methodological considerations for future research on the evolution of entrepreneurial ecosystems. It has been reported that much research to date consists of static, cross-sectional studies that miss out on crucial temporal change dynamics of entrepreneurial ecosystems across time (Adams 2020; Alvedalen and Boschma 2017). There have been negligible systematic attempts at investigating the evolution of entrepreneurial ecosystems through a longitudinal analysis (Ryan et al. 2020). We, therefore, make some recommendations for longitudinal process approaches to future research more befitting of the study of evolutionary processes of entrepreneurial ecosystems.

In addition to advancing the heterogeneous and yet growing literature on entrepreneurial ecosystems, our work also carries important policy implications. Firstly, we contend that understanding the key mechanisms underpinning the evolution of entrepreneurial ecosystems will offer some valuable insights to policymakers focusing on fostering the competitiveness of regions and cities. Particularly in today's highly volatile global economy, understanding when and why ecosystems evolve over time and across space represents an essential starting point for any entrepreneurship- and innovation-focused policy. Secondly, tracking the evolution of entrepreneurial activities at local level will offer policymakers the opportunity to gauge the evolutionary trajectory of firms' specialization and sources of competitive advantage. This, we argue, will allow a finer-grained analysis of the specific requirements marking entrepreneurial firms' operational activity and the related areas of policy intervention like investments in the local educational systems, logistical infrastructures, and financial support. Finally, and building on the previous implication, a more explicit longitudinal analysis of entrepreneurial ecosystems will permit local institutions to scout outside the ecosystem for complementary resources. From the deployment of policies aimed at attracting foreign direct investments, to the creation of global pipelines to tap into relevant sources of knowledge and capital, we contend that a thorough understanding of the historic evolution of a local ecosystem will represent the necessary starting point for any outward-looking industrial policy.

The structure of the paper is as follows. The next section of the paper focuses on a systematic literature review. Section 3 develops theory on evolutionary entrepreneurial ecosystems and illustrates some shortcomings inhibiting the emergence of a general theory. Section 4 addresses issues under debate and endeavours to shape a future research agenda and calls for the deployment of more apt methods. The final section presents a discussion and some early conclusions.

2. Systematic Literature Review

The conduct of our systematic review was influenced by robust exemplars of best practice previously published in *Small Business Economics* (Dabić et al. 2019; Grégoire and Cherchem 2020; Karami et al. 2019; Pittaway and Cope 2007). Guided by such, our systematic review broadly involved three stages: in the first, we systematically identified, collated and filtered the existing EE literature to create a study population of top-quality journal articles. We then proceeded to categorise these articles into four themes that have to date served as the main foci of the entrepreneurial ecosystem literature. We lastly showed that of these four themes, the literature on evolutionary dynamics and processes of entrepreneurial ecosystems has been least explored.

Stage one of our systematic review process followed the method proposed by Tranfield et al. (2003): (1) a detailed planning of the review process around search terms, and (2) a staged filtering of the collated literature via a rigorous filtration process for inclusion and exclusion, and (3) a detailed deep-grained analysis of the selected literature. For the first planning step, we defined the conceptual boundaries and screening criteria such as publication type and objective research quality via the widely recognised ABS classification system. As the initial academic paper on EE was published in 2006, we conducted the search for publications between 2006 and 2020. Based on these screening considerations and decisions, we then assembled the EE literature through the conduct of an extensive literature string search of various databases, including ProQuest, Scopus, Web of Science (WoS), Business Source Complete (BSC). The search strings used were “*Entrepreneur* Ecosystem**”. The first wave search included published and unpublished materials such as journal articles, working papers, conferences proceedings, and papers in an edited volume (Mochkabadi and Volkmann 2020). Our initial filtration process only included scientific publications with a definite abstract. Therefore, publications such as books, book chapters, reports, and editorials were excluded (Liñán and Fayolle 2015). This initial search and filtration, combined with the cleansing and eliminating of duplicates, recovered 2,697 articles. We then screened these filtered set of papers by analysing the content of the title and abstract to ensure it was explicitly related to EE. Post this second round filtration process, we identified 568 relevant contributions on EE in all journals of the broadest quality. Figure 16 shows that after the initial use of the term ‘entrepreneurial ecosystem’ in the publication of Cohen (2006), EE published research output showed no pattern of increase for almost a decade. The publication in HBR of Isenberg’s (2010) policy advisory steps triggered stronger interest among academics. Consequently, output sharply increased from the year 2015. Of the twice filtered 568 articles, 387 were found to be in the ABS listing, and, of these, 137 were top-ranked classed as ABS 3, 4 or 4*. Figure 17 shows EE research has been published in leading journals such as *Entrepreneurship Theory & Practice*, *Research Policy*, *Small Business Economics*, *Entrepreneurship and Regional Development*, *Regional Studies*. This list represents an interesting mix of Entrepreneurship and Economic Geography

journals. This final number of 137 journal articles constituted our final study population for subsequent thematic analysis and categorisation.

The co-authors now reviewed and analysed these 137 higher ranked articles following Braun and Clarke's (2006) systematic procedure to identify the principal themes within the EE literature published to date. From our deep understanding of the EE literature and assiduous reading of population articles, we identified themes based on our agreed categorization and classification of our population of publications. Any discrepancies in theme identification were discussed by the co-authors and minor adjustments applied where deemed necessary. If a publication addressed multiple themes, the stated aim of the study served as our criterion for categorisation and classification (Liñán and Fayolle 2015). Our analysis resulted in four predominant themes: Place, Governance, Actors, and Evolution (See Figure 18). We readily established that the quantity of articles in three of the thematic categories, place, actors and governance, heavily outnumbered those on evolution. There is clearly a distinct paucity of explicit studies on the evolution of entrepreneurial ecosystems. Of the 137 top-ranked articles, we have only identified 14 articles that can be deemed to have entrepreneurial ecosystem evolution as their prime focus of investigation (See Table 12). All of these have been published since 2016. Only nine of these are empirical and even these limited few have methodological dissonance having been widely reproached for a failure to extend beyond a static framework and attendant inability to capture evolutionary processes over time (Acs et al. 2017; Adams 2020; Alvedalen and Boschma 2017; Cavallo et al. 2019; Stam 2015). In Table 13 we identify merely 10 longitudinal studies in our population and only four of these (Auerswald and Dani 2017; Schafer and Henn, 2018; Thompson et al., 2018; Ryan et al., 2020) are also to be observed in the list of EE evolution studies. Previous EE review articles also point to the drawback of static studies and lack of dynamism and longitudinal methods and approaches, but tangentially and without much guidance for rectification and theoretical advancement (Alvedalen and Boschma 2017; Brown and Mason 2017; Malecki 2018). Although some scholars have called for and placed increased emphasis on the temporality of EE through studies of evolutionary processes and governance across time (Colombo et al., 2017; Spiegel and Harrison, 2018), they still represent a significant minority. Therefore, to redress these deficiencies, we propose a research agenda for theory development that places a heavy emphasis on future studies to better and more comprehensively capture evolutionary processes of entrepreneurial ecosystems.

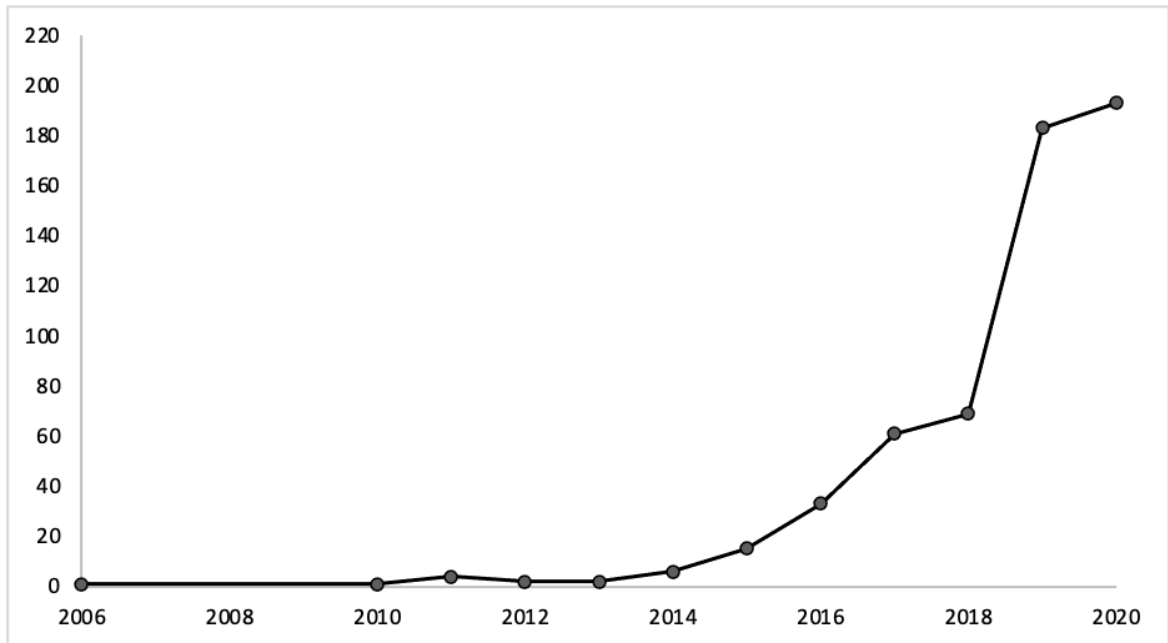


Figure 16 Numbers of publication (ABS journals)

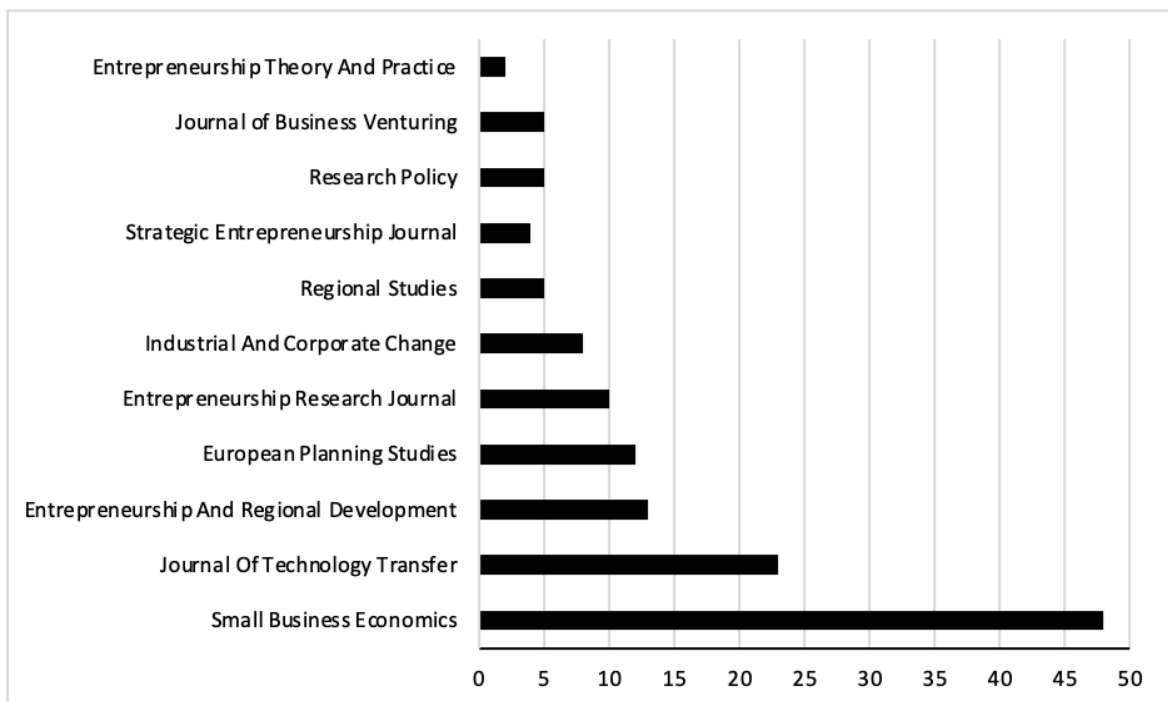


Figure 17 Principal Journal outlets (peer-reviewed)

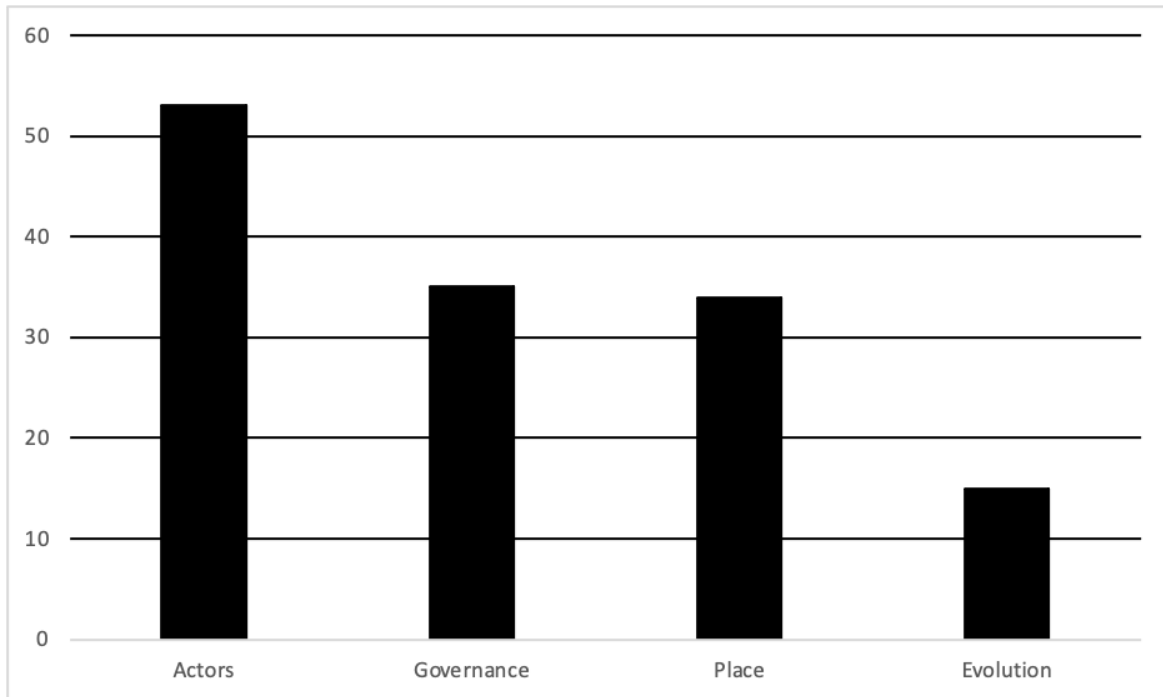


Figure 18 Primary Themes in EE Literature (ABS 3 and above journals)

Table 11 Review of EE literature

Authors (Year)	Type	Elements of EE	Future research/Shortcomings of EE
Stam and Spiegel (2016)	Descriptive	Attributes of EE 1) Cultural 2) Social: Network, talent, capital etc 3) Material: Infra, Uni, policy, services	<Model> EE elements(conditions) produces “entrepreneurial activity(outcome) that leads to aggregate value creation (outcomes)
Alvedalen and Boschma (2017)	Descriptive	Dynamic network framework 1) Focus on institutional change 2) Micro-level analysis on region, actors etc. 3) Emphasis on the institution that blocks dynamic EE 4) Evolutionary perspective is missing	1) Comparative research on networks 2) EE’s perception of different networks(knowledge, political) 3) institutional entrepreneurship (conditions for EE formation)
Mason and Brown (2017)	Critical	1) Actors: support 2) Connectors: Professional service, enterprise centres etc 3) Resource providers: banks, VC etc 4) Entrepreneurial Orientation: role model, education etc.	1) Scale-up ecosystem 2) Dealmakers – social capital, mediators 3) Block-buster entrepreneurship: High-growth & potential 4) Entrepreneurial recycling (serial entrepreneurship)
Cavallo et al. (2019)	Bibliometric	1) EE emphasize the complexity and non-linearity of entrepreneurship 2) Focus change: economic actors → culture within the EE 3) Evolutionary aspect of EE is lacking 4) Context and temporal aspect is key to EE	1) Entre. dynamics and governance 2) Analysis of Sub-systems of wider EE 3) Focus on innovative & growth-oriented entrepreneurship 4) Focus on specific territory
Maleki (2018)	Bibliometric	1) EE is spatial and centrally local 2) university-centred EE 3) Evolution of EE – lifecycle (scale-up)	1) Longitudinal study 2) Network-based research 3) Identify spinoff firms 4) Narrative accounts 5) Investigation of the EE elements

Hakala et al. (2020)	Review method	<p>Proposed review method</p> <ol style="list-style-type: none"> 1) Thematic: themes, questions 2) Enstoried: Plot, Narrative, characters, voices, moral lesson 3) Rhetorical reading: rhetoric device, rhetorical strategy 	<p>Model narrative of EE</p> <ol style="list-style-type: none"> 1) concentration, clusters, locality etc. 2) Regional actors create EE and lead, produces only winners, the system may lack governance, the interaction of the elements 3) Govern to create the ecosystem
Cao and Shi (2020)	Systematic	<p>A. EE elements</p> <ol style="list-style-type: none"> 1) Logic – structural interaction system 2) Resource – resource allocation system 3) Governance – ecosystem policy approach <p>B. EE in emerging economies</p> <ol style="list-style-type: none"> 1) Institutional voids 2) Resource scarcities 3) Structural gaps 	<ol style="list-style-type: none"> 1) Digital affordances and EE apply to advanced economy → can enable delocalization 2) Entre culture can be the result rather than a driver 3) Distinctiveness of EE and the related concept has not been discussed substantially 4) Reliance on government-led EE needs to be reduced

Table 12 Specific papers on evolution of entrepreneurial ecosystems

Article Title (Author)	Year	Journal	Conceptual or Empirical	Location	Cluster	Method	Timeframe of Data Collection
The evolutionary dynamics of entrepreneurial ecosystems (Mack and Meyer)	2016	Urban Studies	Empirical	Phoenix, US	Yes	Case Study	May 2007, Jan 2013 to Jan 2014
The adaptive life cycle of entrepreneurial ecosystems: the biotechnology cluster (Auerswald and Dani)	2017	Small Business Economics	Empirical	US National Capital Region	Yes	Case Study (longitudinal)	2004 to 2013
Looking inside the Spiky Bits: A Critical Review and Conceptualisation of Entrepreneurial Ecosystems (Brown and Mason)	2017	Small Business Economics	Conceptual	-	-	Critical review	-
Hierarchical and relational governance and the life cycle of entrepreneurial ecosystems (Colombelli et al.)	2017	Small Business Economics	Empirical	Turin, Italy	Yes	Social Network Analysis	2007-2017
Toward a process theory of entrepreneurial ecosystems (Spigel and Harrison)	2018	Strategic Entrepreneurship Journal	Conceptual	-	-	-	-
The emergence of entrepreneurial ecosystems: A complex adaptive systems approach (Roundy et al.)	2018	Journal of Business Research	Conceptual	-	-	-	-
The evolution of entrepreneurial ecosystems and the critical role of migrants. A Phase-Model based on a Study of IT startups in the Greater Tel Aviv Area (Schäfer and Henn)	2018	Cambridge Journal of Regions, Economy and Society	Empirical	Tel Aviv, Israel	Yes	Case Study (longitudinal)	1970-2017
How entrepreneurial ecosystems take form: Evidence from social impact initiatives in Seattle (Thompson et al.)	2018	Strategic Entrepreneurship Journal	Empirical	Seattle, US	No (non-profit)	Case Study (Content analysis, Longitudinal, Coding)	2000 to 2014

Toward a complex adaptive system: The case of the Zhongguancun entrepreneurship ecosystem (Han et al.)	2019	Journal of Business Research	Empirical	Beijing, China	Yes	Case Study	2014 (interview) * timeframe of analysis: 1980 to 2018
The role of MNEs in the genesis and growth of a resilient entrepreneurial ecosystem (Ryan et al.)	2020	Entrepreneurship & Regional Development	Empirical	Galway, Ireland	Yes	Case Study (Longitudinal)	1980 to 2017
From orchards to chips: Silicon Valley's evolving entrepreneurial ecosystem (Adams)	2020	Entrepreneurship & Regional Development	Empirical	Silicon Valley, US	Yes	Case study	1940s to 1950s
Entrepreneurial ecosystems: a dynamic lifecycle model (Cantner et al.)	2020	Small Business Economics	Conceptual	-	-	-	-
The injection of resources by transnational entrepreneurs: towards a model of the early evolution of an entrepreneurial ecosystem (Harima et al.)	2020	Entrepreneurship & Regional Development	Empirical	Santiago, Chile	Yes	Case study (Systematic data analysis, coding)	2015,2017, 2019
Meeting its Waterloo? Recycling in entrepreneurial ecosystems after anchor firm collapse (Spigel and Vinodrai)	2020	Entrepreneurship & Regional Development	Empirical	Waterloo, Canada	Yes	Case Study (Quantitative -database analysis)	2008 to 2016

3. An Evolutionary perspective on Entrepreneurial Ecosystems

The entrepreneurial ecosystem perspective represents a more holistic and finer-grained approach to studying the evolution of a local economy and its underlying mechanisms (Audretsch and Belitski 2017; Cohen 2006; Isenberg 2010; Stam 2015; Stam and van de Ven 2019; Stam and Spigel 2016). An entrepreneurial ecosystem generally operates on a grander scale and scope than a conventional industrial cluster and is commonly industry and technology agnostic (Auerswald and Dani 2017; Autio et al. 2018; Malecki 2018). Among the features that define the entrepreneurial ecosystem framework, the notion of sustainability has been at the core of this novel research discipline since its early developments (Cohen 2006). An ecosystem's sustainability derives from the introduction of heterogeneous variation and adaptation that can extend an entrepreneurial ecosystem's lifespan (Boschma 2015; Colombelli et al. 2019; Malecki 2018; Roundy 2017; Ryan et al. 2020; Spigel and Harrison 2018). As a result, the resilience and long-term competitiveness of an entrepreneurial ecosystem spring from coherency around specialism in its early existence (Roundy 2017; Spigel and Harrison 2018) and heterogeneity from the later diversity introduced by new firm formations across multiple technologies (Malecki 2018).

Much of the early work on entrepreneurial ecosystem research was policy-oriented aiming to develop economic growth prescriptions for, and via expanded entrepreneurial activity (Cukier et al. 2015; Gauthier et al. 2017; Isenberg 2011; Mason and Brown 2013, 2014; Mulas et al. 2016). Growth, by its very nature, implies evolutionary processes. In a seminal and highly influential policy report, Mason and Brown (2014) presented an early evolutionary model of an entrepreneurial ecosystem. Building on this, a few years later the same authors developed their pilot policy work academically to propose a two-stage typology of nascence and maturity of entrepreneurial ecosystems distinguishing between early-stage 'embryonic' and later-stage 'scale-up' ecosystems (Brown and Mason 2017). Around the same time, and confirming the development of a new research pattern, Mack and Mayer (2016) pioneered an evolutionary model that dealt with EE dynamics over time. Colombelli et al. (2019) then used hierarchical and relational governance lenses to present the life cycle stages of entrepreneurial ecosystems as 'birth', 'transition' and 'consolidation'.

As the study of the evolution of EEs gained traction, further studies examined the origins and creation of an entrepreneurial ecosystem and the early stages of its existence (Harima et al. 2020; Roundy et al. 2018; Thompson et al. 2018); others then placed particular emphasis on the later maturity stages. Malecki (2018), for instance, describes the elements of an entrepreneurial ecosystem that matured into one deemed to be a 'strong' entrepreneurial ecosystem, and others depicted the composition of a matured 'resilient' version (Roundy 2017; Ryan et al. 2020). For some researchers, however, the life cycle approach came to represent an inappropriate lens since the evolution of an entrepreneurial ecosystem was seen to be non-linear across stages, but rather,

recursive as with an adaptive system (Adams 2020; Auerswald and Dani 2017; Haarhaus et al. 2020; Roundy et al. 2018).

Existing studies also suggest that there are multiple evolutionary pathways for entrepreneurial ecosystems. The creation and evolution of an entrepreneurial ecosystem can be organically entrepreneur-led (Feld 2012); alternatively, and possibly simultaneously, it can be guided by the visible hand of Government (Adams 2020; Fuerlinger et al. 2015), or even anchored by large corporations (Bhawe et al. 2019; Colombo et al. 2019; Ryan et al. 2020) and universities (Cunningham et al. 2019; Hayter 2016; Johnson et al. 2019; Miller and Acs 2017; Nicholls-Nixon et al. 2020). Additionally, an entrepreneurial ecosystem can mutate from a pre-existing system such as an industry cluster (Autio et al. 2018; Pitelis 2012), or set of co-located clusters of varying vintages, through technological convergence in related and unrelated branches (Auerswald and Dani 2017). For instance, Ryan et al. (2020) empirically illustrated how a strong, resilient entrepreneurial ecosystem could emerge from the metamorphosis of an antecedent industrial cluster, primarily via MNE spinouts, and lead the evolution of an entire production region. Contrariwise, Cantner et al. (2020) conceptually outlined subsequence for an entrepreneurial ecosystem in its further evolution into a 'business ecosystem'.

Regardless of the specific evolutionary path, an ecosystem can follow, incumbent entrepreneurs and corporate or institutional spillovers generally play a key role in the development of entrepreneurial ecosystems. Pioneer entrepreneurs that either serially start more firms or successfully exit their initial venture, serve to activate an entrepreneurial ecosystem's ongoing growth and renewal. They do so as role models, mentors and even angel financiers that channel their resources, time and energy into its perpetuation (Mason and Brown 2014; Mason and Harrison 2006; Ryan et al. 2020). Spillovers can serve to propel and expand the evolution of an entrepreneurial ecosystem, primarily by building on and expanding the accumulation of knowledge at a local level (Agrawal and Cockburn 2003; Breschi and Lissoni 2003; Clarysse et al. 2014; Harima et al. 2020; Ryan et al. 2020; Van De Ven 1993). They generally come in either of two forms, spinout or spinoff.

Large enterprises, both indigenous and inward investors, can serve as the breeding grounds of local entrepreneurship in several domains. They can contribute and catalyse an entrepreneurial ecosystem's creation and growth by taking the role of incubators and stimulating the spinout of high-tech start-ups in related and unrelated varieties (Brown and Mason 2017; Colombelli et al. 2019; Klepper 1996, 2007; Ryan et al. 2018; Spigel and Harrison 2018). Large firms attract skilled employees, enhance their managerial skills and provide them with business opportunities by connecting them to global customers (Colombelli et al. 2019; Ryan et al. 2020). Employees' experiences and learnings in these large organisations are likely to spawn new spinout ventures mostly through the development of variants of a core product. Over time, this process increases

heterogeneity in the entrepreneurial ecosystem, hence supporting its long-term competitiveness. Spinouts, in fact, fuel diversification and new knowledge creation and create heterogeneity that eventually strengthens the resilience of an entrepreneurial ecosystem. As such, large firms act as ‘knowledge integrators’ within the entrepreneurial ecosystem and facilitate the codification and absorption of new knowledge at the local level and provide connectivity to new global market opportunities for indigenous firms or aspiring entrepreneurs (Bhawe et al., 2019; Buciuni and Pisano, 2018).

Large firms are not the only actors supporting the evolution of an entrepreneurial ecosystem. Universities can also deepen an entrepreneurial ecosystem’s technology base and enhance its capacity as the breeding ground for entrepreneurship. Extensive research shows that universities can incubate and facilitate new venture spinoffs in an entrepreneurial ecosystem too (Cunningham et al. 2019; Hayter et al. 2018; Johnson et al. 2019; Miller and Acs 2017; Nicholls-Nixon et al. 2020; Theodoraki et al. 2018). Renowned entrepreneurial ecosystems, such as Silicon Valley, Route 158 and Cambridge UK have world-class universities that record-high rates of such spinoffs (Audretsch and Belitski, 2013). These spinoff ventures are commonly in new technology domains either in related or unrelated varieties (Boschma and Frenken 2011; Meoli et al. 2019; Meoli and Vismara 2016). This increased heterogeneity amplifies the resilience of the entrepreneurial ecosystem (Roundy 2017).

4. Debates and Agenda for Future Evolutionary Entrepreneurial Ecosystem Research

There are areas of discord amongst the community of entrepreneurial ecosystem (EE) scholars that are in need of resolution to progress the entrepreneurial ecosystem from framework to theory. We now bring forth what we identify as some crucial debates and issues for resolution in the entrepreneurial ecosystem field and suggest specific areas for future research on the evolutionary processes rather than the more prevalent but issues such as EE elements and actors. These are both static and by now well-rehearsed.

4.1 Is the evolving EE more a life cycle or an adaptive system?

Our systematic review shows that of the few articles published on the evolution of EEs, most presented a life cycle stages model (Cantner et al. 2020; Colombelli et al. 2019; Mack and Mayer 2016; Thompson et al. 2018). But there are issues around this approach to mapping the evolution of entrepreneurial ecosystems. Mack and Mayer’s (2016) original life cycle model culminates with dual pathways either of deathly expiration or, more positively, rebirth through

recycling or renewal. This debate mirrors an earlier, largely unresolved one for cluster theory as to whether life cycles or adaptive systems represent more realistic versions of evolutionary processes (Martin and Sunley 2011). However, clusters can be finite and destroyed by technological disruptions (Narula 2002). But, as the term 'ecosystem' prescribes, the ultimate aspiration for an entrepreneurial ecosystem is a continuing renewal (Malecki 2018). A weak or 'failing' entrepreneurial ecosystem (Auerswald 2015) is not equivalent to death and can be resuscitated. Failure can be overcome, and even serve as a learning experience building resilience. Rather than the disastrous pathway to expiration under the life cycle thesis, the aim in a strong entrepreneurial ecosystem is to avoid dwindling into decline, through engendering resilience and sustainability over time (Roundy 2017). Therefore, despite the obvious appeal of the life cycle approach to the characterisation of the evolution of an entrepreneurial ecosystem (Malecki 2018), for some researchers, the life cycle represents an inappropriate lens since the evolution of an entrepreneurial ecosystem is not linear across stages but rather recursive as with an adaptive system (Adams 2020; Auerswald and Dani 2017; Roundy et al. 2018). Some entrepreneurial ecosystem research distinguishes between the life-cycle aspect of the cluster and the complex adaptive system of evolutionary entrepreneurial ecosystem (Kuratko et al., 2015). Future research can address which approach has more merit.

Further, and extending the adaptive systems debate, as with all economic systems and production regions a debate on entrepreneurial ecosystems persists as to whether their birth and evolution is a natural process, a form of 'panarchy' (Holling and Gunderson 2002), or artificially man-made (Hannan and Freeman, 1993; Schumpeter, 1994). But this debate is magnified in the entrepreneurial ecosystem context given its underpinning of a natural analogy in the ecosystem. The entrepreneurial ecosystem approach is linked to ecological concepts. This debate is even more strident for entrepreneurial ecosystems given the central focus on 'ecosystem' which is borrowed from the natural world as distinct from industrial districts or regional innovation systems. The relation and application of ecosystem in the natural world to entrepreneurial ecosystem is well-rehearsed (Auerswald 2015). However, Colombelli et al. (2019) nevertheless query the extent to which it is artificially guided and governed. Also, Acs et al. (2017) argue against the non-nuanced applicability of the ecosystem analogy from natural sciences as it (naturally) differs from that of economic agents that interact within their environment. The ecological/biological view supports the structure and relationships in the ecosystem. Ecosystems are geographically bound with mutually dependent parts (Napier and Hansen 2011). A natural ecosystem is based on Darwinist evolutionary issues of diversity, selection, diversification, adaptation, resilience and strength (Boschma 2015). Moore (1993) was the first scholar to adopt the term 'ecosystem' in the fields of business and management. For Moore, the evolution in the business ecosystem derives from the "original swirl of capital, customer interest, and talent generated by innovation, just as successful species spring

from the natural resources of sunlight, water, and soil nutrients” (Moore, 1993, P.76). Further research can usefully evaluate the extent to which the evolution of entrepreneurial ecosystems is a result of nature or nurture, or some hybrid?

But the less clear cut on the superiority of the adaptive cycle approach with its recursive essence is how to establish the original creation of an entrepreneurial ecosystem (Cantner et al. 2020; Harima et al. 2020; Mack and Mayer 2016; Roundy et al. 2018; Ryan et al. 2020; Thompson et al. 2018). Different actors can impact the birth and growth of an entrepreneurial ecosystem. Examples of EE catalysts include the local university (Cunningham et al. 2019; Hayter et al. 2018; Johnson et al. 2019; Miller and Acs 2017; Nicholls-Nixon et al. 2020), incubators and accelerators (Breznitz and Zhang 2019; Hochberg 2016; Qin et al. 2019), diaspora (Baron and Harima 2019; Schäfer and Henn 2018) and large firms (Bhawe and Zahra 2019; Colombo et al. 2019; Mason, Colin; Brown 2014; Ryan et al. 2020). Future research could address the roles of actors in the creation of an entrepreneurial ecosystem. Then examine if the same actors govern its growth, consolidation, even disruption?

Ultimately, an entrepreneurial ecosystem is an evolutionary system that links actors in a place within a governance structure. The relativities of importance shift over time and with that comes evolving emphases on priorities. Which aspects matter at different stages of evolution and how the elements interact within the ecosystem over time is an avenue of interest for research on system and network dynamics. Case research can usefully identify idiosyncratic depictions of interrelations across evolution of an entrepreneurial ecosystem.

Large, often anchor, firms have been shown to profoundly affect the evolution of an EE (Buenstorf and Klepper 2009; Feldman 2003; Giblin and Ryan 2012; Ryan et al. 2020). But further explanation is needed on how entrepreneurial activity is incubated, nurtured and expanded in and by these large firms. These large firms can be inward investing MNEs (Bhawe and Zahra 2019; Ryan et al. 2020) that may incubate (Acs et al. 2013; Ryan et al. 2020) or squeeze out entrepreneurship in a local economy (Audretsch and Keilbach 2008; Berrill et al. 2020; De Backer and Sleuwaegen 2003) Future research could explore the balance of benefits versus drawbacks of FDI in entrepreneurial ecosystem creation and evolutionary growth and strength.

4.2 What are the evolving boundaries and different models of entrepreneurial ecosystems?

Some notable scholars in the field of economic geography and systems of entrepreneurship have set out the context of entrepreneurial systems as national wherein entrepreneurs drive the system and institutions support and regulate their actions (Ács et al. 2014). Conventionally in the literature, however, an entrepreneurial ecosystem is rooted in place with a relatively distinct local or regional geographic boundary within which is contained mutually dependent components

(Adams 2020; Auerswald 2015; Mason and Brown, 2014; Brown and Mason 2017; O'Connor et al. 2018; Stam 2015). These have dynamic evolutionary processes of selection, variety and adaptation (Boschma 2015; Malecki 2018; Roundy et al. 2018). Bounded dynamic entrepreneurial activity encompasses local culture, the decision-making, firms' growth and individual traits (Audretsch and Belitski 2017; Feldman and Kogler 2010). From an evolutionary perspective, the essence of place can change over time as boundaries may shift and scale expands. Recently, scholars have considered the challenges and nuances for entrepreneurial ecosystems and localness in the digital age (Song 2019; Sussan and Acs 2017). They propose that local context may be constraining since digitization not only pays little or no respect to local boundaries but affords greater opportunities to entrepreneurs within a virtual scaffolding (Autio et al. 2018). In this view, EE research would no longer be in the purview of regional development. Research may consider it an expanded form of entrepreneurial ecosystem beyond local or a new category for the global scale for systems of entrepreneurship.

In the economic geography and IB fields, even under conditions of localness, global connectivity has been shown to be important for the success of local economies under the auspices of modern globalisation (Mudambi et al. 2017; Perri et al. 2017). The successful local ecosystem hinges on the global economy and draws new knowledge from a variety of sources often situated outside its geographical boundaries. This allows the ecosystem to avoid 'cognitive myopia', a condition that has caused the demise of numerous traditional industrial clusters (Buciuni and Pisano 2018). Furthermore, a globally connected EE can serve as a global pipeline for entrepreneurs in the region and encourage the development of innovation in related and unrelated technological domains. Critical to this process is the ability of entrepreneurs to mix global market knowledge and local production and technical expertise in the attempt to generate new product and process innovation. Building on this phenomenon, it will be useful for future research to understand the external mechanisms that enable valuable resources and knowledge to flow into, and out of the ecosystem, thereby promoting its evolution and continued sustenance.

Assessing the mechanisms whereby an ecosystem's boundaries evolve over time and across space requires understanding the meaning of the geographical scope of such boundaries. If the digitized global scale for an EE is too large, then, at the other extreme, viewing universities and accelerators, not as actors or elements but rather as EEs in their own right is confusingly too small and restricting (Johnson et al. 2019; Nicholls-Nixon et al. 2020; Qin et al. 2019). Future research should focus on the region as the unit of study but can also consider 'nested' subset ecosystems. In addition, further research should be dedicated to explore the relationship between entrepreneurial ecosystems and industrial clusters, with a specific focus on the intersections and overlaps between these distinct frameworks. Although the entrepreneurial ecosystem concept is broader in scope (cross or beyond industry) than individual industry clusters (Auerswald and Dani 2017; Autio et al.

2018), future investigations into entrepreneurial ecosystems could usefully embrace firms operating in a variety of co-located industry clusters (Stam and Spigel 2016) to assess their interdependence and its impact on a region's competitiveness. Building on this, future research should better match entrepreneurial ecosystems to local economies, investigate the relationships existing between these two concepts, and analyse how the geographical boundaries of the two can change over time and across space.

Understanding the nature and the dynamics underpinning the evolution of entrepreneurial ecosystems will also allow us to shed greater light on different models and typologies of ecosystems that can take shape over time and across space. To date, in fact, there hasn't been any significant attempt at understanding whether different typologies of entrepreneurial ecosystems may coexist, how they differ from one another, and what are the key characteristics marking each possible typology. As the literature on entrepreneurial ecosystems keeps expanding rapidly, an evolutionary perspective on this very topic can inform scholars researching in this field on the different trajectories that different ecosystems can follow over time. Clustering ecosystems into different categories could therefore help provide a better understanding of how entrepreneurial ecosystems work and how they change over time, and what implications their evolution carries for policymakers, scholars and entrepreneurs alike. Building on the work of Markusen (1996) on the plurality of industrial districts, and more recently, that of Buciuni and Pisano (2021) on the variety of architectures in global value chains (GVCs), we call for future research that can examine the existence of different models of entrepreneurial ecosystems.

4.3 Governance of evolutionary entrepreneurial ecosystems

Governance of an entrepreneurial ecosystem's evolution has two potential approaches, invisible (bottom-up) and visible (top-down) (Colombo et al. 2019). The bottom-up school suggests that rather than being spawned by visible government, corporations or institutions, entrepreneurial ecosystem evolution should be entrepreneur-led (invisible hand) (Auerswald 2015; Feld 2012; Isenberg 2010; Kuckertz 2019; Mason and Brown 2014). According to this view, the unique culture and dynamic network of actors creates a bottom-up and invisible governance in EE (Bosma et al., 2018). To what extent is the invisible hand at play or the guided visible hand predominant in evolution of entrepreneurial ecosystem? Some scholars warned not to take 'ecosystem' literally since entrepreneurial ecosystem concept is 'artificial' in being human-made (Acs et al. 2013, 2017; Cantner et al. 2020; Mack and Mayer 2016; Roundy 2017; Stam 2015; Stam and van de Ven 2019; Stam and Spigel 2016). Alternatively, the visible hand of State (Adams 2020; Fuerlinger et al. 2015) may be in evidence through supporting institutions and organisations, both public and private, that fund incubators and accelerators and provide mentorship for actors in the entrepreneurial ecosystem (Hochberg 2016). Future research could usefully investigate which governance approach to

evolutionary entrepreneurial ecosystem is more effective, naturalistic organic entrepreneur-led or artificial structured Government-led? Besides this apparent dichotomy, the origin and evolution of EEs might, in fact, depend on both these factors. Instead of thinking of entrepreneur-led and government-led as two alternative options, scholars should investigate their interdependences and potential areas of convergence and examine how they impact on the long-term sustainability of an ecosystem.

4.4 Using methodology right: the need for longitudinal process studies of EE evolution

Surprisingly, most entrepreneurial ecosystem studies lack a ‘time’ dimension (Adams 2020; Donegan et al. 2019). Methodologically, most research to date consists of cross-sectional studies that are static, and thus miss out on crucial temporal change dynamics of entrepreneurial ecosystem evolutionary processes across time (Adams 2020; Alvedalen and Boschma 2017; Stam 2015). An entrepreneurial ecosystem is in a perpetual process of development and evolution (Spigel and Harrison 2018). We contend that the explanation of how entrepreneurial ecosystems evolve over time and across space requires a longitudinal perspective to map and track these metamorphoses in the ecosystem from inception. To date, we identify only ten systematic attempts at assessing the evolution of entrepreneurial ecosystems through a longitudinal analysis (See Table 13). Even of these few, most could be questioned as to whether they are actually longitudinal or rather, retrospective investigations of historical panel set data. Only three are explicitly longitudinal in that data was collected in real-time over time (Ryan et al. 2020; Schäfer and Henn 2018; Thompson et al. 2018). We call for process studies of evolutionary processes of entrepreneurial ecosystems with extended time frames, often across temporal brackets (Langley 2007; Pettigrew 1990; Welch and Paavilainen-Mäntymäki 2014).

Lastly, this calls for longitudinal process studies will mostly necessitate case studies of evolving or evolved entrepreneurial ecosystems. The evolutionary path of an entrepreneurial ecosystem is idiosyncratic, which impacts its theoretical utility. Even in one study, Spigel (2017) illustrates the divergent evolutionary paths of two entrepreneurial ecosystems, Waterloo and Calgary, that differ in their cultural, social and material attributes. There are few prescriptions for the successful evolution of an entrepreneurial ecosystem. For example, even the most renowned of all entrepreneurial ecosystems, Silicon Valley, had its own distinctive origins and journey (Adams 2020). Yet, learning from it did not represent a universal panacea for regional development across the world. This highlights the challenges for future research of theory building from multiple idiosyncratic cases. To meet this challenge, well-designed case studies are required that can be aggregated and deciphered to build theory.

Table 13 LONGITUDINAL STUDIES on ENTREPRENEURIAL ECOSYSTEMS

Title (Author, Year, Journal)	Research Question	Timeframe in years	Data	Method
The adaptive life cycle of entrepreneurial ecosystems: the biotechnology cluster (Auerswald and Dani 2017, SBE)	What is the role of entrepreneurship in developing essential capabilities and networks that drive the sustainable development of regions? (p. 112)	2004-2013 National Capital Region's biotechnology cluster	Cluster Database ACS 2013 – 5-year estimates, National Science Foundation, Inc 5000 2015, Web of Science	Quantitative (Comparison between the cluster and USA)
How entrepreneurial ecosystems take form: Evidence from social impact initiatives in Seattle (Thompson et al. 2018, SEJ)	How entrepreneurial form in the field of social enterprise?	2012-2014 (Social impact business EE, Seattle, US)	Interview (structured), public records, news outlets, webpages, documents Threads of social impact enterprises	Qualitative case (multiple) (Content & Longitudinal analysis, Coding)
The evolution of entrepreneurial ecosystems and the critical role of migrants. A Phase-Model based on a Study of IT startups in the Greater Tel Aviv Area (Schäfer and Henn 2018, CJR)	How are entrepreneurial ecosystems linked to geographically distant entrepreneurial ecosystems and how the linkages between such systems affect regional entrepreneurial performance?	1970-2017 Greater Tel-Aviv Area high-tech cluster	Database: IVC Research Center, US Homeland Security, Startup Nation Finder Interview	Qualitative Case (longitudinal process)
Governance in entrepreneurial ecosystems: venture capitalists vs. technology parks (Cumming et al. 2019, SBE)	What types of start-ups (VC backed or technology parks) achieve an acquisition?	2007-2014 (251 software companies in the US)	Panel data cumulative incidence function (CIF)/ Database Crunchbase com	Quantitative (Regression)

<p>The creation of high-tech ventures in entrepreneurial ecosystems: exploring the interactions among university knowledge, cooperative banks, and individual attitudes (Ghio et al. 2019, SBE)</p>	<p>How does local availability of university knowledge interact with the relative presence of cooperative banks in the local banking industry and with the residents' tendency to behave opportunistically to determine the creation of high-tech ventures in a territory?</p>	<p>2012-2014 (792 high-tech firms created in the Italian provinces)</p>	<p>Panel data Database: Italian Ministry of Education Research (MIUR), Bank of Italy statistical office, Bank of Italy, Thompson One; Venture Capital Monitor, ISTAT, CRIOS-PATSTAT</p>	<p>Quantitative (Econometric modelling – zero-inflated binominal specification)</p>
<p>Entrepreneurial ecosystem conditions and gendered national-level entrepreneurial activity: a 14-year panel study of GEM (Hechavarría and Ingram 2019, SBE)</p>	<p>Does the entrepreneurial ecosystem influence the prevalence of male and female entrepreneurship over time?</p>	<p>2001-2014 (403 cases and 75 countries)</p>	<p>Panel data Database: World Bank Development Indicators, Global Entrepreneurship Monitor Adult Population Survey and National Expert Survey</p>	<p>Quantitative (Survey, autoregressive distributed lagged models)</p>
<p>Regional entrepreneurial ecosystems in China (Lai and Vonortas 2019, ICC)</p>	<p>What is the model capturing systemic factors that explain regional variation in important facets of entrepreneurship in one important emerging economy, China?</p>	<p>2008-2015 (263 Chinese prefecture-level municipalities (out of a total of 334 in the country))</p>	<p>Panel & Survey data Database: National Company Credit Information System (NCCIS), Sixth National Population Census, Province Intellectual Property office, Higher Education Statistical Survey, Asset Management Association, China city yearbook, CSMAR</p>	<p>Quantitative (Econometric analysis)</p>

The buzz before business: a design science study of a sustainable entrepreneurial ecosystem (O'Shea et al. 2019, SBE)	How entrepreneurial opportunities co-evolve within a sustainable entrepreneurship ecosystem (SEE)?	2015-2016 (Helsinki, Finland)	Exploratory (semi-structured) interviews, coding Case: Sustainable Cellulose ecosystem project	Qualitative single case study – multi-stage longitudinal process
Gimme shelter or fade away: The impact of regional entrepreneurial ecosystem quality on venture survival (Vedula and Kim 2019, ICC)	To what extent does the quality of a region's entrepreneurial ecosystem matter for venture survival?	2004-2011 (301 United States Metropolitan Statistical Areas)	Survey, Panel data Database: Kauffman Firm Survey (KFS), US Census Bureau, Thomson Reuters VenturExpert, Small Business Administration and Federal Deposit Insurance Corporation, US Patent and Trademark Office, National Business Incubator Association, Seed-Db.com, National Center for Educational Statistics)	Quantitative (Semiparametric Cox hazard regression model)
The role of MNEs in the genesis and growth of a resilient entrepreneurial ecosystem (Ryan et al. 2020, E&RD)	How do MNEs generate entrepreneurship and shape the form of innovation trajectories that can evolve in an entrepreneurial ecosystem over time?	1980-2017 (Galway medical cluster)	51 in-depth interviews Data: European Patent Office (EPO) PATSTAT, Irish Company Registration Office, FAME, newspaper, websites, LinkedIn	Qualitative multi-level longitudinal process study + Quantitative data

* Sources: Authors * Journal Abbreviations: SBE: Small Business Economics / SEJ: Strategic Entrepreneurship Journal / CJR: Cambridge Journal of Regions, Economy and Society / ICC: Industrial and Corporate Change / E&RD: Entrepreneurship and Regional Development

5. Discussion and Conclusions

Understanding the dynamics and factors underpinning the evolution of economic regions will allow light to be shed on one of the most critical issues confronting local economies, notably their capacity to be adaptive in order to constantly recreate their competitive advantage and survive over time. This matter has lately emerged as one of the most pressing issues for any local economy competing in today's volatile global economic scenario. Confronted by such challenging tasks, scholars, practitioners, and policymakers have the opportunity to tap into the growing and yet underdeveloped literature of entrepreneurial ecosystems to explore an alternative approach to gauge local competitiveness. In particular, we suggest that an explicit focus on the evolution of entrepreneurial ecosystems can offer an effective approach to assess the dynamics underpinning the transformation of local economies across space and over time. In this article we traced a future research roadmap on the evolutionary processes of entrepreneurial ecosystems. Foremost, amongst these are the appropriate and evolving boundaries of the ecosystem; the internal and external sources of new knowledge and the actors blending them with the existing knowledge base, and whether the evolution is guided by the visible hand of Government or is it less visibly anchored by large corporations, often MNEs, or institutions such as local universities. Additionally, shedding light on the intersection between local and global knowledge circuits will be a fundamental element of a new effective research approach.

Tackling these research issues matters for several reasons. First, it will help to shed further light on a topic - the evolution of entrepreneurial ecosystems - that has received only limited attention to date, and that is still largely underdeveloped. Related to this reason is the need to draw the boundaries of an ecosystems and to track them as they evolve. This necessarily requires the study of both the geographical and technological dimensions of an ecosystem's boundaries, a condition that will allow a better definition of the nature and characteristics of any ecosystem. A second motivation to further develop the study of evolutionary entrepreneurial ecosystems relates to the growing intersection of local and global dynamics. As regional economies are increasingly partaking in global value chains, understanding how new knowledge flows into localised ecosystem and supports the establishment of new entrepreneurial activities in related and unrelated technological domains represents a necessary condition in the study of the competitiveness of regional economies.

The study of the evolution of entrepreneurial ecosystems through the analysis of the transformation of their boundaries and the intersection of local and global dynamics will not only open up new research opportunities but should provide additional policy implications. Above all, we argue that our work offers three specific implications to local institutions and policymakers in general. First, we believe that the comprehension of the key dynamics underlying the evolution of entrepreneurial ecosystems will support policymakers' ability to make decisions in support of the competitiveness of their local economy. In a global context which has become particularly turbulent

and volatile in recent times, assessing the mechanisms that drive change in the specialization and competitive advantage of places will be a *sine qua non* condition for the definition of any robust industrial policy agenda. A static approach, on the contrary, could dangerously lead policymakers to a condition of 'cognitive redundancy' (Uzzi 1997) and 'cognitive myopia' (Maskell and Malmberg 2007). Second, tracking the evolution of entrepreneurial firms within an ecosystem will allow policymakers to assess the evolutionary trajectory of firms' specialization and sources of competitive advantage. This, in turn, will permit a finer analysis of the specific resources that are required by local firms and pave the way for the development of *ad hoc* industrial policies. Lastly, a clear understanding of the historical evolution of a local entrepreneurial ecosystem will equip policymakers with invaluable insights into the resources that a local system must attract from outside its boundaries to remain competitive over time. From foreign direct investments to the connection to global pipelines and global value chains, assessing the evolution of context-specific capabilities, resources and constraints will represent the necessary starting point for any outward-looking strategic policy decisions.

DECLARATIONS

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6 Paper 3: Multinational enterprise alumni spinouts in an entrepreneurial ecosystem: Where art thou?

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Abstract

Entrepreneurship and foreign direct investment are the pillars of economic development in most economies, especially modern advanced ones. From its origin, the entrepreneurial ecosystem (EE) concept has emerged as a framework to measure the entrepreneurial interdependence between actors within a local community and shed light on those actors and support systems that facilitate new venture creation. Among the actors in an EE, multinationals (MNEs) have been recognized as key anchors to generate entrepreneurial innovation. However, MNEs have also been shown to squeeze out entrepreneurship in the local region by absorbing scarce talent through offering higher wages than indigenous firms. Therefore, the purpose of this paper is to examine whether multinationals nurture or inhibit the formation and evolution of an EE? To answer this question, a qualitative case study was conducted to investigate the impact of MNEs on the emergence and evolution of an EE. This research provides a plausible explanation for why in this particular case of how the presence of MNEs can, on aggregate, more inhibit rather than nurture the evolution of an EE.

Keywords: entrepreneurial ecosystems, spinout, multinationals, entrepreneurship, evolution, nurture, inhibit, FDI

1. Introduction

Entrepreneurship and foreign direct investment are the pillars of economic development in most economies, especially modern advanced ones (Acs et al., 2008; Dunning & Narula, 2003). From its origin, the concept of an entrepreneurial ecosystem (EE) has emerged as a framework to measure the entrepreneurial interdependence between actors within a local community and shed light on those actors and support systems that facilitate new venture creation (Acs et al., 2017; Cohen, 2006; Isenberg, 2010; Nair et al., 2020; Nambisan & Baron, 2013; Stam, 2015; Stam & Spigel, 2016). An EE is based on the assumption that entrepreneurs are the triggers and enablers that push the boundaries of a given local economic system (Feldman et al., 2019; Schumpeter, 1911; Shane & Venkataraman, 2000). Ecosystems are dynamic and evolutionary by their nature, having an origin and a temporal transition (Alvedalen & Boschma, 2017; Motoyama & Knowlton, 2016; Roundy et al., 2018). However, empirical studies have rarely examined neither the direct antecedents of entrepreneurship in the EE, nor their subsequent role in the evolution of EEs. There are some few exceptions, however these often employ static and cross-sectional methods. (Cantner et al., 2020; Mack & Mayer, 2016; Malecki, 2018; Spigel, 2017; Spigel & Harrison, 2018).

Among the actors in an EE, such as universities, accelerators and government institutions (Colombo et al., 2019; Meoli & Vismara, 2016; Theodoraki & Messeghem, 2017), multinationals (MNEs) have been perceived as key anchors that may propel the evolution of certain EEs (Bhawe & Zahra, 2019; Dunning & Lundan, 2008; Neck et al., 2004; Ryan et al., 2020; Spigel & Harrison, 2018). Governments offer incentives to attract multinationals to locate in certain regions to create employment and gain advanced technological knowledge (Berrill et al., 2020; Ryan et al., 2020). However, MNEs have also been shown to crowd out entrepreneurship in the region by absorbing local talent through offering higher wages than indigenous firms (Berrill et al., 2020; Bhawe & Zahra, 2019). Therefore, the purpose of this paper is to investigate whether *multinationals trigger or inhibit the formation and evolution of an EE?*

Specifically, this research seeks to 1) explore the extent of new venture creation in the form of spinouts founded by alumni of MNEs in high-tech region; and 2) examine the barriers to founding of MNE alumni spinouts. To shed light on these issues, the case-study method is employed to investigate the extent of influence of MNEs, via spinouts, in the emergence and resilience of an entrepreneurial ecosystem. The study adopts a mixed research design consisting of desk research and qualitative interview data to provide a contextualized explanation of the influence of MNEs in the evolutionary process of an entrepreneurial ecosystem (Welch et al., 2011). From the data analysis

the research provides a plausible, though somewhat counterintuitive explanation for why there are so few MNE spinout founders in the case EE. We find that there are multi-level inhibitors to the influence of MNEs on the evolution of this EE.

This paper makes several contributions to emerging theory on EEs. First, this study sheds light on the evolution of an EE by identifying direct, rather than simply indirect, spillover effects of FDI, by using concrete measures MNE alumni spin-outs. Second, it extends theory by exploring the horizontal evolution of an EE and demonstrates how MNEs, on balance, inhibit more than nurture entrepreneurship in the local region.

The structure of the paper is as follows. The next section presents our core theory development. We then outline the research context and method. This is followed by our empirical findings. Lastly, the paper concludes with the discussions and suggestions a future research agenda.

2. Theory development

2.1 FDI spillover externalities

Spillovers can help to propel and expand the evolution of a cluster, primarily by building on and expanding the accumulation of knowledge (Breschi & Lissoni, 2003; Clarysse et al., 2014; Harima et al., 2020; Ryan et al., 2020; Van De Ven, 1993). Policymakers in developing countries have devised a variety of strategies to entice positive spillover (or externalities) from foreign multinational corporations (Moran, 2001). Several studies have focus on co-location and off-shoring firms to track knowledge spillover and finds that the reliance on the co-location effect is highly heterogeneous across firms, particularly firms with lower global exposure and dispersion of activities (Castellani & Lavoratori, 2020).

Governments provide incentives to multinational corporations to locate in specific regions in order to create employment and gain advanced technological knowledge (Berrill et al., 2020; Ryan et al., 2020). There has long been a debate in theory and among policymakers about whether MNEs have a positive or negative impact on the region (Audretsch & Keilbach, 2008; Berrill et al., 2020; De Backer & Sleuwaegen, 2003).

Knowledge and manufacturing activities spread worldwide during the first and second industrial revolutions. Knowledge spillovers are influenced by both agglomeration and geographical proximity. Today, however, knowledge is not only disseminated but also created collaboratively across space (Crescenzi et al., 2020). Knowledge clusters have remote ties with organised and extensive relations over time, often triggering co-development of technologies across agglomeration

within and beyond firms (Boschma & Frenken, 2006). Among the drivers of the dispersion of innovation activity are MNEs that began internationalising in the 1960s (Cantwell, 1995). MNEs from advanced economies started to share their R&D activities and spread knowledge globally. As a result, technological activities increased steadily from the mid-20th century until the financial crisis of 2008 (Athreye & Cantwell, 2007).

Support systems, such as government (public sector), academic, and other research institutions, as well as private firms and investors, are key actors in innovation systems as they become more concentrated. The agglomeration effects boost productivity and innovation within the region. The relationship between the global division of labour and innovation activity becomes apparent when considering the activities of MNEs. Scholarly debate has raged over whether MNEs are embedded as key agents of national economies in their home countries or dis-embedded as anchors of global chains (Vernon, 1979). They acquire and deploy knowledge through their global international networks, improving their performance both at home and abroad (Castellani et al., 2006; Castellani & Zanfei, 2007). However, Crescenzi et al. (2020) argue that there are significant inequalities in innovation capacity between the hotspot region and emerging countries due to the concentration of MNEs and institutions, and they advocate for spatial granularity of innovation.

By systematically reviewing the entrepreneurship and IB literature, Slesman et al. (2021) argue that results of studies on whether FDI nurtures (crowd-in) or inhibits (crowd-out) innovative entrepreneurship are mixed and inconclusive. Others uncovered the role of institutions between FDI spillovers and domestic entrepreneurship in 97 countries from 2006-2016 and discovered that the entrepreneurial benefits associated with FDI inflows depend on the level of domestic institutional absorptive capacity (Xiao & Park, 2018). It also implies that the rate of new venture creation induced by long-term foreign ownership in domestic firms is dependent on the capacity of domestic institutions and can lead to productive entrepreneurship (Baumol, 1996; Cohen & Levinthal, 1989).

2.1.1 MNEs as nurturers of local entrepreneurship

As I have discussed in paper 2, large enterprises, both indigenous and inward investors, can serve as breeding grounds for local entrepreneurship in a variety of fields. MNE can serve as anchor tenants in the evolving ecosystem (Agrawal & Cockburn, 2003; Clarysse et al., 2014; Colombelli et al., 2019; Mudambi & Swift, 2012). They attract skilled employees, improve managerial skills, and provide opportunities for local firms to access global customers (Neck et al., 2004). Some scholars emphasize the importance of multinational corporations in assessing the evolutionary dynamics of EE. They contribute to the growth of EE by acting as incubators and encouraging the formation of high-tech startups in both related and unrelated varieties (Brown & Mason, 2017; Klepper, 2007; Neck et al., 2004; Ryan et al., 2018, 2020; Spigel & Harrison, 2018). Employees' experiences and

learnings in these large organisations are likely to spawn new spinout ventures, primarily through the development of variants of a core product (Klepper and Sleeper, 2005). By incubating entrepreneurs, MNEs can catalyze and strengthen an EE's resilience. Furthermore, these anchors disseminated knowledge via multiple spinoffs of ex-employees in related and unrelated varieties (Ryan et al., 2020). This process, over time, increases heterogeneity in the entrepreneurial ecosystem, thereby supporting its long-term competitiveness. Spinouts, in fact, fuel diversification and the creation of new knowledge, as well as heterogeneity, which ultimately strengthens the resilience of an entrepreneurial ecosystem. As a result, MNEs serve as 'knowledge integrators', interacting with new ventures to generate knowledge spillover based on the ecosystem's 'absorptive capacity' (Bhawe & Zahra, 2019; Buciuni & Pisano, 2018).

2.1.2 MNEs as inhibitors on local entrepreneurship

While the majority of the literature emphasizes the positive effects of FDI, critics of globalisation have emphasized the negative effects of FDI on the economy. Some scholars have identified MNE strategies that generate negative short-term spillovers but positive long-term horizontal spillovers for an indigenous firm (Cantwell & Mudambi, 2005; Mudambi & Navarra, 2015; Spencer, 2008). Others have demonstrated that co-locating domestic firms' R&D loses talent from MNE labs, making knowledge spillover difficult for indigenous firms in emerging markets (Lamin & Ramos, 2016).

Other scholars investigated the relationship between MNE proximity and the labour mobility of R&D functions and discovered that, while technological lagging firms prefer to locate near the leaders, an increasing presence of R&D focused MNEs will have a negative impact on indigenous tech firms because the multinational absorb the talent within the ecosystem (Livanis & Lamin, 2016).

However, the spillover and crowding out effect is too aggregated (broad) and requires a more granular perspective. Thus, MNEs are valuable knowledge sources for aspiring and nascent entrepreneurs in the EE. Furthermore, the concentration of multinational corporations creates the potential for spinouts in both related and unrelated domains (Boschma & Frenken, 2011; Kedron et al., 2019). The resilience of the EE is amplified by this heterogeneity (Roundy, 2017).

2.2 MNE spinouts and alumni founders

Spinouts are new ventures founded by ex-employees of an incumbent firm (Klepper, 2007; Vedula & Kim, 2019), and these standalone firms have "no equity relationships with any incumbent" (Agarwal et al., 2004, p. 501). The spinout has been traditionally explained using the precepts of

agglomeration. Marshall (1920) stated the benefits of co-location, such as lower transportation, labour market pooling, and knowledge spillovers. According to evolutionary economics, clusters emerge as a result of capability transfer from parent firms to spin out companies. Despite the fact that spinout founders may not be related to their parents, spinouts inherit parental characteristics (Berchicci et al., 2011; Klepper & Simons, 2000; Phillips, 2005). Better firms generate a greater number of spinouts, and spinouts in close proximity can form a cluster (Agarwal et al., 2007). The motivation of a spinout is determined by the founder's prior experience and knowledge gained from the parent firm (Agarwal et al., 2004; Phillips, 2002), ability to form the core founding team (Beckman, 2006; Eisenhardt & Schoonhoven, 1996; Wezel et al., 2006), or even the parent company's investment in R&D and marketing (Klepper & Sleeper, 2005).

The majority of the literature focuses on vertical spinouts, in which the new firms stay within the same industry, such as, automobile (Boschma & Wenting, 2007; Klepper, 2007), tire (Buenstorf & Klepper, 2009), disk drive (Agarwal et al., 2004), laser (Klepper & Sleeper, 2005), semiconductor (Cheyre et al., 2015; Ferriani et al., 2012; Klepper, 2009a), and information technology (Garnsey & Heffernan, 2005; Grilli, 2010). Vertical spinouts can benefit from increased absorptive capacity due knowledge passed down from parent companies (Adams et al., 2019). The various types of knowledge include both tacit and codified forms of 1) market (Agarwal et al., 2004; Buenstorf, 2007; Shane, 2000), 2) technology (Franco et al., 2009; Teece, 1986) and 3) industry knowledge such as regulation, competitors, and networks (Chatterji, 2009). With limited resources, a new firm cannot develop all of its innovations optimally (Cassiman & Ueda, 2006). As a result, startups choose those that complement their core capabilities (Yeganegi et al., 2016). Spinouts find new market opportunities by deviating from the core technology of the parent firm (Klepper, 2009b) or by focusing on the needs of different customers (Hellmann, 2007).

Along with the codified and tacit knowledge, ex-employees tap into deep 'contextual knowledge' (Adams et al., 2016). Direct experiences in production and process, as well as close collaboration with customers, are regarded as the path to success in industries such as semiconductors and tires (Buenstorf & Klepper, 2009; Cheyre et al., 2015). However, some intra-industry spinouts are less likely created from activities related to the core technology of the incumbent firm (Hellmann, 2007; Yeganegi et al., 2016). Vertical spinouts, in particular, create intermediate products to bridge the functional gaps between producers and customer demands (Alcacer & Oxley, 2014; Arruñada & Vázquez, 2006). Spinout founders benefit from not only "what they know" but also "who they know" (Adams et al., 2019, p. 5). They may inherit affiliation with key organisations (Higgins & Gulati, 2003), as well as social connections with important actors within the ecosystem (Sorenson & Audia, 2000). Recently, some studies have investigated spinout

in the entrepreneurial ecosystem literature in venture capital and technology park (Cumming et al., 2019), high-tech startups (Harima et al., 2020), vascular-related manufacturing (Ryan et al., 2020), and mobile technology (Spigel & Vinodrai, 2020). As a result, this discussion requires a more in-depth examination of multinationals' activities and roles in the emergence and evolution of EE.

As I have discussed in paper 2, among the actors in an EE, multinationals (MNEs) have been recognised as important anchors to propel the evolution of EE through vertical and horizontal relationships with local actors (Bhawe & Zahra, 2019) and alumni spinouts (Ryan et al., 2020). MNEs, on the other hand, have been shown to crowd out entrepreneurship in the local region in a competitive contest for advanced resources, talent, and knowledge (Berrill et al., 2020; Goel, 2018; Livanis & Lamin, 2016; Spencer, 2008). To answer the research question of whether multinationals trigger or inhibit the formation and evolution of an EE, this study uses a multi-method case study to first identify the extent of MNE alumni spinouts in a local region and then identify the barriers to the formation of MNE alumni spinouts. From 2000 to 2018, we follow the evolution of a purposefully selected set of MNEs and their spinouts in a high-tech region.

3. Research method

3.1 Research setting

Qualitative research has been identified as a highly effective method for developing a comprehensive understanding of entrepreneurship in its contextual and temporal ecosystem (Cloutier & Langley, 2020; Karatas-Ozkan et al., 2014; Klag & Langley, 2013; Ryan et al., 2020). The EE literature, in particular, calls for a more longitudinal and dynamic approach to studying the evolution of EEs (Cho et al., 2021; Malecki, 2018; Ryan et al., 2020). For contextualised explanation (Welch et al., 2011), we purposely selected our case setting as a high-tech local economy containing large scale FDI in the form of global internet companies attracted to Dublin city, Ireland.

In the early 2000s, after the collapse of the dot-com bubble, Industrial Development Agency (IDA) Ireland has attracted multinational internet companies, particularly from Silicon Valley to Dublin, with the support of the Irish government. *Internet companies* are firms that generate revenue through online sales, financial transaction fees, paid advertising, cloud services, and a host of other business lines (Investopia, 2020). Ireland has four main factors for attracting global companies. First, the accessibility to skilled labour is high. Ireland's median population age is 35, which is the lowest in the EU. Second, Dublin is one of the most diverse and international cities in Europe. More than a thousand global firms are operating in Dublin. Third, the corporate tax rate is among the lowest in

Europe, with a 12.5 per cent fixed rate. Ireland also has a double taxation agreement with 69 countries. After the initial arrival of Salesforce in 2000, tech-giant Google opened EMEA headquarters (HQs) in Dublin in 2003 with 100 employees. Fifteen years later, the EU HQ is now Google's most significant outside of the US, with the employment of over 8,000 people from over 70 countries. Other tech giants such as Facebook followed. For this study, an extensive search identified 35 internet-based multinationals which are present in Dublin (IDA, 2020). The historical timeline of these multinationals' first presence in Ireland is presented in Figure 19 below.

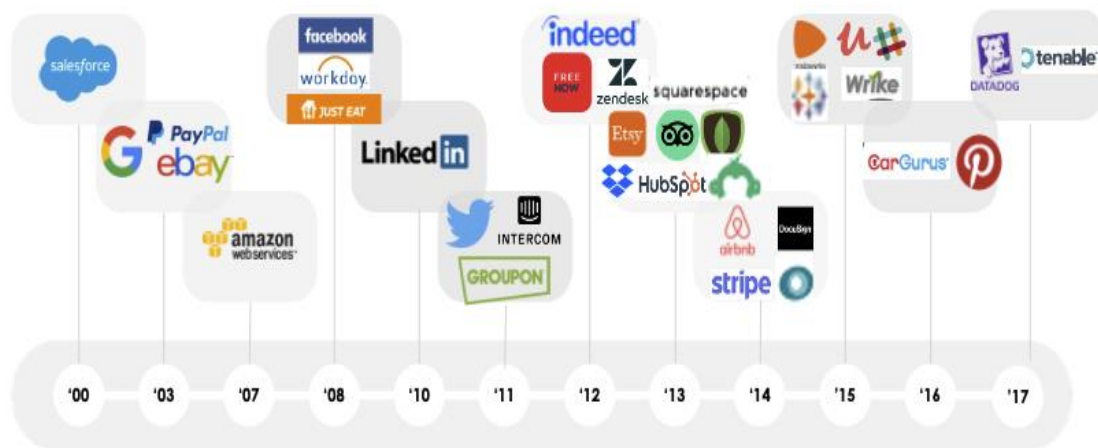


Figure 19 Timeline of Dublin internet companies' establishment (2000-2018)|

3.2 Secondary data search – defining the MNE alumni spinout population

The data collection followed four steps: 1) understanding the Dublin EE, 2) setting the industry boundary of the multinationals, 3) mapping out the internet-based multinationals and examining their activities, 4) searching for the MNE alumni spinout founders. First, over 487 news articles were analysed to search for significant events and founders, 329 newsletters and 48 public reports from government agencies (Department of Business Enterprise and Innovation, IDA, Enterprise Ireland etc.) and professional associations (Irish Computing Association, Irish Internet Association, American Chamber of Commerce etc.) to gain knowledge about the industry and policies. Second, company data were collected from various databases, such as OECD, ORBIS Europe, Enterprise Ireland, IDA, to set the industry boundaries. Third, *internet companies* were selected as the core population for inward FDI. 35 internet multinationals met the criteria. The activities from the 35 internet MNEs are summarised in the Table 14 below.

Table 14 Activities of the multinationals (Internet companies)

Company(year)	Functions (Dublin)
Salesforce (00)	Sales, Product & Technology (Engineer, Network, Security, Product Analysis), Customer Success, Admin, Fin, Alliance & Channels, Legal, HR, Mkt, Prog mgmt., Operation, Strategy
Google (03)	Sales, Marketing, Legal & Finance, HR, Business Strategy, Customer Service, Engineering (SW, Datacentre, Gaming), Data security, Facility
PayPal (03)	Global financial crime/compliance, Sales, HR, Customer Service, Business Develop, Trust, Safety
eBay (03)	Sales, Business Op, Customer Experience, HR, Marketing Communication
AWS (07)	Sales/Mkt, Content/Design, Business Dev, Purchase, SW development, Data admin, Admin
Facebook (08)	Business Services, Operation, Finance, Technologies, HR, Strategy & Design, Gaming, Engineering (Enterprise, Data, Security), Infrastructure & Facility
Workday (08)	Customer Operations, UX & Design, Education, Sales, Consulting, Engineering, Product Mgt, Admin, HR, Legal, Security (SW jobs 187 IE 52)
Just eat (08)	Customer Service, Retail management
LinkedIn (10)	Sales (Global Talent Organisation), Mkt, Admin, HR, Fin, Tech Support, Economic Graph Research & Insights (Data Science), Data Standardization
Twitter (11)	Marketing/Comm, Compliance, Trust & Safety, People, Strategy, Sales & Partnerships, Customer Support and Operation, SW (Networking)
Intercom (11)	R&D Engineering, Legal, Marketing, HR, Product Design, Product Management, R&D Business Systems, Research/Analytics/Data Science, Sales, Sales Business Systems
Groupon (11)	Technology & Product (SW Engineer, Big Data, Cloud Platform, Data Analyst, Info. Security), People, Marketing & Communication (CRM and Loyalty, Channel Strategy), Finance, Sales
Mytaxi (12)	Sales, Customer Service,
Indeed (12)	Admin/HR, Fin, Legal, Corporate Development, Sales / Marketing, Product, Client Success, Engineering (Data Science)

Zendesk (12)	Engineering & Product, Sales & Sales Leadership, Customer Advocacy, Creative (UX, Product Design) People & Places, Marketing, Security
HubSpot (13)	Business Enablement, Product & Engineering, People Operation, Customer Success & Mkt, Sales
Dropbox (13)	Customer Experience (Customer Support), HR, Sales, Regional Solution Architects
Tripadvisor (13)	Software Engineering, Product Design, Marketing, Operations, Sales, HR
MongoDB (13)	Customer Engineering, Engineering, G&A, Sales
Etsy (13)	Engineering, Finance, Product
Squarespace (13)	Customer Operations, Engineering, Finance, Product & Product Design
SurveyMonkey (13)	Sales, Customer Success, Solutions Engineering, Business Development, Customer Operations, Finance
Airbnb (14)	Compliance, Facility/Trust, Operation, Admin, Employee experience, Community Support
New Relic (14)	Sales, Product, Tech Support
DocuSign (14)	Sales, Support and Services, Engineering & Tech Operations, Finance, HR, BusinessDev
Stripe (14)	Business Operation, Marketing, Sales, Engineering, Finance, Legal, People, Data Science, Payment System Interfaces, Product Management, Product Operations, Tech
Tableau (15)	Technical Support, Sales, Business Develop, Business Value Service, Database Engineering
Udemy (15)	Business Development, Customer Success, Engineering and Data, Global Customer Service, HR, Marketing, Sales
Slack (15)	Customer Success, Customer Experience, Marketing, Sales, Sales Operations, Solutions Engineering, Recruiting
Zalando (15)	Data Science, Product Management, Applied Science,
Wrike (15)	Sales, Marketing, Customer Success,
Pinterest (16)	Engineering, Sales, Operations, HR

Cargurus (16)	Sales, Business Develop, Finance, Dealer Relations
Datadog (17)	Sales, G&A, Technical solutions
Tenable ('17)	Engineering, HR, Business Platforms, Tech Support, Sales, Sales Operations, Security

Lastly, the search for MNE alumni spinout founders was conducted in three steps: 1) web search, 2) company database (Techireland.org), 3) social network search (using LinkedIn premium search). First, the web search has been conducted with various search strings, such as "ex- (company name) AND founder", "former (company name) AND CEO", "multinational AND founder", etc. This search resulted in identifying 12 founders. Second, the author searched TechIreland.org database, which contains the largest dataset of multinational companies and startups in Ireland (2,760 startups and 385 multinationals). We have examined the founder profiles for 2,760 startups via LinkedIn and identified 15 additional founders. Third, an in-depth search was conducted with LinkedIn. With the LinkedIn premium search, 43,000 potential founders and CEOs were identified in Dublin with the search string "Founder AND Dublin" OR "CEO AND Dublin". From this search, the researcher has applied the premium filter to identify founders with previous employment history in multinationals. Thirty-four internet MNEs were selected, and the refined search identified 767 additional founders (797 founders in total). After the search, the profile of the founders has manually been verified. Ex-employee founders who are: 1) sole entrepreneurs (low impact on the evolution of EE), 2) the location of the multinational was outside of Ireland (out of scope), 3) and with less than one year of working experience (knowledge transfer and learning experiences are minimal) were excluded to. The data were cross-checked for duplication across the three steps and ultimately identified thirty-six spinout companies, including thirty-six founders and nine co-founders who previously worked in multinationals. The data search process is illustrated in the Figure 20 below.

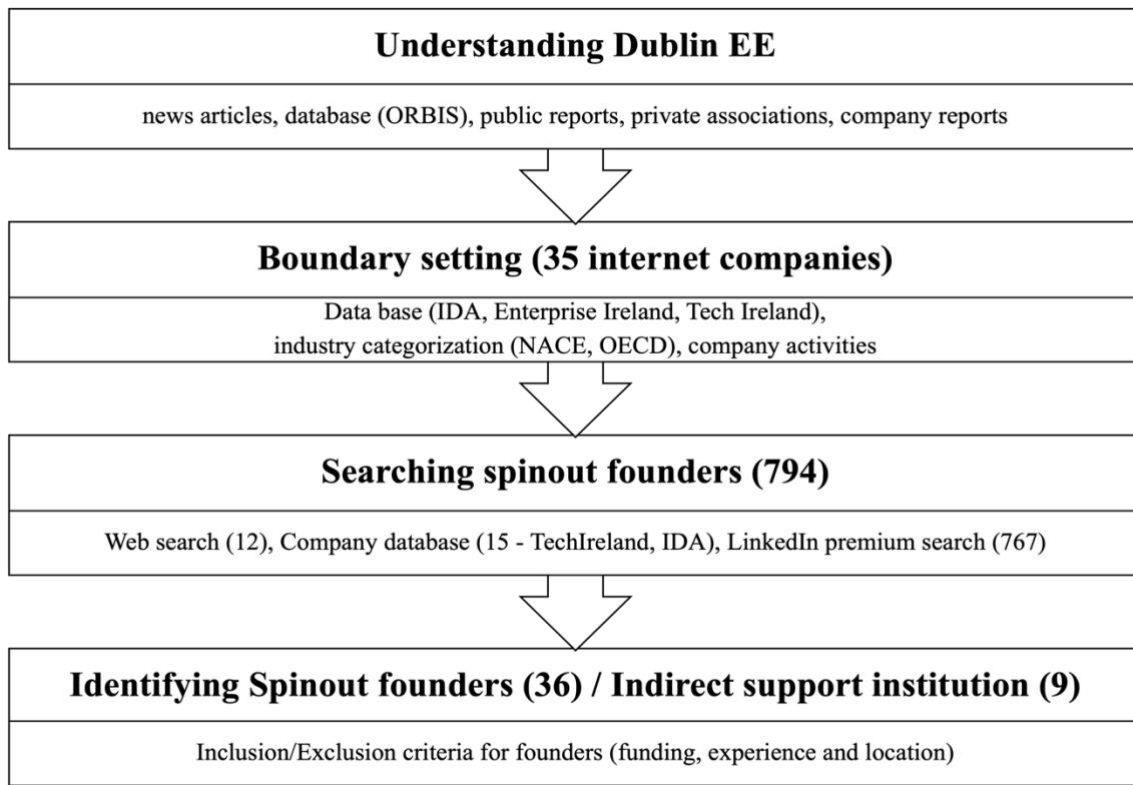


Figure 20 Data search process

3.3 Data collection

3.3.1 Spinout founders

In our first stage of primary data collection, 27 semi-structured interviews were conducted with MNE alumni founders (most were via zoom but include three interviews via email). The list of MNE alumni founders' interviewees has been anonymized below (Table 15) and the interview schedule is then listed in Table 16 below.

Existing studies also suggest that there are multiple evolutionary pathways for entrepreneurial ecosystems. The creation and evolution of an entrepreneurial ecosystem can be organically entrepreneur-led (Feld, 2012b); alternatively and possibly simultaneously, it can be guided by the visible hand of Government (Adams, 2020; Fuerlinger et al., 2015), or even anchored by large corporations (Bhawe et al. 2019; Colombo et al. 2019; Ryan et al. 2020) and universities (Cunningham et al., 2019; Hayter, 2016; Johnson et al., 2019; Miller & Acs, 2017; Nicholls-Nixon et al., 2020). Additionally, an entrepreneurial ecosystem can mutate from a pre-existing system such as an industry cluster (Autio et al., 2018; Pitelis, 2012), or set of co-located clusters of varying vintages, through technological convergence in related and unrelated branches (Auerswald & Dani, 2017). For instance, Ryan et al. (2020) empirically illustrated how a strong, resilient entrepreneurial ecosystem could emerge from the metamorphosis of an antecedent industrial cluster, primarily via MNE spinouts, and lead the evolution of an entire production region. Contrariwise, Cantner et al.

(2020) conceptually outlined subsequence for an entrepreneurial ecosystem in its further evolution into a ‘business ecosystem’.

Regardless of the specific evolutionary path an ecosystem can follow, incumbent entrepreneurs and corporate or institutional spillovers generally play a key role in the development of entrepreneurial ecosystems. Pioneer entrepreneurs that either serially start more firms or successfully exit their initial venture, serve to activate an entrepreneurial ecosystem’s ongoing growth and renewal. They do so as role models, mentors and even angel financiers that channel their resources, time and energy into its perpetuation (Mason and Brown 2014; Mason and Harrison 2006; Ryan et al. 2020). Spillovers can serve to propel and expand the evolution of an entrepreneurial ecosystem, primarily by building on and expanding the accumulation of knowledge at a local level (Agrawal and Cockburn 2003; Breschi and Lissoni 2003; Clarysse et al. 2014; Harima et al. 2020; Ryan et al. 2020; Van De Ven 1993). They generally come in either of two forms, spinout or spinoff. Table 15 and 16 below illustrate various data of spinout founders and their interview schedules. When collecting secondary data, prior experiences of the founders were collected via LinkedIn profile and founder information. According to Table 15, thirteen of the twenty-seven founders ventured into unrelated fields, while the rest remained in the same sector. Interestingly, there was no direct relationship between the previous roles (i.e. sales, product development, engineering) of founders and their choice of sectors when starting their new businesses.

Table 15 Founder interview List

ID	Year founded	Current position	Prior experience	Sector (related/unrelated)	Funding (Million EU)
F-1	2007	Founder	Google	Health (unrelated)	3
F-2	2012	Founder	Google/Twitter	Ecommerce (unrelated)	21
F-3	2013	Founder	Google	Enterprise Solution (related)	5
F-4	2015	Founder	Google	Ecommerce (unrelated)	115
F-5	2015	Founder	Zendesk	Retail (unrelated)	1.2
F-6	2016	Founder	Groupon/Salesforce	Brand management (unrelated)	Seed(N/A)
F-7	2017	Founder	Twitter	Data security (related)	0.58
F-9	2017	Founder	Salesforce	SaaS (related)	1
F-10	2017	Founder	Twitter	Media (related)	2.3
F-11	2018	Founder	DocuSign/eBay	Data security (related)	41
F-12		Cofounder	DocuSign		
F-13	2018	Cofounder	Groupon	SaaS (related)	33
F-14	2019	Founder	Google	Health (unrelated)	30
F-15	2019	Founder	Google(Fitbit)	Travel (unrelated)	0.5
F-16	2019	Founder	Google, Facebook	HR (related)	Pre-seed

F-17	2019	Founder	Intercom	HR (unrelated)	2
F-18	2019	Founder	Intercom	Fintech (unrelated)	2
F-19	2020	Founder	Google	Food (unrelated)	0.3
F-20	2020	Founder	Facebook	Fintech (unrelated)	Seed
F-21	2020	Founder	eBay	Cleantech (unrelated)	Seed
F-22	2021	Founder	Stripe/Zalando	SaaS (related)	1
F-23	2021	Founder	Google	Health (unrelated)	Pre-seed
F-24	2013	Founder (acquired)	Google	Retail (related)	Seed (N/A)
F-25	2017	Founder (acquired)	Google/eBay	Pest control (unrelated)	202K
F-26	2017	Founder (dissolved)	Google	Marketing (related)	N/A
F-27	2020	Founder (dissolved)	Google	Marketing (related)	2

Table 16 Founder interview schedule

Interviewee	Purpose	Questions
Founders	Icebreaking	- Do you miss the free food in the cafeteria from when you were working in the multinational?
	Motivation	- Why did you quit and start your own business? -Where was the business idea from? What was the spinout process? -Why did you leave the multinational? -Did you have a chance to present your idea in the multinational?
	Founder numbers	-Why do you think there are so few ex-MNE founders like you? -What makes it so hard to leave?
	Snowballing	-Do you know any other ex-MNE founders?

3.3.2 Indirect support institutions

To increase the broader institutional/infrastructural support context of Dublin EE, we included two angel investors, two venture capitalists (VCs), three directors of accelerators, one high-level manager of a government investment agency, ex-MNE founder networks, and private associations each. The interviewees were mostly asked the same interview questions as the founders. Supplemental questions were asked their individual insights into paucity of internet spinouts and lack of scale of many of those founded. The list of the support institutions and the supplemental interview schedule is presented in Tables 17 and 18 below.

Table 17 Indirect support institution interview list

ID	Current position	Duration (min)	Mode
A-1	Accelerator	30	Interview
A-2	Accelerator	30	Interview
A-3	Accelerator	30	Interview
V-1	VCs	35	Interview
V-2	VCs	35	Interview
V-3	Angel investor	30	Interview
V-4	Angel investor	30	Interview
G-1	Government agency	35	Interview
G-2	Government agency	40	Interview

Table 18 Indirect support institution supplemental interview schedule

Interviewee	Purpose	Questions
Supporting organisation (VCs, accelerators, government agencies)	Founder numbers	-Why do you think the numbers of ex-MNE founders are so low?
	Interconnectedness of the Dublin EE	-What is missing in Dublin EE?
	Founder's motivation	-What aspect do you prefer from the founders if you are investing/supporting?

3.4. Data analysis

We utilized the Gioia method for our data analysis using a two-phase process to achieve systematic data reduction (Gioia et al., 2013; Langley & Abdallah, 2015). NVivo software was used to aggregate the interview data and for assigning codes. In the thematic analysis we employed open coding to capture concepts, codes and categories. In extracting 1st order concepts, we prioritised interview quotes according to their frequency and emphasis in the interview data. The first-order concepts are summarised in the Appendix 1. We categorised the 1st order concepts to 2nd order themes to bundle the relevant theoretical concepts. Lastly, categorised the codes into themes.

4. Findings

Dublin has built a thriving indigenous internet EE. Since 2006, Enterprise Ireland (2020), a government-based institution that supports new ventures has funded 1,379 High-Potential Startups (HPSUs) and 698 Competitive Startup Fund (CSFs) in the internet space nationally. Dublin was home to over 30% of these Internet HPSUs (446 HPSUs) and 60% of the CSF (243 CSF startups)

awardees constituting a vibrant indigenous EE. Some of these startups have been very successful and attained ‘soonicorn’ ratings. Table 19 shows the total funding obtained by the top five indigenous internet companies. By 2021, they had received funding in excess of 100 million Euros.

Table 19 List of indigenous Internet companies in Dublin (Top 5 funding in 2021)

Company	Funding (Million EU)
Fenergo	211
Wayflyer	203
Swvire	115
Flipdish	113
Cubic telecom	102

*Source: Irish Times (2021)

Dublin presents an excellent accelerator and incubator ecosystem that provides pre-seed investment, office space, and mentoring to early-stage startups. These include NDRC, NovaUCD, LaunchBox, Dogpatch Labs, and DCU Ryan Academy. For example, one of the oldest accelerators, NDRC, has been in operation for over a decade and has invested in over 255 startups, with one-quarter of its portfolio companies receiving more than \$250,000 in follow-on investments. Dublin also possesses post-Series A VC funds like Atlantic Bridge, ACT Venture Capital Fund, Fountain Healthcare Partners Fund, Frontline Venture Fund, Kernel Capital Growth Fund, Suir Valley Ventures, and Seroba Life Sciences to support new ventures in its evolving EE (see figure 21 below).

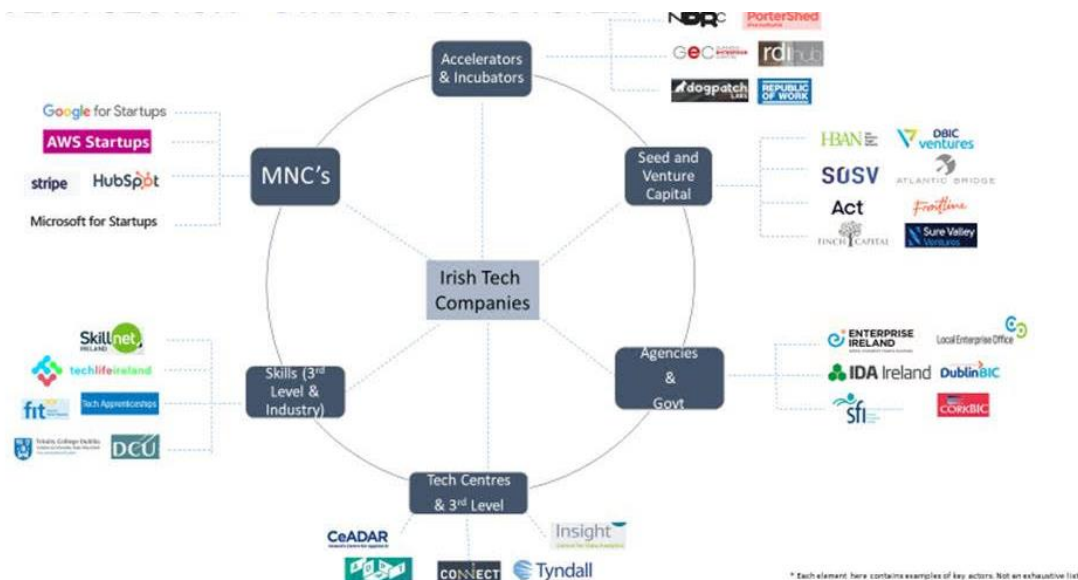


Figure 21 Indirect support institutions of Dublin EE (Enterprise Ireland, 2020)

MNEs, however, had a negligible impact on the growth of Dublin’s internet EE. My findings illustrate that whilst Dublin-based MNEs have been passively incubating startups through in-house programmes, these have had little tangible impact on the EE. To demonstrate the relative low impact of MNEs on the Dublin EE via spinouts, I made a comparison in terms of (a) quantity as pure number of spinouts and (b) quality in terms of funding, of the Dublin Internet EE with the vibrant Galway Medtech EE that is anchored by two R&D-intensive MNEs (Medtronic and Boston Scientific). First, in terms of quantity I compared purely the number of spinouts in both EEs. I rather roughly, for broad illustrative purposes, calculated the ratio of MNE spinouts to total MNEs in both the Dublin Internet EE and Galway Medical EE (see below in table 20).

1) Quantity (number of spinouts)

Table 20 MNE Spinout Ratio

Region (Year-2018)	Indigenous Spinouts (A) & FDI companies (B)	Spinout ratio (A/B)
Galway	62 & 33 (Medical MNEs)	1.8
Dublin	27 & 35 (Internet MNEs)	0.7

The ratio differential indicates that MNE spinouts in the Dublin Internet EE are relatively low in number when compared to Galway Medical EE. However, the number of recent spinouts (after 2018) in Dublin has been increasing, indicating an early emergence of MNE spinouts. Yet, this remains a low number compared to the indigenous internet startups founded in Dublin.

2) Quality (funding scale) of the spinouts

According to secondary data I collated, the highest valued MNE spinout company in Dublin’s Internet EE is 300 million USD with total funding of 41 million USD raised (as of 2022) (See Table 15 - Funding). From the valuation, there are no unicorns (valued at 1 billion USD) in Dublin from amongst the MNE spinouts, compared to five unicorns (Workhuman, Fenargo, LetsgetChecked, Flipdish and Wayflyer) from indigenous startups in Dublin (Irish Times, 2022).

Compared to Dublin-based EEs, multinationals in the Galway Medtech EE created R&D facilities within ten years of their initial arrival in 1982 (CR Bard-later to Medtronic) and 1994 (Boston Scientific). At the time of their establishment, the MNE subsidiaries were simply engaged in basic assembly production and manufacturing activities. However, over time, the Galway MNE subsidiaries have demonstrated their capability through incremental innovation, and eventually, they were able to actively contribute to the company’s new product development. Over the subsequent years, indigenous startups in the Galway Medtech EE emerged in the form commonly of spinouts in

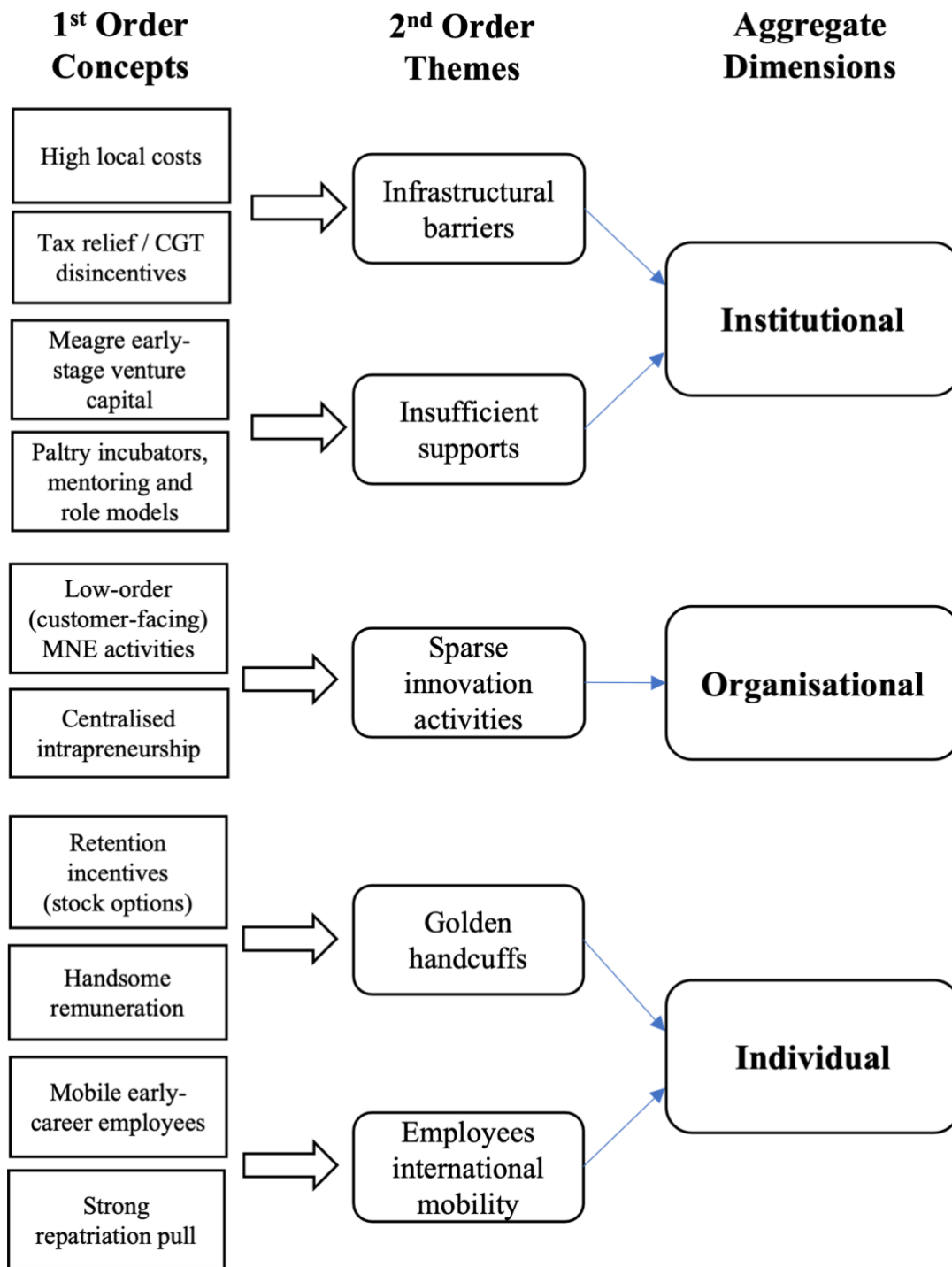
specialised vascular-related medicine (cardiovascular and endovascular) and later in unrelated varieties of technological domains (Ryan et al., 2020).

In Dublin however, the MNE subsidiaries were slow to attract R&D activities even after two decades of their local presence. Table 14 demonstrates the MNEs' value chain activities. I created this table using both official company websites and secondary sources, such as tracking job vacancies at the MNE internet companies over time. The majority of Internet MNEs are seen to be focusing on employing customer-facing and acting as simple operational units in their Dublin branches. Little evidence of upward evolutionary change in their activities was found over time based on the data collected. Prominent MNEs such as Google, Facebook, and Amazon were seen to maintain engineering functions. However, these were primarily focused on maintaining the system engineering and data centres (network engineering) that are non-R&D functions. There are, of course, a number of spinouts of which more later. Google has been the source of the highest proportion of these spinouts. Ex-Googlers account for about 30% of total MNE spinouts. Yet, this is not surprising given that the company employs over 8,000 people and is the region's largest employer amongst the Dublin-based MNE Internet companies.

However, I have, somewhat promisingly for future growth of the Dublin Internet EE, identified R&D-related engineering units in recent arrivals, such as Stripe, Intercom and Zalando. Intercom and Stripe have a unique context in that the founders were Irish nationals who relocated to the United States to scale up their companies. Based on a recent interview given by Des Traynor (Intercom CEO), the decision to relocate the core engineering function to Dublin was made with a specific goal in mind of upgrading to R&D activities (Silicon Republic, 2022). Unsurprisingly, Stripe, Zalando, and Intercom are seen to be catalysts for some recent MNE spinouts, but as yet few in quantity.

In contrast to the vibrant indigenous Internet EE, our study shows that MNEs had a greater impact as inhibitors of entrepreneurship despite evidence of some spinouts. These were mostly by skilled engineers in areas of high potential, such as cyber-security or by founders from the executive suite that had achieved personal economic security and cashed out high-growth stock options. According to our primary interview data, the reason so few MNE became new venture founders was principally due to factors that can be broadly categorised as those of 'deterrence' and 'disincentivisation'. The former includes obstacles to new venture creation such as high costs of doing business, tax disincentives, poor support infrastructure, scarce role and success models. Disincentives occur where the prospective founder is dissuaded from new venture start up by opportunity costs and loss of high salaries, generous working conditions, retention stock options allied to high personal living costs. Our data analysis employed the Gioia method to identify aggregate dimensions of MNEs whilst EE evolution via spinouts. These are 1) individual, 2)

organizational, and 3) institutional. Each category has sub-categories (2nd order themes). The summary of the Gioia analysis is illustrated in the Figure 22 below.



* CGT: Capital gains tax

Figure 22 Summary of the findings (Gioia analysis)

4.1 Pressures to stay in MNE – Individual level

4.1.1 Golden handcuffs

4.1.1.1 Retention incentives (stock options)

The efforts of our study MNEs to retain skilled employees are strenuous. Stock options have been popular compensation and retention incentive for these MNEs. Restricted stock units (RSUs) are a significant benefit for the employees as the stock prices of internet companies have increased dramatically during the decade. The number of stocks an employee can claim increases with each passing year. One ex-MNE founder with top-level executive experience emphasized the significance of RSUs to motivate the MNE employees to stay longer in the job. "The RSU is a huge factor from a retention perspective" (F-16). Stock options have proven to be the most significant individual factor in dissuading exit from the MNEs to start a new venture.

4.1.1.2 Handsome remuneration

Another ex-MNE founder emphasized the retentive power of handsome compensation, such as high salary, attractive working conditions (despite long hours) and multiple employee benefits. "There are people that get an enormous amount of salary increase every year and fresh avocado in the morning. There are people now who are probably in the middle of their careers that literally started with Google or Apple 15 years ago, that would never ever leave those companies." (F-7).

4.1.2 Employees international mobility

4.1.2.1 Mobile early-career employees

Early-career employees in the study MNEs are of diverse nationality. Over seventy per cent of the workforce are international (The Irish Times, 2020). The average age of the employees working in these internet companies is just under 30 years, about five years younger than the hardware/consumer multinationals with an average age of 35 (The Journal.ie, 2015). This relatively young workforce can, and do, move across country subsidiaries within these MNEs. One of the founders mentioned: "Dublin tends to be the European headquarters, it tends to have an overwhelming number of staff that aren't indigenous, ... you'd be surprised how many of them aren't necessarily happy to be in Ireland, either. Thus, the attachment to the region is weak. So, a lot of people that work in Google, if they had their say, would be working in their domestic market. So, many of the French people working in Google Ireland, and in Facebook, Ireland, if they are given

the option opportunity, they would say, No, I want to do the same job. But I want to be located in France (F-13).”

4.1.2.2 Strong repatriation pull

Having gained work and life experiences in the study location, repatriation to their home country, sometimes within the MNE, others to start new enterprises domestically, is common. From the LinkedIn search of 797 founders, more than 50 founders have started their business abroad. One founder interviewee commented: "I think that there's a lot that ... go back to their own countries and start businesses because there's a huge number of international workers coming in from all over the world. So, I know quite a few have left them to create their own company (back home) (F-21).”

4.2 MNE activities - Organizational factors

4.2.1 Sparse innovation activities

4.2.1.1 Low-order MNE value chain activities

The low-order value chain activity of the MNEs in Dublin was one of the main factors for the low spinout rates. Most of the companies, at least until 2015, focused on low-order activities, such as sales, operation, customer service. One founder stated that: "When you look at the skill profiles, many of the individuals working here do not have the core product technical skills to build leading solutions (F-13)". However, some engineering and product development activities seem to be emerging from 2016 onwards, with the arrival of Stripe and Intercom. A VC mused: "I think as you saw new functions coming into Ireland ... more high-end sales, or engineering, product management ...technical functions emerging over the years ... that create founders...like Silicon Valley (A-2). However, engineering activities were primarily controlled by HQ or other tech-hub locations, such as London, Tel-Aviv or Bangalore. Most of the study’s spinout founders had such technical skills.

4.2.1.2 Centralised intrapreneurship

MNEs commonly invest in internal projects that could eventually become corporate spin-offs. Data shows that intrapreneurship activities of the Internet MNEs have decreased globally over the last ten years. Facebook discontinued its intrapreneurship projects in 2018, whilst Google’s Area 21 project is centralised in HQ. A spinout founder mentioned there are limits to intrapreneurship activities stating: “But in many cases, it could be simply solving an internal problem, where it’s not going to generate revenue for the company...I don’t think it goes too far (F-19)”. Also, some ex-MNE founders reported that intrapreneurship activity is concentrated at MNEs’ HQ. A founder mentioned: “All of that (intrapreneurship) in San Francisco is really hard to reach (F-23).”

4.3 Institutional level

4.3.1 Infrastructural barriers

4.3.1.1 High local business costs

Potential founders were deterred from exiting the studied MNEs and setting up a new venture due to the high costs of doing business and the opportunity cost of living in Dublin. In particular, commercial and residential rent in Dublin has increased more than 30% over the last three years (The Irish Times, 2021). One founder reported the barriers to starting a business in Dublin that is related to high living costs: "You meet lots of young talented people, but they're paying crazy rent. And you know what happens to them, they go and live in Barcelona, the Canary Islands or somewhere that's cheaper to live. So that's that. It's just a simple fact of life in Ireland. (F-1)

4.3.1.2 Tax relief and capital gains tax (CGT) disincentives

Tax disincentives to represent deterrents to potential exit and start up. Tax relief for any losses incurred in startups is a common incentive for the companies in other EEs, such as Silicon Valley and London. This has an especially positive impact on high-risk ventures. Capital gains and tax relief is limited to equity rounds, while other EEs are allowing tax relief for wider forms of investment, such as convertible loans, notes and safe agreements. A founder mentioned: "Tax relief to various investment measures would have a big impact if it were possible to use those structures and still benefit from the tax relief (F-12)."

4.3.2 Insufficient supports

4.3.2.1 Meagre early-stage venture capital

Most of the founders faced difficulties in getting the angel investment in their early stages. Significantly, there is decreasing trend of funding in smaller startups while the total funding amount of Dublin EE has increased in recent years. According to the funding report from Tech Ireland (2020), Irish EE recorded the total funding in the year 2020 over 1 billion Euros; also, the total amount being invested during the last decade has been growing substantially. However, the number of small early-stage deals have declined over four years by 12 %. A founder mentioned the difficulties of scaling after the seed investment. "There is a kind of expectation that there's some follow-on funding there, which often isn't available. And so after that, initial angel investment we got, you know, we ran out of money, you know, put money in ourselves, and we got a strategic investor from France to put money into the company. (F-3)". A venture capitalist who is an ex-MNE employee also supports this argument: "In Silicon Valley, I think your alternatives today are very

good. But your alternatives in the future are also very good...If you jump out, your chances of getting funding are probably fairly good...And the amount of funding ...will be good enough to maintain some elements of a lifestyle for two or three years until you succeed or fail. And if you fail, and there's such a developed ecosystem with companies that absolutely every stage and every function, you can jump back, it not the case of Dublin (V-1).” Another VC stated that "I'd also like to see the ability for people to invest in Fund type structures. So that somebody who isn't a kind of a tech person while she is perhaps a dentist or a doctor or who is interested in investing A, you know, a few 1000 euros into start startups, can I assess the portfolio rather than just kind of an individual company (A-1)." Another founder called for more diverse investment from the government agencies: "And also from a funding perspective... government funds tend to focus on...ideas around AI, renewable energy that is very unattainable (F-13).”

4.3.2.2 Insufficient incubators, lack of mentoring and role models

Along with early-stage funding, incubators and mentoring are critical to startups' growth and survival. Incubators source various founders with different professional skills and support the protentional founders in matchmaking, business model development, finding product-market fit, and providing relevant networking. The number of incubators and accelerators in Dublin has been decreasing over the ten years: "Compared to 10 years ago, we've got fewer accelerators, we've got less momentum (A-3)". On the lack of critical successful role models and serial entrepreneurs, one founder stated that: “there aren't the second-generation success stories of founders who were massively successful and invested in other stuff.” (F-11). Another commented that “success breeds results, right.” (F-27)

5. Discussion and conclusion

5.1. Contributions to theory

This study investigated whether MNEs foster or stifle the formation and evolution of entrepreneurial ecosystems. It looked specifically at 1) the extent of new venture creation in the form of spinouts founded by alumni of MNEs in high-tech region, and 2) the barriers to the formation of MNE alumni spinouts. To shed light on these issues, we used the case-study method to investigate the extent to which MNEs influence the emergence and resilience of an entrepreneurial ecosystem through spinouts. The study adopted a mixed research design that included desk research and qualitative interview data to provide a mix of interpretive sensemaking and contextualized explanations of the role of MNEs in the evolutionary process of an EE (Welch et al., 2011). We provide a plausible, albeit somewhat counterintuitive explanation for why there are so few MNE

spinout founders in the case of Dublin EE based on our data analysis. Broad secondary data revealed that one out of every thousand MNE alumni founders is present in Dublin, making the EE appear extremely hollow. Contrary to Ryan et al. (2020) this study challenges the view of incubators and finds that MNEs instead, on balance, inhibit entrepreneurship within the EE.

This study contributes to EE theory by demonstrating the direct effect of FDI spillover through concrete measures such as MNE alumni spinouts. By investigating the horizontal evolution of an EE, this study demonstrates how MNEs, in this case, crowd out rather than promote entrepreneurship in the local region. This paper adds to the sparse and mixed evidence on the MNE as an actor in an EE by combining literature on international business (i.e. FDI) and entrepreneurial ecosystems (Ryan et al., 2020). Unlike Ryan et al. (2020), who identify MNE subsidiaries as conduits of 'global pipelines' (Bathelt et al., 2004) into and out of the EE, MNEs in this study result in both lagging evolution over time and inhibiting the spillover and spinout process.

Unlike the studies that describe the crowding-out effect (Berrill et al., 2020; Goel, 2018; Livanis & Lamin, 2016; Spencer, 2008) (i.e. taking the talent and resources), MNEs, in our study, instead bind employees and potential spinout founders with golden handcuffs. We discovered that there are multi-level "contextual explanations" (Welch et al., 2011) that can function as a potential cause of spinout inhibition by investigating the question "why so few spinouts?" Through a rigorous search using social media (LinkedIn) and semi-structured interviews with ecosystem actors, the paper investigated whether FDI-based internet companies support or restrict entrepreneurship in the region. Only 45 founders have spun out and been active since the arrival of the 35 internet companies (year 2000), out of more than 50,000 employed up to 2020. This begged the question of why MNEs suffocate local entrepreneurship. This study contributes to EE theory by adding to the sparse and mixed evidence on role of multinationals in supporting the genesis and evolution of EE (Bhawe & Zahra, 2019; Ryan et al., 2020). Whereas Ryan et al. (2020) point to MNE entry as a key mechanisms for genesis a resilient EE, we show that MNEs' strategies can also inhibit entrepreneurship in the region. More specifically, we contend MNEs' strategies can undermine the competitiveness of an EE and inhibit its evolution over time. This paper highlighted several obstacles to MNE spinout entrepreneurship.

Specifically, our study identifies higher-order themes at all levels, from the micro-level (individual) to the meso-level (organizational) to the macro-level (institutional). According to our findings, there are multi-level inhibitors to the influence of MNEs on the evolution of this EE. The various inhibitors are illustrated in Figure 23 below.

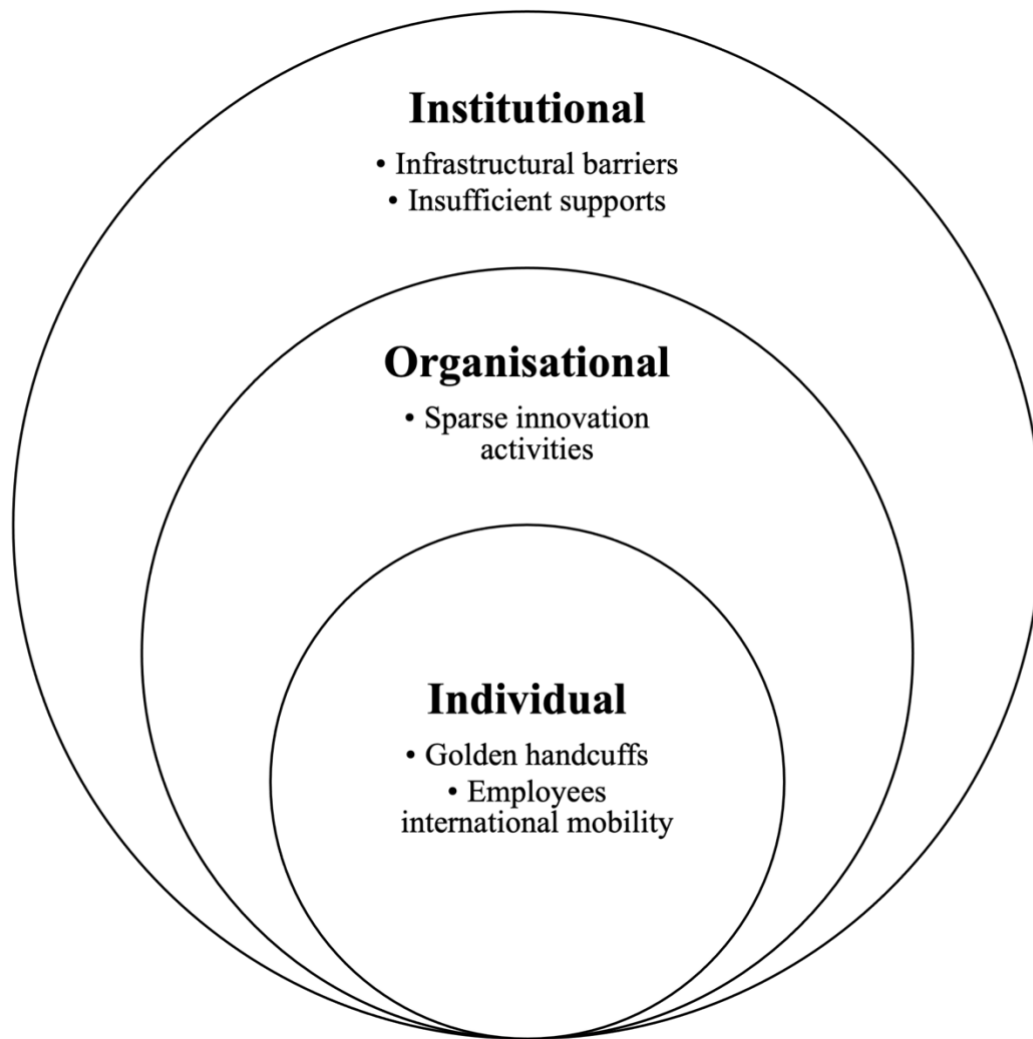


Figure 23 Multi-level analysis of inhibitors of Dublin EE (2nd Order Themes)

There are several mechanisms that inhibit entrepreneurship in Dublin EE. First, the pressure on the individual to stay with the MNE is caused by 1) economic stability (golden handcuffs), and 2) employees international mobility. Stock options and high compensation, in particular, entice employees to stay with the organisations. Furthermore, the Dublin internet companies' young and diverse workforce is more focused on horizontal mobility among MNEs and has less attachment to the region. Additionally, the common repatriation of skilled labors makes knowledge accumulation more difficult.

Second, at the organisational level, the majority of Dublin's internet multinationals that conduct sparse innovation activities, limiting the potential founder's opportunities and capabilities to spin out. MNEs in our study were also seen to be slow to promote intrapreneurship activities. For example, the majority of in-house accelerators were concentrated at HQ.

Finally, due to a variety of challenges, the institutional attraction of Dublin internet EE has lessened over the last ten years. For starters, the local cost of both doing business and living is significantly

higher, causing young and talented workers to relocate to more affordable areas. Second, the lack of tax relief on losses and the high capital gains tax system deter venture capitalists (VCs) from investing. Finally, insufficient supports, such as meagre early-stage funding and a lack of mentoring, demotivate spinout activities.

5.2 Conclusion and future research

The results of this paper carry important implications for policymakers. It provides policymakers with insights about the role a multinational can play in supporting entrepreneurship in the region where FDI occurs. When attracting foreign investment, policymakers should consider not only to focus on the potential employment capacity of MNEs, but also on the typology of activities which can trigger spinouts. The evolution of an FDI-anchored EE depends on promoting innovation and intrapreneurship activity within the multinational and creating a local entrepreneurial culture by investing in diverse support systems (i.e. incubators and early-stage capital).

Finally, because this study only focused on one region, the research's comparability and breadth are limited. Using a longitudinal and processual analysis, future research can address and compare various ecosystems. Therefore, this paper calls for future research to be dedicated to the following research issues: 1) scaling of the ex-MNE spinouts, 2) longitudinal and processual study, and 3) comparative analyses of different EEs to shed further light on the evolution of EEs.

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Appendix

Table 21 Appendix 1 Summary of 1st Order concepts

1st Order Concepts
<p>High local cost</p> <p>“You meet lots of young talented people, but they're paying crazy rent. And you know what happens to them, they go and live in Barcelona, or the Canary Islands or somewhere that's cheaper to live, and they're still working for an Irish company, perhaps, but they're not living in Ireland, or Dublin anyway. So that's that. It's just a simple fact of life in Ireland.” (F-1)</p>
<p>Meagre early-stage capital</p> <p>“But there is a kind of expectation that there's some follow-on funding there, which often isn't, isn't available. And so after that, initial angel investment we got, you know, we ran out of money, you know, put money in ourselves, and we got a strategic investor from France to put money into the company.” (F-3)</p> <p>“I suppose in terms of investment. And then the second problem with that is, I don't think there's any venture capital firms in Ireland at all, I think they masquerade as venture capital firms. And what they actually are private equity growth firms, is they're investing in businesses that are that are what I would class as late stage, these businesses are proven. If strong revenues in the multi-Indian in maybe 10 million plus, before an Irish VC gets involved. That's not venture capital. That's, that's, I mean, that's private equity.” (F-12)</p>
<p>Paltry incubators, mentoring and role models</p> <p>“Here are there are some places like you should be and so on the deNovice, the centre and NOVA UCD. And there are startup phones there. But they tend to focus on super, super big, lofty ideas around AI and, you know, renewable energy and so on very unattainable. And for most entrepreneurs.” (F-14)</p> <p>“I have a really strong sense that we are that we are able to build great companies here in Ireland, and in great companies here in Europe, there are definitely impediments like, like this the whole way the tax system is set up isn't does not really incentivize entrepreneurship. But, but definitely, I feel like Europe is Europe is not bringing much to the party on tech at the moment, all they're doing is bringing a bunch of annoying legislation. US is bringing innovation, China's bringing in innovation, and Europe is bringing legislation. And, and I do think Europe needs to start really stepping up and being more at being seen more as a place of innovation.” (F-16)</p> <p>“You know, it's kind of two different parts that I think there is a small business culture and so you know, going out and doing your thing, or whatever. But there isn't the second-generation success stories of founders who were massively successful and invested in other stuff. And</p>

that's changing a bit now with quite a few Irish unicorns emerging. So you hope that they start to put money and expertise into more our founders.” (F-11)

“Again, success breeds results, right. And that's actually part of why I'm doing it here is, I believe that, you know, the first one will work and second one will work but maybe the third one will do it. For the fourth one, we'll do it, you know, so you have to adjust yourself, then start over and go. I'm just committed to creating a global success story from our doorstep and will encourage us to actually invest in other people with the same ambition.” (F-14)

Tax relief / capital gains tax disincentives

“And there isn't there you don't get upfront investments from the tax, the tax code, that underpins the investment environment needs to be improved to allow more investment in small companies at an early stage. So that there isn't so much risk and financial pain for an investor. You can't blame the investors. But that situation has led to there's just a lot of people who are you might call them tire kickers, they're kind of sniffing around looking for something easy. And they might say, oh, I'll give you 10 grand, but I want 15 or 20% of your company. And you know, this is not very useful for a startup like theory stage, you want a proper investment 50 to 100 250 for reasonable expectations of equity. And it's hard to find that type of investor, you know, you'll get 25 or 50 from enterprise Ireland, you might spend a lot in year to 18 months and then beyond able to find anything after.” (F-1)

Low-order (customer-facing) MNE activities

“And I'm not sure that the multinationals here when you look at the skill profile that that many of the people that are actually working here have actually got the core product technical skills to actually build leading solutions.” (F-12)

“And so, you, you traditionally then have these jobs, which are very much based on and folks who are either A in Project programme management when an engineering or folks then who are basically on the sales side of things are working on the softer sides of business, and they typically don't lend themselves to people who would spin out and found on businesses that are product related based and rather than so I that's one big element, the roles in Dublin they don't actually live themselves.” (F-7)

Centralised intrapreneurship

“And I think within Google itself, I was part of there is a lot of Google for entrepreneur's work happens within there. But it's, it's more a PR exercise of being part of the Dublin community than driving entrepreneurship. And so, I was involved with helping and put on like startup weekends, the Startup Grind was on every week. So, I used to, I used to host stuff, I used to be the guy who, you know, helped the guys get the room and arrange the access and all the security badges. So, I was attempting from winning Google to be part of that ecosystem, and kind of

been like meeting people and trying to build a network etc. and but in general, trying to encourage people in there to be part of it was very little, then area 21 started. So, it's a big thing in Google in the United States where you can pitch a business, and then Google may move you into an in-house incubator, but all of that in San Francisco is really hard to reach. It's very difficult to get anywhere nearby. And so, unless you really have the opportunity to push yourself and then they're not really driving you to do that.” (F-7)

Retention incentives (stock option)

“But the RSU is a huge factor from a retention perspective, but also a total comp perspective. Like, you look at the tech companies that are in Dublin, and the amount of capital that's coming in, that's coming into, you know, Dublin households because of RSU is just phenomenal, and the Exchequer is benefiting massively from that as well. Because RSUs r, are effectively cutting tax at the marginal rate. Ultimately, yeah, 120,000. By the time, by the time the tax gets out that and your daily expenditure of childcare and all that, you know, you know, yourselves guys, that stuff goes, that's just, you know, it's like any kind of salary is ephemeral. And, you know, you get used to it, you get used to it, but the RSUs, that's a meaningful thing.” (F-16)

Handsome remuneration

“And my biggest problem is that a lot of the people that I know who started out in Twitter, and that have left Twitter have gone to other multinationals. And there are people now as I say that I've never known known a job where they've got fresh avocado in the morning. There are people now who are probably in the middle of their careers that literally started out with Google or Apple 15 years ago, that would never ever leave those companies. And it is like having a prize crown jewel of these talented Irish people locked away in another Museum in another country.” (F-7)

Strong repatriation pull

“One is that because Dublin tends to be the European headquarters, it tends to have an overwhelming number of staff that aren't indigenous, right, so they aren't from Ireland in the first place. So that when they are there, you'd be surprised how many of them aren't actually necessarily happy to be in Ireland, either. So, a lot of people that work in Google, if they had their say, would be working in their domestic market. So, all the French people working in Google Ireland, and in Facebook, Ireland, if they give the option opportunity, they would say, No, I want to do the same job. But I want to be located in France” (F-13).

“Even a majority of ex-Googlers in Dublin, I would say are international folks not as Irish folks. And if they've international folks leave Google and start a business, they typically return to the cities or ecosystems where belonging. So back to Berlin, they might go to, you know, our to back even to the states and some of these folks, and they go, we'll take it there.” (F-7)

Mobile early-career employees

“I mean, the attractiveness of these companies is that it's really stable, like they pay really well. It's great experience to have on your CV. It doesn't necessarily attract potential founders. I mean, I suppose a lot of I don't know what your research has shown, but there's probably people who go there, you know, if they're entrepreneurial, or if they're going to start a business they do, what's your earlier like, they do it in their 20s, or they do it straight away out of college, and maybe then they get a job if it doesn't work, but they go back to it.” (F-6)

“Or they're after they're at the point that they're right there at the right point in life, age wise. But they can't really take the risk, because they won't have anywhere to live if things go wrong. You probably know from your research that most successful startups are actually not performed by young 20-year-olds, they're actually formed by older people. I'm 42. And so I'm not. Yeah, I think I'm kind of in the age, in that age bracket of the older founder.” (F-1)

7 Discussion and conclusion

This chapter discusses the findings and contributions to theory of each paper, followed by policy implications, research limitations, and areas for future research. The chapter concludes with a brief discussion of the study's overall contribution to knowledge and a summary of the thesis.

Entrepreneurial ecosystems have been proposed as a novel perspective for assessing the entrepreneurial interdependence of local community actors. The entrepreneur and entrepreneurship are highlighted as key features in capturing regional development by EE in particular. Despite growing research interest, current literature places little emphasis on evolution's key feature. As a result, the following gaps were addressed in this dissertation. The first paper, titled "*Complementary frameworks for examining global innovation: Aligning global value chains (GVCs), industrial clusters and entrepreneurial ecosystem*" proposed EE as a complementary framework of cluster theory and GVCs for capturing global innovation. The second paper "*Evolutionary entrepreneurial ecosystems: A research pathway*" built on the first paper by conducting a systematic review of the EE literature and categorizing it into four major themes (actor, places, governance, and evolution). The evolutionary dynamics of EE have received insufficient attention among these themes. As a result, the findings of this study advocated for a more longitudinal and process-oriented approach to EE research. Extending from previous papers, paper 3 "*Multinational enterprise alumni spinouts in an entrepreneurial ecosystem: Where art thou?*" emphasized the role of MNEs and examined whether they anchor or obstruct entrepreneurship in the region. Overall, the three studies contribute to our understanding of the emerging field of EE while also making significant original contributions. The three papers in this dissertation are logically interconnected to answer the main research question of whether MNEs foster or inhibit the formation of an EE and its evolution into a mature, strong, vibrant, and resilient ecosystem. Despite their exponential growth, MNEs appear to stymie the emergence of an EE in the case of Dublin internet companies. As tripartite theory building blocks, I will now summarise the contributions of each paper in order.

7.1 Discussion and contribution - Paper 1

This paper contributes to theory by conceptually reviewing and discussing the significance of examining global innovation in both production clusters and global value chain (GVC) framework. It drew on clusters, GVCs, and EEs in an interdependent manner. To investigate a complex phenomenon, this study required the collaboration of elements from various disciplines. So far, scholars have only focused on clusters or the GVC framework to address innovation. However, because of the emphasis on firm-level interactions, innovation has received only partial attention to date, necessitating future research (Coe & Yeung, 2015).

Despite the literature expanding our understanding of the dynamics of firm innovation and resilience in the global economy, neither cluster theory nor GVCs explicitly focused on the micro-foundations that are fundamental to innovation (Kano et al., 2020; Pietrobelli & Staritz, 2018). The vast majority of research has been conducted at the inter-organizational (meso) level of analysis (Kier & McMullen, 2018; Szirmai et al., 2011). While the literature acknowledges the significance of understanding how leading firms compete at the intersection of local clusters and GVCs, it is unclear how entrepreneurs influence global innovation development.

This study also contributes to methodology by offering an EE perspective on using micro-dynamics and longitudinal research to examine global innovation. Only a few studies in cluster and GVC have used a real-time longitudinal approach to assess firm competitiveness and innovation, limiting understanding to a rather static perspective. Entrepreneurs are essential in EE because they spark innovation and propel the industry forward (Brown & Mason, 2017). They are also the primary unit of analysis that allows the dynamics of the micro-foundations to be realized. A cluster can evolve into unrelated varieties through spinouts, generating innovation in the global economy. Entrepreneurs also combine local knowledge with new ideas, resulting in innovation. While established cluster firms accumulate local knowledge, new technologies can emerge from the global market and be integrated into local production systems via GVCs. The entrepreneur is frequently the link between different types of knowledge in order to generate innovative processes through a dynamic perspective and the role of entrepreneurial ventures by blending local and global knowledge. As a result, this study proposes EE as a complementary framework of cluster and GVC in order to shed light on global economic innovation.

Overall, this paper suggests that EE can aid in the understanding of the mechanisms of innovation in a globalized economy. As a result, in order to understand the complexity and dynamics of the innovation process across boundaries, this study proposed using the evolutionary EE concept as a complementary perspective to the cluster theory and GVC framework.

7.2 Discussion and contribution - Paper 2

This study contributes to theory in a variety of ways by conducting a systematic review of the EE literature to date. First, the study investigates the growth of EE literature and identifies potential methodological approaches using bibliometric analysis. Second, it emphasizes the key themes of EE to guide future research. These are the themes of location, actors, governance, and evolution. Third, by categorizing the topics, the study contributes to the EE perspective by refocusing the current discussion on key elements and addressing the perplexity. This paper followed rigorous examples from both the entrepreneurship and IB fields to ensure dependability and replicability (Jones et al., 2011; Karami et al., 2019).

As EE is an emerging field, a slow start was followed by a dramatic increase in publication output, which was triggered by Isenberg (2010). This concept attracted the attention of both researchers and policymakers interested in entrepreneur-led local economic growth (Acs et al., 2017; C. Mason & Brown, 2014). The number of outputs in the EE literature has grown at an exponential rate since 2016, impeding theory development. By systematically examining the literature, this paper summarizes the research to date and refocuses on the framework's core tenets. Despite some systematic approaches to EE (Cao & Shi, 2020; Wurth et al., 2021), this was the first study to focus on the evolution of EEs specifically. As a result, the study's contribution is that it clearly delineated the advancement of the still underdeveloped concept of EEs to date. This study, in particular, calls for a greater emphasis on the evolutionary dynamics and processes that are central to the concept. Due to data collection challenges, only a few attempts have been made to investigate the evolution of EEs through a longitudinal lens (Ryan et al., 2020). As a result of this research, some key recommendations for future research on longitudinal process approaches to advance the evolutionary aspect of EEs are made.

7.3 Discussion and contribution - Paper 3

This study investigated whether MNEs foster or stifle the formation and evolution of entrepreneurial ecosystems. It looked specifically at 1) the extent of new venture creation in the form of spinouts founded by alumni of MNEs in high-tech region, and 2) the barriers to the formation of MNE alumni spinouts. To shed light on these issues, we used the case-study method to investigate the extent to which MNEs influence the emergence and resilience of an entrepreneurial ecosystem through spinouts. The study adopted a mixed research design that included desk research and qualitative interview data to provide a mix of interpretive sensemaking and contextualized explanations of the role of MNEs in the evolutionary process of an EE (Welch et al., 2011). We provide a plausible, albeit somewhat counterintuitive explanation for why there are so few MNE spinout founders in the case of Dublin EE based on our data analysis. Broad secondary data revealed that one out of every thousand MNE alumni founders is present in Dublin, making the EE appear extremely hollow. Contrary to Ryan et al. (2020) this study challenges the view of incubators and finds that MNEs instead, on balance, inhibit entrepreneurship within the EE.

This study contributes to EE theory by demonstrating the direct effect of FDI spillover through concrete measures such as MNE alumni spinouts. By investigating the horizontal evolution of an EE, this study demonstrates how MNEs, in this case, crowd out rather than promote entrepreneurship in the local region. This paper adds to the sparse and mixed evidence on the MNE as an actor in an EE by combining literature on international business (i.e. FDI) and entrepreneurial ecosystems (Ryan et al., 2020). Unlike Ryan et al. (2020), who identify MNE subsidiaries as

conduits of 'global pipelines' (Bathelt et al., 2004) into and out of the EE, MNEs in this study result in both lagging evolution over time and inhibiting the spillover and spinout process.

7.4 Policy implication for Entrepreneurial Ecosystem

This thesis also emphasizes the importance of policy. First, it provides policymakers with insights into the FDI-based host region on how a multinational can act as an anchor to boost entrepreneurship. The best way to foster local economic development by attracting foreign investment is to focus not only on potential employment capacity, but also on bringing in core product functions to generate greater opportunities for meaningful spinouts. Policy could also eliminate institutional barriers by implementing an effective and diverse support systems for spinouts to both emerge and scale.

7.5 Limitations of the research

Despite its implications for EE theory and practice, this dissertation has several limitations. The EE in paper 1 takes micro-foundation into account, but it is still a meso-concept. EE is concerned with elements and their interactions. The role of the entrepreneur in the EE, specifically how the EE affects the behaviors and performance of entrepreneurs involved in cross-border innovation, is an intriguing aspect to investigate further. This would necessitate focusing on a diverse range of entrepreneurial species operating in various institutions, ranging from established MNEs to newly formed global firms. Furthermore, the role of inter-regional linkages is underdeveloped in both the EE literature and this study.

Due to space constraints in the journal, only the evolutionary aspect of EE is discussed in detail in paper 2. Other themes, such as actors, place, and governance, were later incorporated into Chapter 2 of this dissertation in order to capture the broader aspect of EE. Furthermore, due to the assumption that EEs focus on regions, emerging EE topics such as digital EEs and university-based EEs were excluded from the review.

Because of the change in the initial research question of "What are the learning experiences of an ex-MNE founder in the Dublin EE?" the processual approach in paper 3 was limited. The findings of Study 3 also prompted the question, "Why is it difficult to scale in Dublin EE?" (scaling)". Furthermore, because this study only focused on one region, the research's comparability and breadth were limited. Using a longitudinal and processual analysis, future research can address and compare various ecosystems. The limitations mentioned above will be addressed in the section that follows.

7.6 Future research

Despite the limitations discussed in the preceding section, this research has the potential to broaden theory in some areas. The first paper advocates for global EE interconnections. Paper 2 seeks mechanisms for longitudinal process approaches to studying EE evolution. Paper 3 examines the issue of scaling within an EE and compares EEs in various regional contexts. Table 22 below summarizes the areas of future research.

Table 22 Areas for Future Research

Study	Areas for future research
Paper 1	<ul style="list-style-type: none"> • What are the roles of EE in innovation development? • What is the contribution of an entrepreneurial firm in global innovation development? • What are the novel approaches that can capture the use of dynamic perspective in innovation studies? • What is the role of an entrepreneur that triggers the evolution of an EE?
Paper 2	<ul style="list-style-type: none"> • What are the effective approaches of EEs in assessing the dynamics that underpin the sustainability of local economies? • What are the appropriate and evolving boundaries of the ecosystem, the internal and external sources of new knowledge? • Can EEs be better explained in complex adaptive systems or life-cycle theory? • Is the evolution of EE guided by the visible hand of Government or by the less visibly anchors, such as MNEs, institutions and local universities? • What is the new research approach that can shed light on the intersection between local and global knowledge? • What are the mechanisms for longitudinal process studies of EE evolution?
Paper 3	<ul style="list-style-type: none"> • Why is it so hard to scale in (Dublin) EE? • What are the contextual differences between multiple EEs?

7.7 Conclusion

Despite its limitations, this thesis makes an important contribution to the EE literature and the field of international entrepreneurship. This dissertation investigated the interaction of FDI and

indigenous companies in the host region and how it affects regional economic development. The evolution of the EE of Dublin internet companies was the focus of this thesis. It focused on the role of MNEs in laying the groundwork for the emergence of new ventures.

Despite significant progress in the burgeoning subject of EE, it is clear that the domain has a long way to go. Overall, this thesis is a first step toward understanding and exposing the origins and evolution of EE.

8 Bibliography

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