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Innovation, Entrepreneurial, Knowledge, and Business Ecosystems: Old Wine in New Bottles?

Abstract

Rooted in the territorial approach, this theoretical paper offers a systematic literature review (SLR) of ecosystems based on a selection of 104 articles and books and their archetypes. First, we identify and discuss the four main types of ecosystems – business, innovation, entrepreneurial, and knowledge ecosystems – and indicate the presence of other transversal concepts. Second, we provide an overview of related and well-established theories from the territorial approach that have been largely omitted although they are ecosystem archetypes. Third, we identify the invariants across the four diverging streams from the ecosystem approach and the seven diverging streams from the territorial approach. Finally, we propose a research framework based on the comparison between key invariants from both approaches and discuss their similarities and differences that could serve as a foundation for future empirical research. This study therefore links the ecosystem and territorial approaches under the complex evolutionary system umbrella by creating a theoretical framework that reflects the complex interconnection between models, theories, and emerging concepts.

1 Introduction

Only two decades after the introduction of an *ecosystem* parallel (Moore, 1993) in the management field, researchers have started to use this term more frequently. According to Web of Science (WoS), until 2015, one could only find 39 articles exclusively related to business, management, and economics that responded to the search string ‘ecosystem*’ AND ‘busines*’ AND ‘innovat*’. In contrast, in 2015 and 2016 alone, one could find 21 and 26 new publications, respectively. This rapid growth justifies the recent emerging discussions, such as by de Vasconcelos Gomes et al. (2016), Dedehayir, Mäkinen, and Ortt (2016), Oh, Phillips, Park, and Lee (2016), and Ritala and Almpapoulou (2017).

Scholars contributed to the early development of research in this field by first considering the concept of the *business ecosystem* (Moore, 1993), then the *innovation ecosystem* (Adner, 2006) and the *entrepreneurial ecosystem* (Prahalad, 2005), and most recently, the *knowledge (based) ecosystem* (van der Borgh, Cloudt & Romme, 2012).¹ We ask, are those concepts complementary, supplementary, competing, convergent, or divergent? Because of its relatively broad conceptual scope, the ecosystem term runs the risk of being overused and only temporarily settling into the literature until it goes out of fashion (Oh et al., 2016). Therefore, there is a need for conducting a systematic literature review (SLR) to identify the common invariants across the diverging streams of literature dealing with ecosystems to better structure the existing knowledge and avoid potential misuse of this term.

Ecosystems have been studied through the lens of different theories, such as the institutional theory (DiMaggio & Powell, 1983) or the resource dependency theory (Pfeffer & Salancik, 1978), and at three different levels of analysis: the industrial or network level (Nambisan & Sawhney, 2011; Teece, 2007), the firm level (Zott & Amit, 2010), and the individual level (Nambisan & Baron, 2013). Furthermore, scholars have linked the concept of ecosystems with open innovation (Chesbrough, 2003) or dynamic capabilities (Teece, 2007). Nevertheless, more theoretical works grounded in well-established theories are urgently needed to strengthen the foundation of the field of ecosystems.

However, following Mitleton-Kelly's (2003) perception of the business ecosystem as a complex evolutionary system, we see a promising direction in coupling the ecosystem approach with the literature that deals with the territorial approach. Exploring the ecosystems' roots and archetypes and anchoring the growing literature on ecosystems to more established theories can contribute to greater legitimacy. More precisely, what is needed is an investigation into the similarities and

¹ To simplify the terminology used in the article, we will often refer to the extended notion of a business, entrepreneurial, innovation, or knowledge ecosystem by using the shortcut term *ecosystem*, unless we are providing some insights into a particular literature stream.

differences between the ecosystem approach and the territorial approach as well as development of a common research framework that will constitute a sound base for further research.

The objectives of this study are (1) to explore and present the terminology that management scholars use when referring to the various streams of research dedicated to ecosystems by systematically reviewing a wide range of papers from business, management, and economics; (2) to list the invariants that appear unchanged despite the timing and framing of a literature stream; (3) to link the ecosystems' growing stream of literature to the well-established and mature literature dealing with the territorial approach; and (4) to build the framework that will be a base for further research.

In order to reach these objectives, we address the following research question: *What are the conceptualizations of the ecosystem approach, its invariants, and its links with the territorial approach?*

Our intended contribution is (1) to build a common understanding of the term ecosystem by identifying and discussing four main types of ecosystems; (2) to define the ecosystems invariants and thus fill the gaps between various ecosystem approaches and conceptualizations; (3) to position the literature on ecosystems at the intersection of not only business and management but also the economic geography by identifying and exploring the ecosystems archetypes, such as the territorial approaches; and (4) to bridge business and territorial approaches by proposing a research framework based on the key invariants that will constitute a conceptual base for identifying the future research agenda.

The article is structured as follows: first, we introduce the review design of the systematic literature review on ecosystems; second, we characterize the emergence of the ecosystem approach along with four major streams of literature; third, we present the ecosystems archetypes through the territorial approach; fourth, we scrutinize, analyze, and combine the ecosystems and territorial approaches to discuss a set of invariants by taking part in a research framework that bridges these two perspectives; and finally, we proceed to the conclusion and propose further research.

2 Review Design

The concept of an ecosystem is neither well-defined nor well-established. As a term, it emerges in various literature streams within biology, environmental engineering, agriculture, computer science, marketing, management, and economics. Therefore, before further conceptualizations and discussions, there is a strong need to clarify the different taxonomies, which requires the use of a structured literature review.

In this study, we conducted an SLR following Tranfield, Denyer, and Smart's (2003) three stages of systematic review and Greenhalgh, Robert, Macfarlane, Bate, Kyriakidou, and Peacock's (2005) metanarrative review phases. We specifically explored peer-reviewed research studies related to ecosystems from a management perspective. Figure 1 presents our entire literature review process with all its objectives, steps, and outcomes. The seven steps that will be elaborated upon are: 1) initial search, 2) scoping studies, 3) article search, 4) article selection, 5) reference backtracking, 6) content analysis, and 7) invariant analysis.

Figure 1: Systematic Literature Review Process

2.2 Search Protocol

The database selection process concluded with the selection of the WoS database. We considered the Ulrich list, the European Research Index for the Humanities (ERIH), the Norwegian reference list, the Australian Excellence in Research list (ERA), WoS, and Scopus. This raises a question about the academic relevance and quality of those journal lists. The incompleteness of WoS versus the inclusiveness of the non-scholarly content in Scopus are some of the issues presented by Hicks and Wang (2011). The following three arguments made us choose WoS instead of Scopus: First, Ball and Tunger (2006) argued that WoS has the highest number of quality journals and articles and, consequently, can be considered the worldwide number one. Second, Bauer and Bakkalbasi (2005) contended that WoS best retrieves older sources. Third, Hicks and Wang (2011) used Venn diagrams to represent the coverage across the various lists. The results indicate that almost all journals included in WoS are also included in Scopus and other lists. The authors argued that it is necessary to achieve a hundred percent overlap between the lists to ensure consensus on what is considered scholarly literature within social sciences and humanities. Being the most restrictive, WoS also seems to be the most appropriate because it only includes well-recognized content.

Subsequently, we performed a few initial searches (Step 1) based on the preliminary list of search keywords and started the scoping studies (Step 2). Following Tranfield et al. (2003), we initially considered journals and also conference proceedings, industry trials, and internet sources, but after reviewing the content of some of these records, we resolved to narrow our search criteria. Consequently, to generate the most “reliable knowledge” (Tranfield et al., 2003, p. 5), we decided to exclude proceedings and only focus on peer-reviewed articles and books (see Table 1).

Since the term ecosystem is widely used, especially in environmental sciences and in computer science, we modified the search criteria to reduce our search to management, business, and economics studies. An overview of all inclusion and exclusion criteria is outlined in Table 1.

Table 1: Inclusion and Exclusion Criteria

Inclusion criteria	
Research area (WoS category)	Management, business, economics
Language	English
Timespan	From 1900 to November 2015
Exclusion criteria	
Document types	No proceedings papers

In one of the oldest studies of ecosystems in the field of management, Moore (1993) introduced the term *business ecosystem*, which became a starting point for our search. Later studies further developed the ecosystem concept by focusing on innovation (Adner, 2006; Adner & Kapoor, 2010). That is why ‘ecosystem*’, ‘business*’ and ‘innovat*’ were the most frequently used keywords. Other keywords such as ‘entr*’ was added after the initial scoping studies had identified another type of ecosystem, namely the entrepreneurial/entrepreneurship ecosystem. Finally, ‘network*’ as a keyword was added after consulting a list of potential keywords by scholars having published influential studies in the field, as explained in the data collection discussion.

2.3 Data Collection

During the process of searching for and collecting articles (Step 3), we also identified the most influential (most-cited) studies (articles and/or books) and sought advice from experts in the field (as suggested by Greenhalgh, Robert, Macfarlane, Bate, and Kyriakidou (2004)) by contacting the authors from such studies to collect a set of keywords/terms that they associate with ecosystems. The most frequent terms – platforms, innovation, networks, and orchestration – were used in the data collection, the (sub)categorization, and the process of identifying the ecosystem invariants.

In order to get the most relevant results, we conducted three rounds of searches:

- 1) the core search (searches 1-3), which gave us a total of 133 different records;
- 2) the supporting searches (searches 4-6), which numbered 153 records; and

- 3) the saturation check searches (searches 7-10), which totaled 354 records, but only gave us 8 additional core items.

All ten searches totaled 35 primary, 30 secondary, 117 peripheral, and 172 non-relevant records. All the data (number of records) are presented in Appendix I.

2.4 Data Categorization

In order to identify the core papers, we started the selection process by clustering papers into several subdivisions. To conduct the selection and the clustering (Step 4), we analyzed the title, the abstract, and the keywords and searched for the term *ecosystem* in the body of the text of all 354 records. We categorized the articles based on their relevance: primary, secondary, peripheral, and not relevant. We then identified the key subcategories where scholars used the word ecosystem in a very distinctive way and conveyed the same theoretical focus throughout their studies (such as strategic management, entrepreneurship, etc.). The same categorization criteria were later used for the additional publications sourced from the backtracking. Furthermore, within these subcategories, we also divided the papers based on type, applied theoretical perspective, key findings, and key referencing; this overview is available in Appendix II and Appendix III.

During the process of selecting papers and dividing them into categories and subcategories, we applied appraisal techniques that assured the quality of the selected papers (Greenhalgh et al., 2004, Greenhalgh et al., 2005, Parris & Peachey, 2013). Among other things, authors assessed the appropriateness of empirical and non-empirical studies (see Appendix IV and V) by evaluating whether the method was appropriate, whether the data collection and analysis were rigorous, whether the findings were clearly stated, and whether the concept was well-developed (Parris & Peachey, 2013). Factors like sufficient background and clear focus and purpose were secured by the initial selection and clustering method.

We divided the manuscripts into categories mostly based on the relevance and the extent to which the ecosystem concept was elaborated in the manuscript. Subcategories were identified based

on the clustering by theme. In the section dedicated to the findings, we only focused on the primary and secondary categories; the peripheral categories were excluded because those scholars were referring to ecosystem either as a subtype of a business ecosystem (e.g., digital ecosystem) or as a well-established term present in a particular literature stream (e.g., service ecosystem in marketing).

Additionally, in line with the recommendations from Greenhalgh et al. (2004), we applied the citation tracking method. We conducted the backtracking of ecosystem-related references (Step 5) from the primary and secondary papers to make sure we covered the entire scope of ecosystem-related manuscripts. Reference backtracking gave us 39 additional items, including 31 articles and 8 books (or book chapters) that were subject to analysis. Finally, the 35 primary items, the 30 secondary items, and the 39 additional items from backtracking constituted our final list of 104 items to be considered in the data analysis.

2.5 Data Analysis

After completing the list of 104 records (94 articles and 10 books) with the best fit with our study, we conducted the content analysis. Appendixes V and VI present an overview of the most frequently appearing journals along with the number of papers included in the content analysis (Step 6) and outline the most frequent authors and co-authors of the analyzed papers. The content analysis focused on identifying key terms, definitions, and theoretical frameworks related to (a) an ecosystem at large and (b) the various types of ecosystems.

We divided the selection and analysis of the papers into two stages. First, each author focused on one of the approaches (the ecosystem approach or the territorial approach). Second, each author reviewed the synthesis of analyzed articles of the other author and provided a critical evaluation. As an outcome of Step 6, content analysis of both ecosystem and territorial approach records, each of the authors developed a list of invariants that were further analyzed and compared in Step 7, which resulted in the development and synthesis of a framework that bridges both perspectives (Adams, Jeanrenaud,

Bessant, Denyer & Overy, 2015). Both the ecosystem approach and the territorial approach and the framework have been discussed with experts in related areas at conferences and seminars.

In section 3, we present what emerged from the ecosystem approach, and in section 4, we discuss what arose from the territorial approach.

3 The Ecosystem Approach

Based on the clustering criteria and the selection of 104 key items, we identified the following main ecosystem concept types that the scholars refer to: business, innovation, entrepreneurial/entrepreneurship, and knowledge ecosystem. The entire taxonomy along with definitions can be found in Table 2. In the next sections, we elaborate on these four main concepts of ecosystems and discuss their main elements.

Table 2: Ecosystem Taxonomy

Ecosystem	Definition	Selected references
Business ecosystem (62 records)	<p>“Loose networks—of suppliers, distributors, outsourcing firms, makers of related products or services, technology providers, and a host of other organizations—affect, and are affected by, the creation and delivery of a company's own offerings. Like an individual species in a biological ecosystem, each member of a business ecosystem ultimately shares the fate of the network as a whole, regardless of that member's apparent strength.” (Iansiti & Levien, 2004, p. 2).</p> <p>“An economic community supported by a foundation of interacting organizations and individuals [...] produces goods and services of value to customers, who are themselves members of the ecosystem. The member organisms also include suppliers, lead producers, competitors, and other stakeholders. Over time, they coevolve their capabilities and roles, and tend to align themselves with the directions set by one or more central companies.” (Moore, 1996, p. 26).</p>	Iansiti & Levien, 2004; Li, 2009; Moore, 1993; Moore, 1996; Zhang & Liang, 2011.
Innovation ecosystem (25 records)	“The collaborative arrangements through which firms combine their individual offerings into a coherent, customer-facing solution. Enabled by information technologies that have drastically reduced the costs of coordination, innovation ecosystems have become a core element in the growth strategies of firms in a wide range of industries.” (Adner, 2006, p. 1).	Gastaldi et al., 2015; Leten et al. 2013; Li & Garnsey, 2014; Nambisan & Baron, 2013.
Entrepreneurial/ entrepreneurship ecosystem (9 records)	<p>“The entrepreneurship ecosystem consists of a set of individual elements—such as leadership, culture, capital markets, and open-minded customers—that combine in complex ways.” (Isenberg, 2010, p. 4)</p> <p>“The market-based ecosystem allows private sector and social actors, often with different traditions and motivations, ad of different sizes and areas of influence, to act together and create wealth in symbiotic relationship. Such an ecosystem consists of wide variety of institutions coexisting and complementing each other.” (Prahalad, 2005, p. 65).</p>	Prahalad, 2005; Isenberg, 2010; Spigel 2015; Autio et al., 2014; Suresh & Ramraj, 2012.
Knowledge ecosystems (3 records)	“The flow of tacit knowledge between companies and the mobility of personnel have been advanced as the main advantages of geographic colocation which characterize these hotspots. Such hotspots have been characterized as knowledge ecosystems where local universities and public research organizations play a central role in advancing technological innovation within the system.” (Clarysse et al., 2014, p. 1).	Clarysse et al., 2014; van der Borgh et al., 2012.

3.1 Business Ecosystems

The idea of business ecosystems has been adapted from biology, where ecologically homogenous units constitute a community of living organisms interacting as a system with various components of their environment. Moore (1993) drew a parallel between a biological system and a business counterpart where companies striving for new innovations interact with each other and exist in a given business environment. In its simplest form, an ecosystem could be a combination of different members that interact closely with one another, not only within but also outside the cluster.

Scholars differ in their characterization of business ecosystems. Li (2009) pointed out three traits of a business ecosystem: (1) loose network or horizontal and vertical actors, (2) a platform, and (3) an evolution/coevolution of these actors. Additionally, Basole (2009) considered the main business ecosystem attribute to be the ability to adapt to changes that take place both inside and outside of the ecosystem. Furthermore, Clarysse et al. (2014) referred to two main characteristics of the business ecosystem: a loose network of interconnected participants (Iansiti & Levien, 2004) and an orchestrator or a *keystone* company. The latter is usually firmly established in the network because of its many connections and is therefore in a position to develop and maintain the ecosystem, thus enhancing the participants' performance (Iansiti & Levien, 2004; Moore, 1996). Finally, Rong, Wu, Shi, and Guo (2015) conceptualized the business ecosystem as an independent economic community, which through various dynamic mechanisms supports transformation of a so-called passive social network (Burt, 2010; Eisingerich, Bell & Tracey, 2010) into an active value creation chain (Shang & Shi, 2013).

Scholars have also been discussing three dimensions of the business ecosystem: context (Lu, Rong, You & Shi, 2014; Moore, 1993; Rong, 2011), configuration (Iansiti & Levien, 2004; Rong, Lin, Shi & Yu, 2013), and cooperation (Chen, Rong, Xue & Luo, 2014; Moore, 1996; Rong, Shi & Yu, 2013). Distinguishing and analyzing business ecosystems in the perspective of these three dimensions facilitate a comprehensive picture of not only the nature of this ecosystem but also the potential industries that may emerge within such an ecosystem (Hu, Rong, Shi & Yu, 2014). Business context,

in its most extended form, covers six phases: emerging, initiating, diversifying, converging, consolidating, and renewing (Lu et al., 2014). Configuration considers different roles, connections, and interactions between various ecosystem stakeholders (under different contexts). Iansiti and Levien (2004) described the four typical ecosystem roles, namely those of keystone, niche player, dominator, and hub landlord, which could be supported by non-direct business-related stakeholders, like governments and industry associations (Moore, 1993). Cooperation serves as the glue between context and configuration and focuses on the roles ecosystem stakeholders play in the different phases. Furthermore, the literature offers insight into two types of cooperation inside the ecosystems. The first is the ecosystem roles' strategy for expressing the interactions between the keystone, focal firms and their complementors. This strategy aims at nurturing the ecosystem (Iansiti & Levien, 2004; Rong et al., 2013). The second is a collective, process-based strategy that covers adjustment, adoption, and convergence (Rong et al., 2013).

A business ecosystem includes different organizational members and, due to their close interaction, inter-organizational networks are created (Moore, 1993). Given the importance of a collaborative approach along the value network, creating and capturing value through innovation is one of the aims of business ecosystems (Basole, 2009). No less important is the achievement of competitive advantage (Clarysse et al., 2014; Iansiti & Levien, 2004), which usually happens through collaboration that leads to economies of scale. Clarysse et al. (2014) referred to a very particular type of value creation, namely interactions based on mutual complementarity. When a company is not able to commercialize a product or service because it lacks internal competencies, innovation resource synergy (Chen & Chen, 2013; Li & Garnsey, 2014), skills, or assets (Eisenhardt & Galunic, 2000), external sources may be needed to overcome these internal deficiencies.

Moore (1993), however, pointed out the existence of coopetition relationships, in which firms simultaneously collaborate and compete. In most cases, scholars refer to business ecosystems as networks of companies located in fairly close proximity to each other (Iansiti & Levien, 2004) or

simply as inherently local (Kanter, 2012). Nevertheless, in the specific case of platforms, the latter constitutes an anchor point to an ecosystem (Isckia & Lescop, 2013), and such a virtual co-creation community is then the main place for interaction (Mäkinen, Kanniainen & Peltola, 2014). Platforms appear both in business and innovation ecosystems, but they are primarily discussed in and associated with an innovation context. Therefore, the innovation ecosystem seems to be a response to the growing interest in innovation studies that has both extended and shifted from the business ecosystem conceptualization to social media and various internet platforms.

3.2 Innovation Ecosystem

According to Wright (2014), research on innovation ecosystems only recently emerged. The main difference between business and innovation ecosystems seems to be a lack on the demand side (customer/user) in the latter (Clarysse et al., 2014; Gawer, 2014; Wright, 2014). In the business ecosystem perspective, the way to approach a customer is more *tangible* than in an innovation ecosystem, which takes the user for granted.

Understanding the value creation/capture logic is essential for the development of successful innovation ecosystems (Adner & Kapoor, 2010; Iansiti & Levien, 2004; Moore, 1993). Adner (2006) asserted that no single firm could achieve value creation on its own and that research in this domain often depicts a large firm (in a high-tech industry) as the ecosystem orchestrator (Adner, 2006; Adner & Kapoor, 2010; Rohrbeck, Hoelzle & Gemünden, 2009). An innovation ecosystem consists of interdependent actors such as firms, non-governmental organizations (NGOs), governmental organizations, and other types of resource providers (like funders) (Adner, 2006, Carayannis & Campbell, 2009; Li & Garnsey, 2014; Wright, 2014).

Stakeholders in innovation ecosystems play different roles in the value creating process (Adner & Kapoor, 2010; Eisenhardt & Galunic, 2000; Moore 1993; van der Borgh et al., 2012; West & Bogers, 2014). In an innovation ecosystem, as in a business ecosystem, an orchestrator (Adner 2006), hubs, stewards, or keystone companies (Dobson, 2006) may or may not have to emerge depending on the

ecosystem structure. Such keystone companies should create a strategy that coordinates the knowledge flows and accounts for all the challenges inherent in collaborative networks. Nevertheless, the concept of an innovation ecosystem is constantly evolving in new directions, be they virtual spaces, platforms, etc., centered on the keystone companies, who usually play a significant role in the ecosystem emergence and further development process. Unfortunately, due to the lack of consensus on and strict definitions of the different types of ecosystems, scholars have been using various ecosystem names interchangeably. For instance, when a business ecosystem consists of firms focusing on new product development, scholars refer to it as to an *innovation ecosystem* or as a *business ecosystem*.

3.3 Entrepreneurial/Entrepreneurship Ecosystem

The entrepreneurial ecosystem is different from other ecosystem types. First, in the entrepreneurial ecosystem, the government and its leaders should nurture and sustain entrepreneurship and thus the related ecosystem through direct or indirect support (Isenberg, 2010). Second, the entrepreneurial ecosystem purposely builds its business environment centered on an entrepreneur or entrepreneurial teams. Prahalad (2005) coined the term entrepreneurial ecosystem, which mainly focuses on economic wealth and the generation of prosperity. This type of ecosystem is a combination of various stakeholders, including individuals, entrepreneurial teams, firms, and supporting organizations (Autio et al., 2014), which, despite their differences in objectives and expectations, jointly work towards economic growth (Suresh & Ramraj, 2012). The ecosystem emerges through successful interaction between the actors at the national and individual level, which is an intersection of national culture and political and legal systems and entrepreneurial cognition (Nambisan & Baron, 2013) along with their personality and behavior (Suresh & Ramraj, 2012).

This distinctive combination goes beyond the traditional triple helix relationship (Etzkowitz & Leydesdorff, 2000) and leads to establishing a quadruple helix model, in which Carayannis and Campbell (2012) added civil society to government, university, and industry. Prahalad and Ramaswamy (2013) focused on a very particular part of the society – the bottom of the pyramid (BoP)

– which constitutes the largest and poorest socioeconomic group, a very active sector developing new business models and establishing new ventures. That is why, despite issues with legal frameworks and democratic values, the entrepreneurship ecosystems work most effectively in emerging and developing economies (Isenberg, 2010).

Nevertheless, ecosystem development is not just a two-actor (government and entrepreneur) game; it also involves established enterprises, universities, and the non-profit sector, all of whom share the responsibilities in developing business environments. The process of involving established market players should start as early as possible, because their role is to advise the policymakers about potential entrepreneurial-friendly frameworks, programs, and structural barrier reduction (Isenberg, 2010). Their input is crucial for building *venture-friendly* business environments and shaping the direction of their long-term growth. Remaining ecosystem actors, such as venture capitalists, law firms, accountants, and others, constitute an entrepreneurial support network (Kenney & Patton, 2005). Additionally, large companies may not necessarily serve as an anchor to the ecosystem (especially if they are not available in some of the newly emerging clusters or regions). Nevertheless, Garud, Gehman, and Giuliani (2014) proposed a concept of *anchor events* initiated by policymakers that could serve as networking platforms for various ecosystem stakeholders.

3.4 Knowledge Ecosystems

Clarysse et al. (2014) explicitly made a distinction between a knowledge and a business ecosystem. The main differences fall into three categories: the ecosystem's focus activities, the players' connectivity, and the keystone player (Clarysse et al., 2014). In the knowledge ecosystems, the key activities are centered on the university and the dense network of surrounding companies. These are usually geographically clustered/localized (Bathelt & Cohendet, 2014), and along with the keystone player, they focus on knowledge generation.

Based on their study of innovative Flemish start-ups, Clarysse et al. (2014) concluded that participating in a knowledge ecosystem, which might be understood as knowledge sourcing from a

particular region, does not automatically make a company a member of a business ecosystem. Nevertheless, these knowledge and business ecosystems are not mutually exclusive.

In contrast, van der Borgh, Cloodt, and Romme (2012) used a knowledge-based business ecosystem frame to investigate how value is created and delivered in a sustainable way. Van der Borgh et al. (2012) defined a knowledge-based business ecosystem as an interdependent set of heterogeneous and knowledge-intensive companies. In their study, the participating companies are not geographically dispersed (in line with Iansiti and Levien (2004)). The presence in the geographical hot spot is a purposive action centered on knowledge. This knowledge-generating institution, also called an anchor tenant, could be a university or a public research organization (Clarysse et al., 2014). The main role of an anchor tenant is to facilitate research commercialization processes and to connect all the players. The latter function is especially important when the ecosystem consists of many players with diverse organizational forms.

3.5 The Need for Invariants

We observed that, despite some overlaps, these four ecosystem conceptualizations represent different views of an ecosystem. Therefore, our intent is to define the ecosystem invariants to provide an overview of the similarities, differences, and complementarities of these ecosystems. In comparing these four conceptualizations, we developed a list of invariants, which are outlined in Table 3.

Table 3: Invariants of the Ecosystem Approach

	Invariants	Business Ecosystem	Entrepreneurial Ecosystem	Innovation Ecosystem	Knowledge Ecosystem
Territory	Anchoring	Platform as an anchor point to the ecosystem			Presence of an anchor tenant
	Territorial size	Close proximity; inherently local	The country or region	Spatial proximity (in case of innovative business ecosystems) or/and virtual spaces	Close proximity
Values	Industry		Disruption of existing industries and creation of new ones	Wide range of industries	Technological clusters
	Trust	Trust		Trust	Trust
	Belonging to a community	Virtual/co-creation community		Mutual dependence on exchange relationships	Collective sense of belonging to a special group
	Mutual understanding		Understanding, of one's own entrepreneurial cognitions	Understanding as a key controllability factor	
	Uncertainty reduction		Visible success reduce the perception of risk	Mitigation of interdependencies risks	
Stakeholders	Culture, history, routine		Culture impacts the ecosystem development		Promotion of culture of innovation
	Firms	Inter-organizational/interfirm networks	Entrepreneurial firms embedded in networks, Interconnected companies	Firms embedded in networks	Large firms with established R&D departments, SMEs, and start-ups
	Networking among firms	Learning, connectivity, and mutually influencing interactions	Interaction between entrepreneur and ecosystem	Interdependence	Collective learning Networking between residents
	Other stakeholders	Complementors; a large volume of innovating entities	Individuals and entrepreneurial teams; social, institutional, industrial, organizational, temporal and spatial networks,	Complementors, government organizations, funders, resource providers, standard setters, and complementary innovators	The universities, public research organization
	Value chain	Customers, suppliers, distributors, outsourcing firms, makers of related products or services, technology providers	Open-minded customers, specialized suppliers, service providers, training institutions, and support organizations	Customers, suppliers, intermediaries	Diversity of organizational forms
Economics	Governance	Orchestrator	'Anchor events' as governance platform	Leading firm/ecosystem orchestrator/network orchestrator	University or public research organization (PRO)
	Localization economics				Collective resources
	Localized spillovers				Local spillovers
Social	Economies of scale	Economies of scale			Economies of scale and scope
	Economic and non-economic		Economic progress stimulation, social-economic interactions	Shared economic and social value	
	Collaboration versus competition	Collaboration and competition resulting in coopetition relationships; symbiosis	Private enterprises coexisting in symbiotic relationships	Simultaneous cooperation and competition	Knowledge-based R&D collaboration
Knowledge	Workforce	Job creation function	Mobility of innovative entrepreneurs; job creation		Mobility of personnel
	Type of knowledge	Protected i.e. Patents			Tacit and protected
	Knowledge dynamics	Knowledge mobility	New knowledge production through interaction	Coordinated knowledge flows: purposive knowledge inflows and outflows Synergistic relationships of people, knowledge, and resources	Make use of knowledge available in the region: proximity to knowledge generators
Outcomes	Synergies	Synergies of innovation resources			
	Economic Innovation	Value creation; performance enhancement Innovation	GDP growth Radical innovation	Innovation	Innovation
	Competitiveness	Competitive advantage through collaboration in value network			
	Entrepreneurship		Venture creation		Cross-realm transposition
	Development	Adaptation and evolution	Co-creation and evolution, which are fostered by policymakers and drives innovation	Co-creation	

The concept of business ecosystems was developed many years ago. It focuses on inter-organizational networks located in close proximity to each other and on large firms that take on the orchestration role. This type of ecosystem heavily emphasizes the business-related value-creation process that emerges due to close collaboration between various firms. The emergence of entrepreneurial, innovation, and knowledge ecosystems seems to represent a somewhat multidirectional development.

The first direction towards an entrepreneurial ecosystem focuses greatly on a particular territory, specifically a region or a country, and underlines the importance of both governmental level actors and entrepreneurs. In this sense, the entrepreneurial ecosystem acknowledges the contribution and impact of the actors on the individual and team level on the economy. However, in order to make sure that this contribution to the economy takes place, support of the policymakers is necessary.

The second direction towards an innovation ecosystem drives an ecosystem in the direction of a virtual route. The innovative products/services can be developed by companies from different industries that are located in close (geographical or cognitive) proximity to one another. Those companies serve as a demand side (customer or user) spreads around the globe. For this reason, the uncertainty level related to both the supply side and the demand side is definitely higher in an innovation ecosystem than in the other ecosystem cases. In the case of an innovation ecosystem, the virtual presence is also a distinguishing factor between national and regional innovation systems (which are inherently local).

The knowledge ecosystem constitutes a bridging concept between the business ecosystem and the territorial approaches. It covers important elements of collaboration and knowledge exchange, and it acknowledges the value-creating intersection of the business world and the academic world. Furthermore, the role policymakers play in both knowledge and entrepreneurial ecosystems makes the knowledge ecosystem conceptually closest to the territorial approach.

Even though this SLR focuses on the four ecosystem types, we have also encountered other transversal ecosystem concepts, as for instance industrial ecosystems, service ecosystems, and technology/digital ecosystems. The industrial ecosystems represent another emerging literature stream related to industrial ecology. These focus on the transformation of unsustainable industrial systems (Korhonen, von Malmborg, Strachan & Ehrenfeld, 2004) and are strongly linked to organizational ecology (Hannan & Freeman, 1977). Service ecosystems, on the other hand, focus on firms' direct customer-supplier network and deprioritize other stakeholders. Finally, technology/digital ecosystems represent two conceptually distinct streams of research. Technology ecosystems (Feijóo et al., 2009) usually emerge in computer science and thus refer to computer networks, whereas digital ecosystems, if not referring to computer networks, represent a subtype of business ecosystems.

Despite the discussed ecosystems' seeming connection to systems theory found in this study, we focus on a very particular link between the business ecosystem concept (an umbrella term for innovation, entrepreneurial, and knowledge ecosystem) and a complex evolutionary system (Mitleton-Kelly, 2003). Mitleton-Kelly (2003) specified 10 generic characteristics such ecosystems should include: (a) connectivity, (b) interdependence, (c) feedback, (d) emergence, (e) self-organization, the creation of new order, (f) exploration-of-the-space-of-possibilities, (g) far-from-equilibrium, (h) coevolution, (i) historicity, and (j) path dependence. These characteristics could be explicitly or implicitly seen in the territorial models, which indicates that the ecosystem archetypes could be looked for in the territorial approach.

4 Ecosystem Archetypes – the Territorial Approach

Scholars have acknowledged the possible roots and interconnections between ecosystems in a business/management sense and other taxonomies or other literature streams. Li (2009) highlighted related taxonomies such as biologically inspired industrial ecosystems (Korhonen et al., 2004), evolutionary economics within innovation systems (Cooke, Uranga & Etxeberria, 1997; Malerba, 2002; Martin & Sunley, 2006), organizational ecology (Amburgey & Rao, 1996; Hannan & Freeman,

1977; Trist, 1977), and open innovation (Chesbrough, 2003). Clarysse et al. (2014) found business ecosystem roots in the idea of value networks (Normann & Ramirez, 1993), and van der Borgh et al. (2012) recognized similarities between (knowledge-based) business ecosystems and business parks, clusters, and technopoles (Löfsten & Lindelöf, 2001).

Spatial agglomeration has raised the interest of both economists and scholars within the management literature. By backtracking the possible roots of the ecosystem concept, we found that the theory developed by Marshall (1890) was most probably the starting point. This theory was subsequently complemented by more complex frameworks from the territorial approach that take into account not only economic factors but also social factors important for the exchange of knowledge.

Figure 2 suggests that the various streams of the territorial approach, such as industrial districts, Marshallian districts, innovative milieus, and regional innovation systems, have strongly inspired Moore's (1993) early definition of the business ecosystem. From this early definition, we identified three emerging streams of research: knowledge ecosystems, innovation ecosystems, and entrepreneurial ecosystems. In addition, some transversal views of what business ecosystems are about have been augmented with the emerging concepts of service ecosystems, open innovation ecosystems, digital ecosystems, and regional innovation ecosystems.

Figure 2: The Key Ecosystem Concepts and Their Roots

In addition to the ecosystem field, several systematic literature reviews on the territorial approach exist, including Moulaert and Sekia (2003); Bell, Tracey, and Heide (2009); Crescenzi and Rodríguez-Pose (2012); Crevoisier (2014); and Scaringella and Chanaron (2016). In the scientific community, the critical survey conducted by Moulaert and Sekia (2003) is commonly accepted by scholars and considered as a starting point for comparing various streams of literature.

Based on the existing works, especially the paper from Moulaert and Sekia (2003), we identified seven major streams of literature related to 1) industrial districts, 2) Marshallian districts, 3) innovative milieus, 4) regional innovation systems, 5) new industrial spaces, 6) localized learning, and 7) regional clusters. We investigated all the streams of literature that may constitute possible archetypes of the ecosystem approach.

Similar to the field of ecosystem, the territorial approach's seven streams of literature are not necessarily convergent and also require a search for invariants. To determine the key invariants of the literature on geographic economics, the seven main streams were organized in chronological order. Major schools of thought developed during overlapping time periods; therefore, there is an ongoing debate on *which school did it first*. After the presentation of the main schools of thought, we will compare them to identify the key invariants that emerged from the literature.

4.1 Marshall's Seminal Work

About a century before Moore's (1993) introduction of the term ecosystem, the neo-classical scholar Alfred Marshall identified that some industrial districts were characterized by a specific territory, a certain business area, a population of firms, and the relationships between these firms (Marshall, 1890). He argued that "the mysteries of the trade become not mysteries, but are as it were in the air" (p. 271). Marshall (1927) later found that clusters "have acquired industrial 'atmospheres' of their own, which yield gratis to the manufacturers of cutlery great advantages, that are not easily to be had elsewhere; and an atmosphere cannot be moved" (p. 284).

Based on his studies of the agglomerations of economic activity and agglomeration impact on regional economies and success, Marshall (1920) argued that industrial districts are related to the agglomeration of firms in a given industry sector within a small geographic area. Other scholars found that localized knowledge spillovers within regions create agglomeration (Acs, Anselin & Varga, 2002; Audretsch & Feldman, 1996; Jaffe, Tratjenberg & Henderson, 1993). Consequently, the cost of knowledge acquisition declines within a small geographic area. Overall, such agglomeration has an impact on economic growth, innovation, and competitiveness (Asheim & Isaksen, 2002; Krugman, 1998; Porter, 2000).

4.2 Italian Industrial Districts

In the 1980s, Giacomo Becattini rediscovered a Marshallian district in the Tuscan textile industry while researching the need for renewal in industrial districts facing financial and social

difficulties. Consequently, Marshallian industrial districts became a popular focus with Becattini (1989), and a stream of literature was written by various scholars, such as Best (1990), Boschma and Lambooy (2002), Boschma and ter Wal (2007), Gordon and McCann (2001), Iammarino and McCann (2006), and Langlois and Robertson (1995). Under the name of the Florence School, the concept of the Marshallian district (Becattini, 1990; Becattini, Bellandi & Dei Ottati & Sforzi, 2003; Dei Ottati, 2003; Sforzi, 2003), also named industrial districts and science parks (Bagnasco, 1977; Becattini, 1992, 2003; Benko & Lipietz, 1992; Camagni, 1991; Dei Ottati, 1994a, 1994b; Garofali, 1992), was created.

Grounded in the agglomeration economies, the Marshallian externalities are based on economies of scale achieved by firms. A high degree of industrial localization offers good opportunities to achieve economies of scale and reduce costs. Dei Ottati (2003) highlighted that the reduction of frictions also has a positive impact on the reduction of transaction costs. Consequently, an industrial district is characterized by its ability to divide tasks, jobs, and the value chain activities among local small and medium-sized enterprises (SMEs). Bagnasco (1977) further argued that SMEs are strongly affected by the industries within their geographic areas. In that specific setting, small and very small firms benefit from knowledge spillovers. All in all, colocation, limited transaction costs, and high specialization are important elements of the Marshallian districts.

In districts, firms benefit from economic and non-economic factors, such as trust and the sense of belonging to a community. We cannot dissociate these economic and social factors because there is an interplay between both economic and social structures that must be balanced (Dei Ottati, 2003). Thus, Becattini (1990) introduced the idea that an industrial district is a socioeconomic organization that creates the *industrial atmosphere* of Marshallian districts. More recently, Becattini (2003) defined an industrial district as a *socio-economic vortex*.

The social aspect of an industrial district has an important impact on knowledge dynamics. Organizations that are part of industrial districts benefit from Marshallian externalities, such as tacit

knowledge (Best, 1990; Boschma & Lambooy, 2002). Roveda and Vecchiato (2008) researched the generation and exploitation of both the tacit and explicit knowledge of Italian districts, in which the community of people and the historical background of organizational collaboration matter. Within a local context, one can observe more trusted knowledge sharing, a greater degree of mutual understanding, and communal sharing of values and language (Becattini, 1990). Overall, this stimulates people to develop a feeling of belonging to a community based on common social and political values (Best, 1990; Boschma & Lambooy, 2002). Local interaction intensity and stability lend an *institutional thickness* to some regions (Amin & Thrift, 1995). According to Camagni (1991), local institutions play a central role in reducing uncertainty in knowledge dynamics and implementing collective learning processes.

Operating within an industrial district is not only about sharing knowledge. Empirical studies in Italian clusters indicate that there is a coexistence of collaboration and competition (Becattini, 1992; Best, 1990; Boschma & Lambooy, 2002). Dei Ottati (2003) argued that competition and cooperation coexist in the Italian industrial districts as well as in dynamic local production systems. Dei Ottati (1994a, 1994b) focused on the mode of this coordination and suggested that the quality of information and the ability to share this information facilitate arrangements among local agents. The coordination of knowledge transfer is easier within a short distance (Boschma & Lambooy, 2002), competition encourages people and organizations to perform their best, and cooperation enables organizations to reduce risks and ensures specialization.

Firms tend to be more successful in a district due to external economies, availability of a skilled labor force, specialization of partners/suppliers, reduction of transaction costs (Amin & Thrift, 1992), division of labor based on trust among stakeholders, and the existence of social capital (Storper, 1995). This is specifically true for start-ups. De Marchi and Grandinetti (2014) argued that industrial districts are characterized by a high number of newly established firms and provide fertile ground for spin-offs. Industrial districts can be distinguished by intensive knowledge dynamics thanks to the presence of a

skilled workforce (Markusen, 1996) and the fact that organizations that are located within short distances of each other tend to innovate more intensively (Breschi & Malerba, 2001). In the case of the Italian industrial districts, this proximity strongly inspired policymakers to make decisions related to long-term economic development (Becattini, 1990; Garofoli, 1992). Becattini (1990), Brusco (1990), and Sforzi (2003) argued that the social interaction between co-located individuals and organizations is one of the sources of the success of Italian clusters.

4.3 Innovative Milieus

In the 1980s, the innovative milieu was developed by GREMI (Groupe de Recherche Européen sur les Milieux Innovateurs), which explored the link between innovation activities and space (Aydalot, 1986; Camagni, 1991b; Camagni & Maillat, 2006; Ratti, 1989). Camagni (1991a) was an early contributor to GREMI and defined an innovative milieu as

“the set, or the complex network of mainly informal social relationships on a limited geographical area, often determining a specific external ‘image’ and a specific internal “representation” and sense of belonging, which enhance the local innovative capability through synergistic and collective learning processes” (p. 3).

Fromhold-Eisebith (2004) argued that a milieu is composed of three aspects: 1) network/informal social aspect, trust/tacit knowledge exchange, emotional support of innovation; 2) spatial proximity, because human capital is more mobile in a region than across regions, common culture, and history, which enhance technology transfer; and 3) a sense of belonging, value system, and convention.

Camagni (1991b) argued that

“spatial proximity matters not really in terms of a reduction in physical “distance” and in the related transport costs, but rather in terms of easy information interchange, similarity of cultural and psychological attitudes, frequency of interpersonal contacts and cooperation, and density of factor mobility within the limits of the local area” (p. 2).

One important aspect of innovative milieus is the development of trustworthy relationships between actors (Camagni, 2004; Camagni & Capello, 2005; Capello & Nijkamp, 2004; Crevoisier, 2004; Rémy, 2000). In a local area, knowledge is shared with a greater degree of trust and mutual understanding, and people share the same values and language (Capello & Faggian, 2005). Such mutual understanding contributes to the institutional thickness, composed not only of collaboration but also of competition and rivalry on a regional scale (Amin & Thrift, 1995).

Social aspects enhance the learning and collective learning processes that occur within an innovative milieu which can learn from its universities (Camagni, 1991b). Ratti (1989) advocated for the importance of learning within a milieu in which agents are independent of local spillovers. According to Lundvall and Johnson (1994), knowledge acquisition is a critical process because knowledge itself is the most significant strategic resource. Some organizations encourage knowledge externalities, which contribute to collective learning occurring within networks (Crevoisier, 2004), and Morgan (1997) emphasized the positive effect learning has on the innovation and social capital within a network.

Networks also offer the advantage of achieving economies of scale in complementary relationships. Building networks enhances the cooperation and the synergies (Capello, 2000), which in turn encourages urban economics theory to consider network behavior (Camagni, 1993).

Jaffe et al. (1993) compared countries, states, and metropolitan areas and argued that knowledge spillovers are geographically localized and concentrated. The smaller the geographical area, the more significant the localization of spillovers. A city can also be a rich context for developing networks, and in support of this, Capello (2000) argued that “non-excessive city sizes in fact facilitate environmental equilibrium, efficient mobility and the possibility of conserving a sense of belonging as far as the population is concerned” (p. 1926).

However, the concept of city does not have the same features as the notion of innovative milieus (Maennig & Ölschläger, 2011; Rémy, 2000). Cities rely on geographical proximity, whereas innovative milieus depend on social proximity between individuals.

Cappellin (2006) argued that territorial knowledge capital is likely to be the utmost measure of innovation within a region. Social and economic interactions have been studied by Aydalot (1986), who argued that entrepreneurs are the outcome of a specific innovative milieu. In the philosophy of GREMI, the local environment has an impact on innovation activities that in turn increase the economic performance of firms. Relationships and collaborations contribute to technical changes and economic growth within a territory.

Similar to the Marshallian district, the innovative milieu considers both economic and social aspects. We note that there is a greater emphasis on the social aspect of knowledge dynamics in this stream of literature compared to the literature on the Italian district, which, strongly influenced by Marshall, instead focuses on the economic aspects.

4.4 Regional Innovation Systems

The regional scale appears to be very relevant (Cooke, 1992) and well-established in Europe (Cooke et al., 1997). Philip Cooke contributed to the stream of literature (Braczyk, Cooke & Heidenreich, 1998; Cooke, 1992, 1998, 2003; Cooke et al., 1997) related to the *regional innovation system* that has strongly inspired European policymakers (Asheim & Coenen, 2005; Tödtling & Trippel, 2004) and greatly contributed to the research in the field. According to Cooke (2003) and Malmberg and Maskell (2002), there is a shift towards regional innovation systems (RISs), which define innovation as a *social and interactive process*. According to Cooke (1998), norms, trust, routines, and other informal means of collective learning strongly affect RISs (Carrincazeaux & Gaschet, 2006). Research on RIS is still meaningful today (Keller, Markmann & von der Gracht, 2015).

Knowledge externalities make it possible for firms to capture external knowledge and to learn (Dosi, 1984; Storper, 1995), and overall, knowledge externalities benefit organizations co-located within a cluster (Antonelli, 1988; Cooke, de Laurentis, Tödtling & Trippel, 2007). When firms collaborate in close proximity, the learning process becomes more interactive (Lundvall, 1988). Additionally, the exchange of knowledge becomes easier, cheaper, and more reliable, which may affect public institutions currently involved in stimulating innovation activities and inspiring local stakeholders to develop social connections to enhance regional growth (Cooke & Morgan, 1998).

Edquist (1997) argued that innovation systems are developed on the interactive learning process between various stakeholders. In RISs, much attention is devoted to research institutes (Asheim & Coenen, 2005; Cooke, 1992; Cooke et al., 1997). RIS allows for the inflow of external knowledge (Asheim & Coenen, 2005; Tödtling & Trippel, 2004), and therefore, the organizations taking part in RISs, whether they are large firms or start-ups, benefit from external knowledge developed by research institutes and universities (Asheim & Coenen, 2005; Iammarino, 2005; Lundvall, 1992).

4.5 New Industrial Spaces

The concept of *new industrial spaces* was introduced and developed by Storper and Scott (1988) and focuses on the contribution to the knowledge of stakeholders popularized by Saxenian (1994). The new industrial spaces idea centers on the industrial district that is enhanced with flexible production systems, social regulation, and local community dynamics. Existing economies of scale and interdependencies explain the initial spatial clustering, but Saxenian (1994) provided an explanation of regional economic competitiveness and localized *industrial systems* that combine local institutions, the local industrial structure, and related relationships between firms and the internal organizational structures of firms.

The Californian School of Economic Geography added new insights to the concept of innovative milieus (Saxenian, 1994; Scott, 1986; Storper & Walker, 1989) and prompted Saxenian

(1994) and Scott (1986) to study the success of clusters in Silicon Valley, California, and Orange County, California. Saxenian (1994) found that in order to nurture technopoles, networks must encourage entrepreneurial initiatives. Druilhe and Garnsey (2000) argued that dominant firms, local universities, and policymakers are spawning new technopoles. A technopole is highly path dependent and relies on knowledge developed by research institutes, and this knowledge is often converted into the creation of technological spin-offs.

4.6 Localized Learning

Malmberg and Maskell (1997, 1999) found that *localized learning* intends to explore spatial proximity and how local stakeholders learn. This stream of literature investigates the reasons for specialization of the regional economics and the co-location of stakeholders (Maskell & Malmberg, 1997, 1999).

Malmberg and Maskell (1997) indicated that tacit knowledge is embedded within a localized system and that its transfer is enhanced by geographical proximity. In other words, tacit knowledge transfer between organizations is enhanced when organizations are localized in the same geographical area or in the same industrial cluster (He & Fallah, 2009) in trusted, densely tied networks (Uzzi, 1996).

Concentration of knowledge within a geographical area is linked to the idea that knowledge is sticky (Morgan, 2004; von Hippel, 1994), and therefore, within the cluster, firms benefit from knowledge spillovers due to knowledge's stickiness and tacitness (Bathelt, Malmberg & Maskell, 2004). Asheim and Isaksen (2002) suggested that knowledge is tacit and sticky because it is difficult to transfer knowledge when there is no physical proximity. Morgan (2004) added that tacit knowledge is sticky, anchored within its location, and transmitted thanks to physical proximity.

Similarly, Malmberg and Maskell (1997) posited that tacit knowledge and networks are very difficult to transfer outside of the region. Moreover, the social capital related to clusters is based on both tacit and explicit knowledge spillovers (Almeida & Kogut, 1999; Bathelt et al., 2004; Owen-

Smith & Powell, 2004). The high degree of tacit/sticky knowledge has an impact in term of routines, habits, and, to some extent, path dependency in localized learning processes among clients and suppliers, but also competitors – all of whom are involved in a face-to-face network (Maskell & Malmberg, 1999).

More recently, the concepts of *local buzz* and *global pipelines* have emerged (Bathelt, 2007; Bathelt et al., 2004). Knowledge creation comes from different theoretical backgrounds, such as urbanization economies synonymous with *buzz* (Bathelt et al., 2004; Storper & Venables, 2002), *local broadcasting* (Owen-Smith, Riccaboni, Pammolli, & Powell, 2002), and *noise* representing current happenings and the creation of a dynamic environment (Grabher, 2002). Practical knowledge creation occurs through “chatting, gossiping, brainstorming, in-depth discussions, and problem analysis” (Bathelt et al., 2004, p. 12). Storper and Venables (2004) found that there is a local buzz when agglomeration occurs locally. The relational aspect of economic geography has been defended by Bathelt (2006) and Bathelt and Glücker (2003); however, local buzz is not limited to knowledge exchange, and the mobility of inventors across companies impacts the knowledge flow, keeping it localized in a limited spatial area (Almeida & Kogut, 1999).

However, Bathelt et al. (2004) argued that there is a “need of extra-local linkages by referring to the dangers of local networks that are too close, too exclusive and too rigid” (p. 15). Consequently, to supplement face-to-face contacts, the co-location and co-presence of people/organizations from the same industry through local buzz require long-distance interactions through global pipelines (Bathelt et al., 2004). The creation of knowledge across clusters is called pipelines because of distances that may be significant and are developed among partners that possess different knowledge bits. For instance, Uzzi (1997) demonstrated the importance of external linkages in the textile industry.

4.7 Regional Clusters

Inspired by Marshall and Becattini, Porter (1998a, 1998b) developed the concept of *regional clusters* as a socioeconomic organization. Similar to Becattini’s contention, Porter (1998a) stated that

firms and other organizations, including universities and research institutes, not only cooperate but also compete in clusters. Contrary to the industrial district, Porter (1998b) did not consider the spatial dimension of the clusters, some of which could be the size of a city, a state (e.g., California), a country (e.g., Sweden), or even a group of neighboring countries. The research on the creation of knowledge within clusters has been heavily influenced by Porter (2000) who defined a cluster as “a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities” (p. 15).

Clusters are determined by the geographical concentration and connection among companies, suppliers, service providers, firms, and institutions (Porter, 1998a). This definition was extended two years later to include local institutions providing support and qualified workforces as well as the existence of local competition (Porter, 2000). Porter argued that technology transfers are important in clusters and involve scientific institutes. Moreover, in a cluster, both public and private research institutes have a specific role (Asheim & Coenen, 2005).

In clusters, external economies of scale are available (Fujita, Krugman & Venables, 2000; Krugman, 1991), including those achieved by customers and suppliers (Porter, 1998a) and research institutions and universities (Andersson, Evers & Griot (2013). Engel and Del-Palacio (2011) defined a cluster of innovation as “an environment that favors the creation and development of high potential entrepreneurial ventures, and is characterized by heightened mobility of resources, including people, capital and information” (p. 27). Finally, Moulaert and Djellal (1995) developed *locational and urbanization economies*, which are very similar to what Porter (1996) referred to as *agglomeration economies*.

4.8 Territorial Innovation Models (TIMs) Facing Major Challenges

The territorial approach is composed of multiple models: the innovative milieus (Aydalot, 1986; Camagni & Maillat, 2006; Ratti, 1989), industrial districts and science parks (Bagnasco, 1977; Becattini, 1992, 2003; Benko & Lipietz, 1992; Camagni, 1991; Dei Ottati, 1994a, 1994b; Garofali,

1992), new industrial spaces (Saxenian, 1994; Storper, 1995, 1997; Storper & Scott, 1988), clusters of innovation (Fujita et al., 2000; Krugman, 1991; Porter, 1990, 1996, 1998a, 1998b, 2000), regional systems of innovation (Braczyk et al., 1998; Morgan, 1997), learning regions (Florida, 1995; Lundvall, 1992; Maillat & Kebir, 1999), systems of innovation (Leborgne & Lipietz, 1988), and others – the list is not exhaustive.

The concept of territorial innovation models (TIMs) was introduced by Moulaert and Sekia (2003) who argued that TIMs are based on the various models dealing with regional innovation and the local interactions between institutions.

The first problem in the study of TIMs is that industrial districts are not homogeneous (De Marchi & Grandinetti, 2014). In other words, real-life territorial areas are very unique. Bathelt (2001) studied the economic recovery of Massachusetts' Route 128 and focused on the institutional factors and their actions on the cluster from the mid-1990s onwards. Comparing Massachusetts' Route 128 and California's Silicon Valley, Saxenian (1994) found that innovation processes and governance between local actors are different and unique. He and Fallah (2011) also argued that "different industries tend to support different types of cluster typologies. In other words, an individual cluster's typology is to some extent shaped by the industry group it belongs to" (p. 945).

The second problem, pinpointed by He and Fallah (2011) after having studied 15 clusters in the United States and developed a typology of technology clusters in high-tech industries, is that "the real-world clusters rarely feature any single type of typology; a mixed type of typology is much more prevalent in reality" (He & Fallah, 2011, p. 945).

The third problem has been raised by some scholars who contended that those streams of literature dealing with TIMs are clearly diverging, not converging. Tödtling and Trippel (2005) argued that although the definitions of a cluster and RIS are considered similar, they are not congruent.

The fourth problem is the difficulty of creating a *metafamily* of models. In relation to the theories on related topics, the main streams of literature are not perceived as being equally important.

Moulaert and Nussbaumer (2005) noted that essentially the TIMs can be categorized into three main groups: 1) the innovative milieu model (Aydalot, 1986) and the industrial district model, 2) the system of innovation on a regional scale (Cooke, 1992), and 3) the Californian School (Scott, 1988). According to Moulaert and Nussbaumer (2005), regional clusters (Porter, 1998a) do not fall into the main categories. Additionally, Kajikawa, Mori, and Sakata (2012) studied networks in regional clusters and found that the low density of networks in a regional cluster means that it is very challenging for firms to find partners within an industrial cluster.

Meanwhile, Cainelli (2008) held that there are three distinct approaches to spatial agglomeration: 1) Marshallian industrial districts, 2) innovative milieus, and 3) regional innovation systems. O’Gorman and Kautonen (2004) have previously inferred that the three most significant models of agglomeration are: 1) the technopole model, 2) the regional cluster model, and 3) the innovation milieu model, while recently, De Marchi and Grandinetti (2014) have argued that a Marshallian industrial district is a specific type of industrial district (cf. Becattini (1990)), which is a specific type of cluster (cf. Porter (1998b)). They made an attempt to create a typology of three families of models; an attempt, however, that failed to reach consensus in the research community.

Overall, the literature related to the territorial approach faces the multiplication of TIMs, the difficulty of ensuring homogeneity within each model, the poor match between the TIMs and reality, the non-convergence of TIMs, and the struggle to create a metafamily of models.

4.9 What Those Theories Have in Common?

As we have seen, it seems impossible to position all theories under the name territorial innovation models because the streams of literature diverge. Therefore, our intent is to focus on the invariants – what those theories have in common.

Overall, the major streams of literature have seven things in common:

1. a given territory with a unique atmosphere, the anchoring of an industry, and varying sizes;

2. a set of common values, such as trust, belonging to a community, a mutual understanding built over time through common history, culture, and routine;
3. a set of various stakeholders, such as firms of different sizes, research institutes, universities, and policymakers, all positioned at different stages of the value chain;
4. a strong economics foundation based on localization economies, agglomeration economies, transaction cost theory, localized spillovers, and economies of scale;
5. a strong social foundation based on the coexistence of collaboration and competition, which focuses on the increasing importance of both social and human capital;
6. a central position of knowledge of a different nature (tacit versus explicit), which circulates well through transfer, is well-absorbed through intensive learning, and offers synergies; and
7. important outcomes, which are the catalysts of innovation, entrepreneurial initiatives, and competitiveness and lead to economic growth, long-term development, performance, and success.

In comparing these seven conceptualizations, we developed a list of invariants, which are presented in Table 4.

Table 4: Invariants of the Territorial Approach

Chronological order		1	2	3	4	5	6	7
Stream		Industrial districts	Marshallian district	Innovative milieu	Regional innovation systems	New industrial spaces	Localized learning	Regional cluster
		Marshall (1890)	Becattini (1990)	Camagni (1991)	Cooke (1992)	Saxenian (1994)	Malmberg & Maskell (1997)	Porter (1998a, b)
Territory	Invariants							
	Atmosphere	Atmosphere	Industrial atmosphere	Emotional support of innovation			Local buzz	
	Anchoring	Anchoring	Anchoring	Spatial proximity	System	Initial spatial clustering	Anchoring	
	Territorial size	Small geographical area	Geographic areas	Limited geographical area	Region	Region	Physical proximity	City, state, country
Values	Industry	Industrial sector	Industries				Same industry	Particular field
	Trust		Trust	Trust	Trust		Trust	
	Belonging to community		Belonging to community	Sense of belonging		Local community dynamics		
	Mutual understanding		Mutual understanding	Mutual understanding				
	Uncertainty reduction		Uncertainty reduction	Interpersonal contacts				
	Culture, history, routine			History, culture	Similar norms, routines			
							Similar routines, path dependency	
							Co-location of organizations	
Stakeholders	Firms	Population of firms	Co-location of firms (SMEs)		Large firms, start-ups	Dominant firms	Densely tied networks	Interconnected companies
	Networking among firms	Networking among firms	Specialized partners	Complex network	Learning network			
	Other stakeholders			Universities	Research institutes, universities	Universities, policymakers	Competitors	Research institutes, university
	Value chain	Balance supply/demand	Divided value chain				Clients, suppliers	Customers, specialized suppliers
Economics	Localization economics	Localization economics	Limited transaction costs			Flexible production systems		
	Localized spillovers	Localized spillovers	Knowledge spillovers	Localized spillovers	Knowledge externalities		Tacit knowledge spillovers	
	Agglomeration	Spatial agglomeration	Agglomeration economies				Agglomeration economies	Agglomeration economies
	Economies of scale	Economies of scale	Economies of scale	Economies of scale		Economies of scale		External economies of scale
Social	Economic and non-economic interactions	Economic factors	Balance economic and social interactions	Social-economic interactions	Social-economic interactions	Social-economic interactions	Social-economic interactions	Socioeconomic organization
	Collaboration vs. competition		Collaboration vs. competition	Cooperation and rivalry				Cooperation and competition
	Social capital		Social capital	Informal social aspect	Informal means		Social capital	
Knowledge	Human capital		Skilled workforce	Human capital			Co-presence of people	Qualified workforce
	Type of knowledge		Tacit knowledge	Tacit knowledge			Embedded tacit knowledge	
	Knowledge dynamics		Efficient information flows: Knowledge transfer coordination	Easy information interchange	Inflow of external knowledge		Global pipelines	Technology transfers
	Learning			Collective learning	Collective learning		Localized learning	
Outcomes	Synergies		High specialization	Synergies				Complementarities
	Innovation	Innovation	Innovation	Innovation			Innovative output	
	Entrepreneurship			Creation of entrepreneurs		Creation of spin-offs		
	Competitiveness	Competitiveness		External image	Regional growth	Entrepreneurial initiatives		
	Economic outcomes	Economic growth	Long-term economic development	Economic growth	Economic performance	Economic success		

5 Invariants Discussion

In this section, we compare the list of invariants from the ecosystem approach (Table 3) to the list of invariants from the territorial approach (Table 4).

5.1 The Blended Territorial Ecosystem Approach: What Are the Common Invariants?

The ecosystem literature does not elaborate on the **sense of belonging** in Maslow's definition. Nevertheless, there are strong interconnections and interdependencies between ecosystem stakeholders that may reflect similar ties. Moore (1996), while discussing business ecosystem characteristics, acknowledged that the economic community is created by interacting organizations and individuals. Iansiti and Levien (2004) approached it from an existential perspective and talked about the keystone's contribution, which is crucial to the overall survival of the local community. In the territorial approach, people are part of a community and organizations contribute to the development of a common history of a given territory (Becattini, 1990; Camagni, 1991a). The sense of belonging to a community exists due to the sharing of social and political values and conventions (Best, 1990; Boschma & Lambooy, 2002; Fromhold-Eisebith, 2004). The size of the territory matters in the perception of the sense of belonging. In that connection, medium-sized cities appear to be the most optimal size (Capello, 2000).

Trust is not something that can be demanded from ecosystem members, but it is considered a governance mechanism supplemental to contracts (Ritala, Agouridas, Assimakopoulos & Gies, 2013). It could also have a positive influence on the reduction of transaction costs, which is one of the *clustering advantages* (Pitelis, 2012). There is a tight link between trust, reputation, and credibility, especially if we take into consideration relationships that are formed between various stakeholders coexisting and coevolving in a special proximity (Buciuni et al., 2014; Li, 2009). Particularly, trust and trustworthy relationships are discussed across most of the territorial models. In the territorial approach, scholars strongly emphasize the fact that the success of a certain region is also a matter of non-economic factors. Trust is part of it. More specifically, the innovative milieu strongly discusses

the need for trust in networking and in the exchange of tacit knowledge between actors (Camagni, 2004; Camagni & Capello, 2005; Capello & Nijkamp, 2004; Crevoisier, 2004; Rémy, 2000).

The ecosystem literature covers **various stakeholders involved in the value chain**; their presence is reflected both in their size and different levels of analysis. First, there are the basic value chain actors, such as the focal firm and its suppliers and customers (Iansiti & Levien, 2004; Moore, 1993), expanding to the universities and public research institutions (Clarysse et al., 2014; van der Borgh et al., 2012) and governmental organizations (Autio et al., 2014; Li & Garnsey, 2014) through individuals and entrepreneurial teams (Autio et al., 2014) to other supporting organizations. Similar to the body of knowledge dedicated to ecosystems, the territorial approach highlights the fact that a region can share an entire value chain among local partners of different types (firms, research centers, or universities) and of different sizes (large firms or SMEs). Such division of work enables the smaller entities to learn from the leading institution in a given territorial area (Bagnasco, 1977).

Knowledge dynamics, which characterize the interaction between ecosystem members, are perceived as an important source of innovation. From a university-centric approach, Van der Borgh et al. (2012) considered knowledge as the foundation of an ecosystem. The use of purposive inflows and outflows of knowledge (Chesbrough, Vanhaverbeke & West, 2006) is also perceived as a core element of an open innovation-based business environment. The central questions for territorial knowledge are: how can knowledge be transferred, how can partners identify relevant information, and what are the existing knowledge dynamics among not only local but also external partners. Such questions are common to the various models presented in this manuscript. For instance, in the Marshallian district model, Dei Ottati (1994a, 1994b) argued that the sharing, the quality, and the coordination of information improve when occurring between local stakeholders. In various models, knowledge dynamics take the form of knowledge transfer by which the reduction of the distance (also called spatial proximity) facilitates both the coordination (Boschma & Lambooy, 2002) and the collaboration between skilled people (Markusen, 1996). In the innovative milieu, Camagni (1991b) strongly

emphasized that spatial proximity enhances the exchange of information. Broadening the scope of endogenous knowledge exchange, the recent stream on localized learning encourages the local network to develop external linkages, especially with the development of global pipelines, which complement existing local buzz (Bathelt et al., 2004).

Another important feature of ecosystems is the strong presence of different types of interactions between ecosystem members. **Cooperation and competition** between established firms and new ventures are measures of the ecosystem's success (Adner & Kapoor, 2010; Moore, 1993; Zahra & Nambisan, 2012). These two behaviors could be performed either independently between different stakeholders or simultaneously between the same partners, thus leading to coopetition relationships (Calcei & M'Chirgui, 2012; Isckia, 2009; Ritala et al., 2013). Various territorial models have investigated the dual existence of collaboration and competition between local stakeholders, and this is the case in Italian industrial districts (Becattini, 1992; Best, 1990; Boschma & Lambooy, 2002) as well as the regional clusters of Porter (2000).

The presence of complementary skills in the ecosystems stimulates the creation of **synergies** (Iansiti & Levien, 2004; Moore, 1993), which may not arise if participants are purely heterogeneous. Eisenhardt and Galunic (2000) claimed that coevolving, which takes place in an ecosystem of closely connected actors, is the factor that makes the synergies work. Leveraging synergies can lead to reduction of risks, extension of design space, and creation of buzz (Hienerth, Lettl & Keinz, 2014). Nevertheless, the value creation process, which takes place when many players are combining their capabilities, may also create some challenges and risks that should be mitigated (Adner, 2006). Synergies are developed within a specific innovative milieu when local stakeholders learn collectively and enable others to learn from their experiences in related activities (Camagni, 1991a). Overall, the cooperation between organizations encourages synergies (Capello, 2000), and these synergies are possible to achieve because the companies are interconnected, have much in common, and complement each other well (Porter, 2000).

Adner (2006) found three fundamental types of risk associated with innovation ecosystems: initiative, interdependence, and integration risks, and these must be mitigated by an appropriate innovation strategy. The risks are subsequently linked with project management uncertainties, interdependencies and coordination of joint activities with the complementors, and the adoption process of the entire value chain. Sharing among other stakeholders to properly assess and **mitigate risks** could be a key to the survival as well as success of an innovation ecosystem (Ritala et al., 2013). The objective of operating locally is to reduce the risks, and to that end, local institutions are acting to reduce risks and promote trustworthy relationships within the territory (Camagni, 1991a, 1991b). When organizations cooperate, they tend to share the value chain and, consequently, the risk with other partners. The aggregation of various stakeholders in a given territory constitutes an institutional thickness that guarantees a low level of risk among partners (Amin & Thrift, 1995).

Iansiti and Levien (2004) claimed that large ecosystems consisting of thousands of firms benefit from **economies of scale/scope** and thus have an advantage over smaller ecosystems. Economies of scale and scope are also listed as some of the advantages of belonging to the knowledge ecosystems (Clarysse et al., 2014; van der Borgh et al., 2012). This type of leverage could also be observed in the platform research context (Thomas, Autio & Gann, 2014). In the territorial approach, the subject of economies of scale/scope was introduced by Marshall (1920), whose seminal work emphasized that firms achieve economies of scale in industrial districts. While the literature dedicated to ecosystems only addresses economies of scale, the literature on Marshallian districts clearly establishes a link between the agglomeration economies/industrial localization and economies of scale achieved by firms, and in terms of cost savings, the reduction of transaction costs has been discussed (Dei Ottati, 2003). Economies of scale/scope are available because of the existence of complementarity relationships, networks, interdependencies, the existence of industrial systems, the support of local institutions, the involvement of customers/suppliers, etc. (Fujita et al., 2000; Krugman, 1991; Porter, 1998a; Saxenian, 1994).

According to Basole (2009), delivering **innovation** is one of the aims of an ecosystem. Since innovative businesses neither emerge nor evolve in a vacuum, the creation of a cooperative network is essential for their quick and effective evolution (Moore, 1993). “Successful innovation requires tracking your partners and potential adopters as closely as you track your own development process”(Adner, 2006, p. 1), and that is why Adner (2006) recommended matching a firm’s innovation strategy with its innovation ecosystem. The innovation output is both supported and positively influenced by *knowledge generators*, such as universities or public research institutions (Clarysse et al., 2014). In both the ecosystem and territorial approaches, one of the major outcomes expected when operating within an ecosystem/certain territory is encouragement of innovation. Such innovation can take the form of the creation of spin-offs or start-ups in general (Aydalot, 1986; Breschi & Malerba, 2001).

5.2 The Territorial Approach: What Are the Invariants from the Inner Perspective?

The ecosystem perspective fails to consider certain key features of the territorial approach; therefore, this section aims to further present an *inner perspective* from the territorial approach that can offer deeper insights into the ecosystems concept.

Marshall (1890) introduced the idea that an industrial district’s **territorial atmosphere** is something unique – a specific territory in a given business area with a set of interrelated firms. This concept of *atmosphere* is the foundation of the territorial approach because it offers an advantage to local stakeholders. This was later followed by other schools of thought that further explored the innovation activities conducted within a specific space (Aydalot, 1986; Camagni, 1991b; Camagni & Maillat, 2006; Ratti, 1989).

These territories base their uniqueness on a variety of stakeholders: not only large and small firms (Iammarino, 2005; Lundvall, 1992) but also **research centers and universities** (Asheim & Coenen, 2005). The importance of universities and research institutes has been heavily documented in the territorial approach but underestimated in the case of some ecosystem types. In some instances

(e.g., the state-centered typology), large public or non-profit organizations, such as universities and research institutes, can drive both large and small firms in industrial districts (Markusen, 1996). Research institutions and universities enable local stakeholders to benefit from knowledge spillovers and learn collectively in innovative milieus (Camagni, 1991b).

Between various stakeholders, there is a need to exchange explicit knowledge, but equally or more important is the transfer of **tacit knowledge**. One of the great debates regarding the territorial approach vs. the ecosystem approach is the distinction between explicit and tacit knowledge. Industrial districts offer a specific setting that encourages stakeholders to share their tacit knowledge within a localized system (Malmberg & Maskell, 1997). Within these localized systems, there are regular knowledge exchanges, and co-located organizations benefit from knowledge spillovers (Bathelt et al., 2004). Conversely, at a distance, tacit knowledge is not transferable (Asheim & Isaksen, 2002; Malmberg & Maskell, 1997).

By developing a certain cooperation **routine**, stakeholders contribute to the strengthening of the institutional thickness (Amin & Thrift, 1995). Routines foster several aspects, such as trust and norms, that enhance the informal collaboration of its members who in turn learn more easily (Carrincazeaux & Gaschet, 2006; Cooke, 1998). Moreover, organizations develop habits to facilitate learning from clients, suppliers, and other competing firms. However, because past experiences shape future behavior, scholars have argued that, as a drawback of routines, the territorial approach may also suffer from **path dependency** (Maskell & Malmberg, 1999).

Norms, trust, routines, and tacit knowledge exchange are the antecedents of collective **learning** (Cooke, 1998). The cognitive aspect of the territorial approach has been well-documented compared to the ecosystem approach and has been highly popularized in the innovative milieu model that investigates the collective learning processes (Camagni, 1991a; Lundvall & Johnson, 1994; Ratti, 1989). This topic has become the central focus of *localized learning*, which investigates the conditions that facilitate cognitive processes among co-located stakeholders in specialized geographical

economics (Maskell & Malmberg, 1997, 1999). On one side, organizations can offer knowledge externalities to their networks (Crevoisier, 2004); on the other, learning process capabilities enable stakeholders to capture such external knowledge and knowledge spillovers (Dosi, 1984; Ratti, 1989; Storper, 1995).

The interplay between various institutions, tacit knowledge exchange, and intensive learning processes create a **social capital**, which is a subject of considerable discussion in the territorial approach. Social aspects were introduced by the Marshallian districts (Becattini, 2003) and then amplified in the innovative milieu, which particularly focused on informal social relationships (Camagni, 1991a). Social capital is built on the division of work in trusted relationships (Storper, 1995). Furthermore, innovation is based on a social and interactive process in the RIS model (Cooke, 2003; Malmberg & Maskell, 2002).

The social and economic aspects of the territorial approach are closely related: strong social capital strengthens the **agglomeration** of firms. A set of firms located in the same area and working in the same industry has a positive impact on the availability of **localized knowledge spillovers** in the geographical area (Acs et al., 2002; Audretsch & Feldman, 1996; Jaffe et al., 1993). These agglomeration and localization economies then contribute to reducing transaction costs, encouraging innovation, fostering competitiveness and economic growth/development, and bolstering the success of the local economies (Amin & Thrift, 1992; Asheim & Isaksen, 2002; Becattini, 1990; Garofoli, 1992; Krugman, 1998; Porter, 1996, 2000).

Furthermore, agglomerations strengthen the **anchoring** of knowledge within a specific area, which constitutes *territorial knowledge* (Cappellin, 2006). The knowledge is anchored within a specific context and a specific territory (Morgan, 2004; von Hippel, 1994) because it is sticky. Consequently, anchored knowledge both enhances local buzz (Bathelt et al., 2004; Storper & Venables, 2002) and positively affects the territorial atmosphere in a virtuous circle.

5.3 The Ecosystem Approach: What Are the Invariants from the Broader Perspective?

In the ecosystem approach, as opposed to the territorial approach, scholars go beyond the *inner perspective* and take advantage of the support from different types of institutions, not only those that are local (e.g., those located on the governmental level), and consequently allow inflows (and outflows) of external knowledge (Chesbrough, 2003).

One of the main differences between the ecosystem approach and the territorial approach is the perception and the role of the structures and institutions. In the entrepreneurial ecosystem, the role of government (national or local) seems to be important, but it is different from its role in national (territorial) innovation systems (Autio et al., 2014). Entrepreneurial activities naturally cluster in certain locations because these places usually offer considerable benefits, and these benefits support the emergence of business or technology clusters in the entrepreneurial ecosystem. In these cases, government's role is to help them grow organically and make sure they are not overengineered (Isenberg, 2010). In the knowledge ecosystem, which is the closest to the territorial approach, the main institutions are the universities or public research organizations (Clarysse et al., 2014; van der Borgh et al., 2012). Therefore, in general, ecosystems consist of **firms and (entrepreneurial) innovation** (Zahra & Wright, 2011).

In business and innovation ecosystems, universities and public institutions play a rather peripheral role, **and the duty of the orchestration falls to the large firm**. Business and innovation ecosystems seem to be overwhelmingly industry-driven – **a firm guides the development of the ecosystem** (Adner, 2006) – in comparison to the entrepreneur in an entrepreneurial ecosystem and the university in the knowledge ecosystem. In this sense, industry in the management perception is much broader than in the territorial approach because it is composed of a large variety of stakeholders, including those in emerging and disruptive industries.

Furthermore, territorial approach partners share various tasks, whereas in ecosystems, the members develop **strong interdependence**. This interdependence offers **synergetic interactions**

between **complementors** and **coopetitors**. When firms establish cooperation and together strive for shared business objectives, the interdependencies between them start to become more visible, and proper management and risk mitigation strategies allow them to reduce uncertainty. Nevertheless, only through knowledge exchange and spillovers can the innovative products and services be created. Ecosystem stakeholders are usually **interconnected**, not only co-located, as is often the case in the territorial approach. Partnership leads to a joint **evolution** and **co-creation of value** that none of the partners would be able to create alone. This value creation and sharing process design may be the role assigned to the ecosystem orchestrator (Iansiti & Levien, 2004), and this anchor tenant should be neither disinterested nor directly competing with the other ecosystem members (Clarysse et al., 2014).

5.4 Towards a Conceptual Framework

Based on the common invariants from the blended territorial ecosystem approach and the invariants from the territorial approach (the inner perspective) and from the ecosystem approach (the broader perspective), we developed the framework presented in Figure 3. The framework highlights the interconnection of the three complementary layers: ecosystem, territorial ecosystem, and territorial. The external layer (ecosystem) offers a broader view, the internal layer (territorial) offers an inner view, and the intermediate layer (territorial ecosystem) is the point of friction between the two complementary streams of literature.

We believe that (a) there is a causality between the invariants at each layer, (b) there are virtuous circles at each layer where an interaction strengthens the next iteration, and (c) there is a high degree of porosity among the three layers and a certain influence between invariants: from the ecosystem to the territorial approaches (broad-inner dynamics) or from the territorial to the ecosystem approaches (inner-broad dynamics).

5.4.1 The Ecosystem Approach

Regarding the external layer (light grey color), **entrepreneurial activities** clustered in an entrepreneurial ecosystem offer the possibility for large firms to play the role of **orchestration**, which

shapes **knowledge sharing** between the members, involves a form of **coopetition**, **complementarity**, and **interdependence**, determines the joint **evolution** and the **co-creation** of value, and finally, reinforces the **entrepreneurial activities**.

5.4.2 The Territorial Approach

As regards the internal layer (dark grey color), **territorial atmosphere** supports the development of **research centers and universities** and the exchange of **tacit knowledge**, which consequently creates a certain **path dependency**; it shapes the **collective learning**, the development of a **social capital**, and the **agglomeration** of firms benefiting from localized **knowledge spillovers**, which strengthens the **anchoring** of knowledge; and finally, it reinforces **the territorial atmosphere**.

5.4.3 The Territorial Ecosystem Approach

As for the intermediate layer (grey color), the **interconnections** and **interdependencies** between ecosystem stakeholders create a **trusting** atmosphere and a **sense of belonging**, which encourages various **stakeholders** to become involved in the value chain. Consequently, the stakeholders also engage in **knowledge dynamics** as purposive inflows and outflows of knowledge, and this creates an environment where there is a dual existence of **collaboration and competition**, which is needed to create **synergies** between closely connected actors and **reduce** initiative, interdependence, and integration **risks**, benefit from **economies of scale/scope**, and offer **innovation** as a social and iterative process, reinforcing the **sense of belonging**.

This framework fills the knowledge gap in the field of ecosystems for the following reasons. First, our framework bridges business and territorial approaches and provides a better understanding of the position of ecosystems in comparison with other highly related fields of research, such as the territorial approach. Second, we have built the framework based on theoretical work on the territorial approach, which is novel research. Third, we propose a framework that considers the convergent elements between four various streams of literature: the business ecosystem, the innovation ecosystem, the entrepreneurial ecosystem, and the knowledge ecosystem.

Figure 3: Framework of the Invariants from the Ecosystem Approach, the Territorial Approach, and the Blended Territorial Ecosystem Approach

6 Conclusions

6.1 Findings

Following Tranfield et al. (2003), we conducted a systematic literature review on ecosystems based on 393 references: 383 articles and 10 books. We concentrated our SLR on 104 selected items and identified four major but diverging research streams: 1) business ecosystems, 2) innovation ecosystems, 3) entrepreneurial ecosystems, and 4) knowledge ecosystems. We identified the common invariants to strengthen the foundations of this growing field.

The archetypes of the ecosystems were explored by considering established theories that tend to be omitted in the existing literature. Although the link between ecosystems and open innovation exists and the link between ecosystems and dynamic capabilities has been considered, the link between the ecosystem approach and the territorial approach has not yet been studied. We focused on this theoretical gap by exploring the very rich literature composed of seven major but divergent streams: 1) industrial districts, 2) Marshallian districts, 3) innovative milieus, 4) regional innovation systems, 5) new industrial spaces, 6) localized learning, and 7) regional clusters. Similar to the literature on ecosystems, we created invariants to identify the common factors that remain unchanged despite the literature stream.

In order to compare the ecosystem approach with the territorial approach, we evaluated each approach's list of invariants to identify the similarities and the differences. We argue that these two approaches have many elements in common: a sense of belonging/trust, stakeholder involvement in the value chain, knowledge dynamics, collaboration/competition, synergies, uncertainty reduction, economics of scale/scope, and innovation outcomes.

Our results suggest that ecosystem and territorial approaches are two sides of the same coin: one broader side (entrepreneur, governance/orchestration, knowledge sharing, network/sharing tasks, complementary competencies, interdependence, coevolution, and co-creation) and one narrower inner side (territorial atmosphere, universities and research institutes, tacit knowledge, routine/path

dependency, learning, social capital, agglomeration spillovers, and anchoring). Consequently, policymakers should not restrict their governance to the recommendations provided by the literature on ecosystems that is popular at the present time; rather, with the same energy, they should consider the older literature that has intensely shaped the territorial approach. Because the ecosystem approach and the territorial approach are complementary, experts from both fields should mutualize their efforts to provide holistic solutions to current policy issues.

Overall, we have contributed to the ecosystem literature by 1) identifying the four main streams of literature and other transversal new concepts that emerge from a systematic literature review and were integrated in a conceptual framework; 2) suggesting a list of ecosystem invariants that are true whatever the streams that contribute to the stabilization of the field; 3) exploring the ecosystem archetypes, in particular the territorial approach, which is composed of several well-established models linked to the core aspects of the ecosystem approach; and 4) developing a second framework that bridges the ecosystem approach and the territorial approach that identifies the common invariants, the invariants suitable for the ecosystem approach (broader side), and the invariants appropriate for the territorial approach (inner side).

6.2 Research Agenda for Further Studies

In this paper, we explore both the ecosystem and the territorial approach as two complementary fields of study. There are some limitations to our study, which are mainly related to the selection criterion of only including peer-reviewed articles in English from the WoS database. Consequently, we encourage further research to investigate additional databases and to consider non-English articles. Additionally, we developed the following research agenda for further studies.

6.2.1 Establishing Links with Other Research Communities

We believe that, in addition to developing new competing streams of literature, there is a need to stabilize the field of research, cultivate a common understanding, plan the next steps, and develop

a research agenda. That is why the competition between streams of literature in the ecosystem approach or in the territorial approach hinders the progress of the overall literature.

Therefore, it is even more important to make sure that new taxonomies and conceptualizations are not developed to accommodate a temporary need but are well-grounded in the established literature streams and build on other well-developed theories. While conducting our systematic literature review, we also identified other related taxonomies and lenses through which ecosystems can be viewed and analyzed. These are organizational ecology (Amburgey & Rao, 1996; Hannan & Freeman, 1977; Trist, 1977), institutional theory (Geels, 2004), and value networks (Normann & Ramirez, 1993).

In our view, the organizational ecology could offer very valuable insights. Hannan and Freeman (1977) studied organizational ecology by developing the population ecology theory, which analyzes the response of organizations to the changes occurring in the environment. Some organizations adapt to the changes in the environment, while others do not. This leads to the question, can an ecosystem impact the ability of firms to adapt? In the organizational ecology theory, success and failure are determined by population density, industry life cycle, organization age, and organization size. When the number of incumbents increases, the chances of failure also increase. This major aspect of the literature on organizational ecology contradicts the literature on ecosystems. Therefore, for further research, we recommend scholars explore this and also the other archetypes of the ecosystem approach.

Knowledge of the archetype avoids the trap of trying to invent something that already exists and the criticism that this is an *old wine in new bottles* phenomenon. Further research could focus on analyzing how an ecosystem is perceived by other scholarly communities and identifying any frameworks that could be used for more a comprehensive analysis of the ecosystems.

6.2.2 Broader and Inner Scope

We believe that the ecosystem approach and the territorial approach complement each other by presenting an apt combination of broad and narrow focuses. Most recent theories tend to be very

global, inclusive, and broad. However, we believe that there is a need for combining both broad and more specific scopes. That is why it would be interesting to investigate geographical proximity versus cognitive proximity and their role and influence on globalization processes and technological development in both the established and emerging ecosystems. Further research could also investigate the emergence of territorial approach elements in the local and global ecosystems (i.e., innovation platforms). To us, such research seems crucial to better understand the disparities between well-performing territory/ecosystems and underperforming territory/ecosystems. There is a need to study not only ecosystems' positive factors but also their failures and the reasons behind them.

6.2.3 Ecosystem Life Cycle Guidelines for Practitioners

As with clusters, there is a need to study the ecosystem life cycle's embryonic, established, mature, and declining elements. However, should we be studying ecosystem renewal and how ecosystems reinvent themselves to be sustainable in the long run? Investigation into the processes that steer the creation and the dynamics of ecosystems could bring some new perspectives and understanding on the role of different partners in every life cycle stage. This could have interesting implications for both scholars and practitioners, especially ecosystem orchestrators, because knowledge about all the life cycle processes that take place inside ecosystems and the causality relationships between them could serve as guidelines for practitioners who wish to develop alignment between firm and ecosystem strategies.

6.2.4 The Role of Policymakers

To best offer recommendations to policymakers, we believe that detailed knowledge about the specificities of each territory and each ecosystem is needed. Success in one setting does not guarantee success in another because each atmosphere is unique (e.g., replicating the success of Silicon Valley in another environment has not worked). We believe that trying to understand the good territorial ecosystem strategies that work and those that do not is more efficient than trying to replicate the best cluster. This calls for empirical research that investigates entrepreneurial and interfirm perspectives

and the role of institutions, especially policymakers, in the process of ecosystem creation and development.

6.2.5 The Research Framework Exploration

Further research could also focus on the implementation and validation of our framework in empirical studies. Both qualitative exploratory research and early quantitative studies would help to further develop this framework and offer recommendations to policymakers and other regional actors. It would be beneficial to consider not only different regions or industries but also different levels of analysis (e.g., inter-organizational aspects), seeing that a multilevel perspective could provide more insights into various actors' perceptions of the regional setups they are involved in.

Research questions that could further develop this study include: How can the framework be operationalized with quantitative measurements? How can the growing number of communities (i.e., four in the ecosystem and seven in the territorial approach) work together and learn from each other? How can the ecosystem field strengthen its own anchoring in existing theories?

Appendix I: Search Queries*

Search	Keyword strings	Total	Total (including only management, business or economics)	Total (excluding proceedings)	Total (excluding duplicates)
1	ecosystem* AND innovat* AND busines*	303	140	96	133
2	ecosystem* AND innovat* AND network*	388	103	62	
3	ecosystem* AND innovat* AND entrep*	107	64	35	
4	ecosystem* AND busines* AND network*	307	89	54	153
5	ecosystem* AND busines* AND entrep*	79	52	32	
6	ecosystem* AND entrep* AND network*	47	19	10	
7	ecosystem* AND innovat* NOT busines* NOT network* NOT entrep*	1,620	128	65	68
8	ecosystem* NOT innovat* AND busines* NOT network* NOT entrep*	874	120	68	
9	ecosystem* NOT innovat* NOT busines* NOT network* AND entrep*	68	12	10	
10	ecosystem* NOT innovat* NOT busines* AND network* NOT entrep*	7,331	96	67	
TOTAL		11,124	823	499	354

*Last updated on November 3, 2015

Appendix II: Categories Overview

Category	Subcategory	Definition	Searches 1-6	Searches 7-10
Primary		The ecosystem term is clearly defined and constitutes the core theme of the paper (AND) the manuscript is well-positioned in the scholarly community.	Total: 31	Total: 4
Secondary		The manuscript refers to an ecosystem definition and does elaborate on it in the theoretical background of the paper; however, it is not the main focus of the paper.	Total: 26	Total: 4
	Strategy	These manuscripts mostly focus on platform research (18) and networks (6).	20	4
	Entrepreneurship	These manuscripts mostly focus on entrepreneurial capabilities and innovation.	6	0
Peripheral		The ecosystem term appears in the manuscript, and it defines a very specific type of an ecosystem (usually in a business ecosystem) represented in a separate literature stream; (OR) the manuscript refers to an ecosystem definition, but it usually does not elaborate on it in the theoretical background of the paper due to a completely different focus of the paper.	Total: 50	Total: 67
	Marketing	These manuscripts usually refer to a <i>service ecosystem</i> .	20	18
	Information technology	These manuscripts usually refer to various types of technologically immersed ecosystems, usually called a <i>digital ecosystem</i> .	9	26
	Urban studies	Regional (innovation) ecosystem or local ecosystem.	9	3
	Others	Not forming any particular group.	12	20
Not relevant		The ecosystem term appears in the manuscript, but it is rather accidentally used or only appears in the references; (AND) no conceptual link to other scholars is mentioned; (OR) it refers to an ecosystem in a biological sense.	Total: 46	Total: 126
	Environmental engineering	These manuscripts usually refer to <i>ecosystem services</i> .	13	97
	Others	Not forming any particular group.	33	29

Appendix III: References of Articles

The 5 character codes were developed based on the first letter of the first author's surname, the title of the article, the two last digits of the publication year, and the first letter of the journal; e.g., the first code, AS13J, was composed of Abdelgawad + Strategic +2013 + Journal.

No	Code	Authors	Title	Year	Journal/Publisher
1	AS13J	Abdelgawad et al.	Strategic leadership and entrepreneurial capability for game change	2013	Journal of Leadership & Organizational Studies
2	AM06H	Adner	Match your innovation strategy to your innovation ecosystem	2006	Harvard Business Review
3	AC13E	Adner et al.	Collaboration and competition in business ecosystems	2013	Emerald Group Publishing
4	AV10S	Adner & Kapoor	Value creation in innovation ecosystems: how the structure of technological interdependence affects firm performance in new technology generations	2010	Strategic Management Journal
5	AK14R	Agarwal & Shah	Knowledge sources of entrepreneurship: Firm formation by academic, user and employee innovators	2014	Research Policy
6	AC13A	Alexy et al.	Cui bono? The selective revealing of knowledge and its implications for innovative activity	2013	Academy of Management Review
7	AO14B	Almirall et al.	Open innovation requires integrated competition-community ecosystems: Lessons learned from civic open innovation	2014	Business Horizons
8	AI14T	Autio et al.	Innovation ecosystems: Implications for innovation management	2014	Oxford University Press
9	AE14R	Autio et al.	Entrepreneurial innovation: The importance of context	2014	Research Policy
10	BV09J	Basole	Visualization of interfirm relations in a converging mobile ecosystem	2009	Journal of Information Technology
11	BO11B	Basole & Karla	On the evolution of mobile platform ecosystem structure and strategy	2011	Business & Information Systems Engineering
12	BM13T	Battistella et al.	Methodology of business ecosystems network analysis: A case study in Telecom Italia Future Centre	2013	Technological Forecasting and Social Change
13	BA14E	Benghozi & Salvador	Are traditional industrial partnerships so strategic for research spin-off development? Some evidence from the Italian case	2014	Entrepreneurship & Regional Development
14	BE15C	Blondel & Edouard	Entrance into a platform-dominated market: Virtue of an open strategy on the numerical computation market	2015	Canadian Journal of Administrative Sciences
15	BC08S	Bloom & Dees	Cultivate your ecosystem	2008	Stanford Social Innovation Review
16	BP15T	Bosch-Sijtsema & Bosch	Plays nice with others? Multiple ecosystems, various roles and divergent engagement models	2015	Technology Analysis & Strategic Management
17	BR14I	Buciuni et al.	Rethinking the role of manufacturing in global value chains: an international comparative study in the furniture industry	2014	Industrial and Corporate Change
18	CC12I	Calcei & MaChirgui	Coalition building dynamics in video format wars	2012	Innovation
19	CM12S	Carayannis & Campbell	Mode 3 knowledge production in quadruple helix innovation systems	2012	Springer
20	CC12M	Ceccagnoli et al.	Co-creation of value in a platform ecosystem: The case of enterprise software	2012	MIS Quarterly

No	Code	Authors	Title	Year	Journal/Publisher
21	CP13S	Cennamo & Santalo	Platform competition: Strategic trade-offs in platform markets	2013	Strategic Management Journal
22	CA13I	Chen & Chen	A theory of innovation resource synergy	2013	Innovation: Management, Policy & Practice
23	CE13I	Chen et al.	Evolution of collaborative innovation network in Chinas wind turbine manufacturing industry	2014	International Journal of Technology Management
24	CC14C	Chesbrough et al.	Chez panisse: building an open innovation ecosystem	2014	California Management Review
25	CU14I	Chou & Huang	Understanding the roles of business ecosystems in large public IT infrastructure project development: The case of M-Taipei	2011	International Journal of Information Management
26	CC12I	Christos	Clusters, entrepreneurial ecosystem co-creation, and appropriability: a conceptual framework	2012	Industrial and Corporate Change
27	CC14R	Clarysse et al.	Creating value in ecosystems: Crossing the chasm between knowledge and business ecosystems	2014	Research Policy
28	CT02M	Cusumano & Gawer	The elements of platform leadership	2002	MIT Sloan Management Review
29	DM11T	Dedehayir & Makinen	Measuring industry clockspeed in the systemic industry context	2011	Technovation
30	DC06A	Dobson	Competing, countervailing, and coalescing forces: the economics of intra-and inter-business system competition	2006	Antitrust Bulletin
31	DM15A	Dodgson et al.	Managing digital money	2015	Academy of Management Journal
32	EM14T	Ehrenhard et al.	Market adoption barriers of multi-stakeholder technology: Smart homes for the aging population	2014	Technological Forecasting and Social Change
33	FI11E	Faucheux & Nicolai	IT for green and green IT: A proposed typology of eco-innovation	2011	Ecological Economics
34	GC08I	Garnsey & Leong	Combining resource-based and evolutionary theory to explain the genesis of bio-networks	2008	Industry and Innovation
35	GS08R	Garnsey et al.	Speciation through entrepreneurial spin-off: The Acorn-ARM story	2008	Research Policy
36	GC14R	Garud et al.	Contextualizing entrepreneurial innovation: A narrative perspective	2014	Research Policy
37	GA15I	Gastaldi et al.	Academics as orchestrators of continuous innovation ecosystems: towards a fourth generation of CI initiatives	2015	International Journal of Technology Management
38	GB14R	Gawer	Bridging differing perspectives on technological platforms: Toward an integrative framework	2014	Research Policy
39	GI14J	Gawer & Cusumano	Industry platforms and ecosystem innovation	2014	Journal of Product Innovation Management
40	GH12M	Gawer & Cusumano	How companies become platform leaders	2012	MIT Sloan Management Review
41	GE14T	Gomez-Uranga et al.	Epigenetic Economic Dynamics: The evolution of big internet business ecosystems, evidence for patents	2014	Technovation

No	Code	Authors	Title	Year	Journal/Publisher
42	HE12T	Heikkila & Kuivaniemi	Ecosystem under construction: An action research study on entrepreneurship in a business ecosystem	2012	Technology Innovation Management Review
43	HS14J	Hiennerth et al.	Synergies among Producer Firms, Lead Users, and User Communities: The Case of the LEGO Producer--User Ecosystem	2014	Journal of Product Innovation Management
44	HS14E	Hu et al.	Sustaining the emerging carbon trading industry development: A business ecosystem approach of carbon traders	2014	Energy Policy
45	IS04H	Iansiti & Levien	Strategy as ecology	2004	Harvard Business Review
46	IT04H	Iansiti & Levien	The keystone advantage: what the new dynamics of business ecosystems mean for strategy, innovation, and sustainability	2004	Harvard Business Press
47	II06A	Iansiti & Richards	Information technology ecosystem: Structure, health, and performance,	2006	Antitrust Bulletin
48	IA09C	Isckia	Amazon's evolving ecosystem: A cyber-bookstore and Application Service Provider	2009	Canadian Journal of Administrative Sciences
49	IH10H	Isenberg	How to start an entrepreneurial revolution	2010	Harvard Business Review
50	KK15T	Kang & Downing	Keystone effect on entry into two-sided markets: An analysis of the market entry of WiMAX	2015	Technological Forecasting and Social Change
51	KE12H	Kanter,	Enriching the ecosystem	2012	Harvard Business Review
52	KC13S	Kapoor & Lee	Coordinating and competing in ecosystems: How organizational forms shape new technology investments	2013	Strategic Management Journal
53	KD14B	Kshetri	Developing successful entrepreneurial ecosystems: Lessons from a comparison of an Asian tiger and a Baltic tiger	2014	Baltic Journal of Management
54	LU13D	Letaifa et al.	Understanding Business Ecosystems	2013	De Boeck Supérieur
55	LI13C	Leten et al.	IP models to orchestrate innovation ecosystems: IMEC, a public research institute in nano-electronics	2013	California Management Review
56	LP14T	Li & Garnsey	Policy-driven ecosystems for new vaccine development	2014	Technovation
57	LT09T	Li	The technological roadmap of Cisco's business ecosystem	2009	Technovation
58	LB14E	Lu et al.	Business ecosystem and stakeholders role transformation: Evidence from Chinese emerging electric vehicle industry	2014	Expert Systems with Application
59	MI14J	Makinen et al.	Investigating Adoption of Free Beta Applications in a Platform-Based Business Ecosystem	2014	Journal of Product Innovation Management
60	MP93H	Moore	Predators and prey: A new ecology of competition	1993	Harvard Business Review
61	MT96H	Moore	The Death of Competition: Leadership and Strategy in the Age of Business Ecosystems	1996	Harper Business
62	MB06A	Moore	Business ecosystems and the view from the firm	2006	Antitrust Bulletin
63	MP13T	Muegge	Platforms, communities, and business ecosystems: Lessons learned about technology entrepreneurship in an interconnected world	2013	Technology Innovation Management Review
64	NT07E	Nachira et al.	The digital business ecosystem	2007	Edward Elgar Publishing
65	NE13E	Nambisan & Baron	Entrepreneurship in Innovation Ecosystems: Entrepreneurs' Self-Regulatory Processes and Their Implications for New Venture Success	2013	Entrepreneurship Theory and Practice

No	Code	Authors	Title	Year	Journal/Publisher
66	NO11T	Nambisan & Sawhney	Orchestration processes in network-centric innovation: Evidence from the field	2011	The Academy of Management Perspectives
67	NC13I	Nikayin et al.	Collective action for a common service platform for independent living services	2013	International journal of medical informatics
68	OH15R	Ogilvie	How to Thrive in the Era of Collaborative Services Entrepreneurship	2015	Research-Technology Management
69	OV15J	Oh et al.	Value appropriation between the platform provider and app developers in mobile platform mediated networks	2015	Journal of Information Technology
70	OT14T	Oksanen & Hautamaki	Transforming regions into innovation ecosystems: A model for renewing local industrial structures	2014	The Innovation Journal
71	OC15T	Overholm	Collectively created opportunities in emerging ecosystems: The case of solar service ventures	2015	Technovation
72	PP06E	Peltoniemi	Preliminary theoretical framework for the study of business ecosystems	2006	Emergence: Complexity and Organization
73	PB09S	Pierce	Big losses in ecosystem niches: How core firm decisions drive complementary product shakeouts	2009	Strategic Management Journal
74	PT05P	Prahalad	The Fortune at the Bottom of the Pyramid	2005	Pearson Education
75	PT13H	Prahalad & Ramaswamy	The future of competition: Co-creating unique value with customers	2013	Harvard Business Press
76	PT13A	Priem et al.	Toward reimagining strategy research: Retrospection and prospection in the 2011	2013	Academy of Management Review
77	RV13I	Ritala et al.	Value creation and capture mechanisms in innovation ecosystems: A comparative case study	2013	International Journal of Technology Management
78	RO09R	Rohrbeck et al.	Opening up for competitive advantage - How Deutsche Telekom creates an open innovation ecosystem	2009	R&D Management
79	RB13I	Rong et al.	Business ecosystem extension: facilitating the technology substitution	2013	International Journal of Technology Management
80	RU15I	Rong et al.	Understanding business ecosystem using a 6C framework in Internet-of-Things-based sectors	2015	International Journal of Production Economics
81	RL13I	Rong et al.	Linking business ecosystem lifecycle with platform strategy: a triple view of technology, application and organization	2013	International Journal of Technology Management
82	RR11J	Rong et al.	Reshaping the business ecosystem in China: case studies and implications	2011	Journal of Science and Technology Policy in China
83	RN13I	Rong et al.	Nurturing business ecosystems to deal with industry uncertainties	2013	Industrial Management & Data systems
84	RN15J	Rong et al.	Nurturing business ecosystems for growth in a foreign market: Incubating, identifying and integrating stakeholders	2015	Journal of International Management
85	ST13J	Shang & Shi	The emergence of the electric vehicle industry in Chinese Shandong Province: A research design for understanding business ecosystem capabilities	2013	Journal of Chinese Entrepreneurship

No	Code	Authors	Title	Year	Journal/Publisher
86	SA12S	Shaw & Allen	A systematic consideration of observational design decisions in the theory construction process	2012	Systems Research and Behavioral Science
87	SN13T	Smith	Navigating Risk When Entering and Participating in a Business Ecosystem	2013	Technology Innovation Management Review
88	ST15E	Spigel	The relational organization of entrepreneurial ecosystems	2015	Entrepreneurship Theory and Practice
89	SI14I	Still et al.	Insights for orchestrating innovation ecosystems: the case of EIT ICT Labs and data-driven network visualisations	2014	International Journal of Technology Management
90	SE12E	Suresh & Ramraj	Entrepreneurial ecosystem: case study on the influence of environmental factors on entrepreneurial success	2012	European Journal of Business and Management
91	TI09E	Tee & Gawer	Industry architecture as a determinant of successful platform strategies: A case study of the i-mode mobile Internet service	2009	European Management Review
92	TA14T	Thomas et al.	Architectural leverage: putting platforms in context	2014	The Academy of Management Perspectives
93	VB15T	Valkokari	Business, innovation, and knowledge ecosystems: How they differ and how to survive and thrive within them	2015	Technology Innovation Management Review
94	VV12R	Van Der Borgh et al.	Value creation by knowledge-based ecosystems: Evidence from a field study	2012	R&D Management
95	WW15T	Weber & Hine	Who inhabits a business ecosystem? the technospecies as a unifying concept	2015	Technology Innovation Management Review
96	WT14R	Wei et al.	The fit between technological innovation and business model design for firm growth: evidence from China	2014	R&D Management
97	WE05S	Wessner	Entrepreneurship and the innovation ecosystem policy lessons from the United States, in: Local Heroes in the Global Village	2005	Springer
98	WE12C	Williamson & De Meyer	Ecosystem Advantage	2012	California Management Review
99	WD13M	Woodard et al.	Design capital and design moves: the logic of digital business strategy	2013	MIS Quarterly
100	WA14T	Wright	Academic entrepreneurship, technology transfer and society: where next?	2014	The Journal of Technology Transfer
101	XM10M	Xu et al.	Model of migration and use of platforms: role of hierarchy, current generation, and complementarities in consumer settings	2010	Management Science
102	ZE11A	Zahra & Nambisan	Entrepreneurship in global innovation ecosystems	2011	AMS review
103	ZE12B	Zahra & Wright	Entrepreneurship and strategic thinking in business ecosystems	2012	Business Horizons
104	ZB11T	Zhang & Liang	Business ecosystem strategies of mobile network operators in the 3G era: The case of China Mobile	2011	Telecommunications policy

Appendix IV: Paper Type, Theoretical Perspectives, and Key Contributions

No	Code	Paper type	Theoretical perspectives	Key contributions
1	AS13J	Conceptual	Entrepreneurial capability	Advances the concept of entrepreneurial capability to sense, select, and shape opportunities, and synchronize the strategic moves and resources in pursuit of these opportunities
2	AM06H	Conceptual	Strategic management	Defines and conceptualizes innovation ecosystems linked to value creation, resource allocation, and assessing interdependence, initiative, and integration risks
3	AC13E	Book	Business ecosystem	Deepens the understanding of business ecosystems
4	AV10S	Empirical	Strategic management	Studies the impact of the challenges faced by external innovators on the focal firm's outcomes according to the structure of interdependence
5	AK14R	Literature review	Industry evolution	Offers propositions which provide unique insights into the causes of patterns of industry evolution
6	AC13A	Conceptual	Technology and knowledge management	Discusses selective revealing of knowledge as a strategic mechanism to reshape collaboration
7	AO14B	Conceptual	Open innovation	Offers an integrated ecosystem approach
8	AI14T	Literature review	Innovation ecosystem	Summarizes emerging empirical and conceptual insights regarding innovation ecosystems
9	AE14R	Conceptual	Entrepreneurial innovation	Compares the attributes of national innovation systems, entrepreneurship and entrepreneurial innovation, and categorizes their contextual influences on entrepreneurial innovation
10	BV09J	Empirical	Interfirm relationship and collaboration	Increases the understanding of firm's competitive position in a network context to better characterize the interfirm relationships and ecosystems
11	BO11B	Empirical	Technological platform	Provides a basis for understanding change in the converging mobile ecosystem
12	BM13T	Empirical	Strategic network	Proposes a method for analyzing, modelling and foresighting the business ecosystems as network structures
13	BA14E	Empirical	Strategic alliances	Introduces a new and complementary approach for studying and analyzing the role of alliances in the case of research spin-offs
14	BE15C	Empirical	Open innovation	Concludes that platform strategy coupled with an open strategy could allow a company to penetrate a market dominated by a quasimonopoly of an incumbent platform
15	BC08S	Conceptual	Social entrepreneurship	Offers an ecosystem framework to help social entrepreneurs to create long-lasting and significant social change
16	BP15T	Empirical	Strategic management	Proposes an engagement model
17	BR14I	Empirical	Global value chain	Explores the role manufacturing is playing in the business model of furniture makers operating in mature industrial contexts
18	CC12I	Empirical	Strategic alliance	Demonstrates that various types of agreements are used by the business ecosystem stakeholders to impose their standards
19	CM12S	Conceptual	Quadruple helix	Attempts to provide an emerging conceptual framework for socio-economic prosperity and cultural renaissance based on knowledge and innovation
20	CC12M	Empirical	Platform strategy	Highlights the value of interoperability between software products and stresses that value co-creation and appropriation are not mutually exclusive in interfirm collaboration

No	Code	Paper type	Theoretical perspectives	Key contributions
21	CP13S	Empirical	Platform strategy	Suggests that platform competition is shaped by important strategic trade-offs and that the winner-take-all approach will not be universally successful
22	CA13I	Empirical	Innovation resource synergy	Offers a theoretical model of innovation resource synergy
23	CE13I	Empirical	Collaborative innovation network	Demonstrates the evolutionary trajectory of China
24	CC14C	Empirical	Open innovation	Offers a teaching case
25	CU14I	Empirical	Project development	Differentiates three forms of business ecosystems – knowledge-oriented, resource-oriented, and business-oriented – which emerged in the different phases of project development
26	CC12I	Conceptual	Entrepreneurial theory	Concludes that clusters can involve advantages that help engender superior appropriation of co-created value, as compared to alternatives
27	CC14R	Empirical	Value creation	Analyzes the tension between knowledge and business ecosystems
28	CT02M	Conceptual	Platform strategy	Offers the four levers of platform leadership
29	DM11T	Empirical	Technological system	Shows that the proposed clock speeds together provide informative measures of the pace of change for sub-industries and systemic industry
30	DC06A	Conceptual	Intra-system competition	Highlights the importance of dynamics of market power interactions within and across business systems
31	DM15A	Editorial		
32	EM14T	Empirical	Value network	Develops a generic value network for smart homes and proposes opportunities to improve market adoption of smart home technologies
33	FI11E	Conceptual	Sustainable development	Develops an ecological economic framework
34	GC08I	Empirical	Resource-based and evolutionary theory	Uncovers previously unnoticed features of networks for drug development
35	GS08R	Empirical	Entrepreneurial theory	Proposes the concept of techno-organizational speciation
36	GC14R	Literature review	Actor-centric vs. context-centric	Offers a narrative perspective on how entrepreneurs contextualize innovation
37	GA15I	Editorial		
38	GB14R	Conceptual	Platform	Proposes an integrative framework to advance research in technological platforms
39	GI14J	Empirical	Platform	Identifies and analyzes distinct types of platforms
40	GH12M	Conceptual	Platform strategy	Highlights strategic options for platform leader wannabes
41	GE14T	Empirical	Evolutionary economics	Introduces the concept of epigenetic economic dynamics
42	HE12T	Empirical	Entrepreneurship	Offers an ecosystem model consisting of six sub-ecosystems with different change drivers and clock speeds
43	HS14J	Empirical	NPD synergies	Complements existing studies on user innovation approaches by looking at bilateral interactions
44	HS14E	Empirical	Sustainable development	Explores clean development mechanisms
45	IS04H	Empirical	Ecosystem	Proposes ecosystem strategies
46	IT04H	Empirical	Strategic management	Offers insights into the new dynamics of business ecosystems
47	II06A	Empirical	Ecosystem	Introduces a framework for analyzing the health of a complex business ecosystem
48	IA09C	Empirical	Value network	Discusses the role of web services in the shaping of the ecosystem.

No	Code	Paper type	Theoretical perspectives	Key contributions
49	IH10H	Conceptual	Entrepreneurships	Proposes nine prescriptions for creating an entrepreneurship ecosystem
50	KK15T	Empirical	Platform strategy	Extends the scope of the existing literature on two-sided markets and market entry
51	KE12H	Conceptual	Innovation	Proposes four goals for linking knowledge creation, venture creation, collaboration among firms of different sizes, job creation, university involvement, regional strategy, and investment
52	KC13S	Empirical	Competitive strategies	Highlights the link between firms' coordination choices and their strategic investments
53	KD14B	Empirical	Entrepreneurship theory	Provides unique insights into alternative ways emerging economies can follow to develop successful entrepreneurial ecosystems
54	LU13D	Book	Ecosystem	Confirms the fundamental conceptual nature of the ecosystem metaphor and reconnects the phenomena of scientific conceptualization and linguistic figuration
55	LI13C	Conceptual	Open innovation	Suggests a Dual Core-Dual Site Orchestration Model
56	LP14T	Empirical	Entrepreneurial theory	Shows how research and development networks are needed to further R&D objectives
57	LT09T	Empirical	Technological road map	Explores the ecosystem as a growth strategy enabler
58	LB14E	Empirical	Agent-based system theory	Provides a theoretical framework for analyzing the stakeholders' role transformation
59	MI14J	Empirical	NPD	Concludes that the adoption dynamics of free beta products in a co-creation community follow the Gompertz model rather than the Bass model
60	MP93H	Conceptual	Ecosystem	Defines and conceptualizes business ecosystems
61	MT96H	Conceptual	Ecosystem	Further conceptualizes business ecosystems
62	MB06A	Conceptual	Economic organization	Discusses three pillars of modern business thinking
63	MP13T	Conceptual	Technology entrepreneurship	Provides an entry point to the research literature and identifies gaps in the current body of knowledge, especially regarding the system-level interactions between subsystems
64	NT07E	Book	Digital ecosystem	Insights into software services and technology platforms as well as the complexity of social and economic relationships
65	NE13E	Conceptual	Entrepreneurial innovation	Extends current theory concerning the potential role of self-regulatory processes in entrepreneurship
66	NO11T	Empirical	Product development and network theory	Concludes that network orchestration processes reflect the interplay between elements of innovation design and network design
67	NC13I	Empirical	Platform	Offers insights into organizational perceptions about important factors that encourage inter-organizational collaboration for establishing common platforms
68	OH15R	Empirical	Entrepreneurship	Offers an ecosystem-based business model
69	OV15J	Empirical	Platform	Proposes a new bargaining model
70	OT14T	Empirical	Triple helix	Proposes a model for building innovation ecosystems
71	OC15T	Empirical	Entrepreneurial opportunity	Offers fundamental observations of how opportunity creation and discovery is distributed among a community of entrepreneurs
72	PP06E	Conceptual	Complex adaptive system	Proposes a theoretical framework for the study of business ecosystems
73	PB09S	Empirical	Complementary niche market	Develops the understanding of how competition in business ecosystems evolves
74	PT05P	Book	Bottom of the pyramid	Shows that bottom of the pyramid (BOP) markets are too important to be ignored
75	PT13H	Book	Strategic management	Explores why, despite unbounded opportunities for innovation, companies still can't satisfy customers and sustain profitable growth

No	Code	Paper type	Theoretical perspectives	Key contributions
76	PT13A	Conceptual	Value creation and capture	Proposes an expanded boundary model that includes the demand side, business models, and business ecosystems within the strategy research umbrella
77	RV13I	Empirical	Value creation and capture	Provides new evidence on the facilitating initiatives and underlying mechanisms and structures that are related to the leading firms' orchestration of innovation ecosystems
78	RO09R	Empirical	Open innovation	Identifies opening up traditional development process and embracing external creativity and knowledge resources to enhance the innovation capacity
79	RB13I	Empirical	Technology substitution	Identifies the determinants of sustaining the ecosystem extension
80	RU15I	Empirical	Supply chain	Proposes a 6C framework to understand how a business ecosystem works
81	RL13I	Empirical	Platform strategy	Connects the core firms in the business ecosystem with the evolutionary platform strategies
82	RR11J	Empirical	Traditional network vs. service intermediaries	Identifies five key strategies for reshaping business ecosystems
83	RN13I	Empirical	Platform strategy	Discusses emerging industry uncertainty
84	RN15J	Empirical	Road map	Develops a framework of creating a business ecosystem
85	ST13J	Empirical	Strategic capabilities	Provides a conceptual research framework regarding business ecosystem emergence
86	SA12S	Conceptual	Theory construction	Develops a theoretical model of the theory-building process that avoids bias whilst making best use of the researchers' preconceptions based on a business ecosystem metaphor
87	SN13T	Literature review	Entrepreneurial	Provides five recommendations for entrepreneurs seeking to enter and participate in business ecosystems
88	ST15E	Empirical	Entrepreneurial theory	Demonstrates the variety of different configurations that ecosystems can take
89	SI14I	Empirical	Social network	Demonstrates that data-driven network visualizations offer a powerful approach for providing evidence-based information when talking about ecosystems
90	SE12E	Empirical	Bottom of the pyramid	Offers a conceptual framework along with factors comprising the ecosystem
91	TI09E	Empirical	Platform strategy	Unpacks the interaction between evolutionary processes, industry architecture, and business strategies
92	TA14T	Literature review	Platform	Extends current thoughts on platform evolution
93	VB15T	Conceptual	Ecosystem	Describes how the ecosystem types differ in terms of their outcomes, interactions, logic of action, and actor roles
94	VV12R	Empirical	Value creation	Concludes that ecosystem managers have to deliberately facilitate exit routes for companies that no longer fit the ecosystem in order to enhance and reinforce its business model
95	WW15T	Conceptual	Technospieces approach	Proposes a business ecosystem model anchored around interdependent technospecies
96	WT14R	Empirical	Business model	Concludes that efficiency-centered business model design enhances the negative effect of exploitative innovation and weakens the positive effect of exploratory innovation
97	WE05S	Conceptual	Entrepreneurship	Offers lessons from small business innovation research for comparable initiatives in civic entrepreneurship
98	WE12C	Empirical	Network	Provides insights into a lead firm's strategic approach
99	WD13M	Empirical	Digital business strategy	Advances the notion that conceptualizations of a digital business strategy can and should be grounded in the strategic role of design capital and design moves

No	Code	Paper type	Theoretical perspectives	Key contributions
100	WA14T	Conceptual	Academic entrepreneurship	Provides a broader conceptualization of academic entrepreneurship and an appreciation of the contextual heterogeneity of academic entrepreneurship
101	XM10M	Empirical	Information systems and consumer behavior	Contributes to research on platform leadership and technology ecosystems by conceptualizing complementarities at a micro level
102	ZE11A	Conceptual	Entrepreneurship theory	Concludes that new ventures dependencies with the ecosystem leader define the nature and extent of entrepreneurship within innovation ecosystems
103	ZE12B	Conceptual	Entrepreneurship theory	Distinguishes four types of business ecosystems
104	ZB11T	Empirical	Keystone strategy	Identifies success factors and problems related to ecosystem principles

Appendix V: Theoretical Background or Articles

No	Code	Ecosystem type	Adner, 2006; Adner & Kapoor, 2010	Moore 1993, 1996, 2006	Iansiti & Levinen, 2004a, 2004b	Isenberg, 2010; Prahalad, 2005
1	AS13J	Business ecosystem	X	X		
2	AM06H	Innovation ecosystem			X	
3	AC13E	Business ecosystem	X	X	X	
4	AV10S	Innovation ecosystem	X	X	X	
5	AK14R	Entrepreneurial ecosystem, innovation ecosystem	X			
6	AC13A	Innovation ecosystem	X			
7	AO14B	Ecosystem			X	
8	AI14T	Innovation ecosystem	X	X	X	
9	AE14R	Entrepreneurial ecosystem				X
10	BV09J	Business ecosystem	X	X	X	
11	BO11B	Business ecosystem		X	X	
12	BM13T	Business ecosystem	X	X	X	
13	BA14E	Business ecosystem		X	X	
14	BE15C	Business ecosystem		X	X	
15	BC08S	Ecosystem	X	X	X	
16	BP15T	Business ecosystem	X	X	X	
17	BR14I	Domestic ecosystem		X	X	
18	CC12I	Business ecosystem		X	X	
19	CM12S	Innovation ecosystem				
20	CC12M	platform ecosystem			X	
21	CP13S	Ecosystem				
22	CA13I	Business ecosystem		X	X	
23	CE13I	Business ecosystem	X	X	X	
24	CC14C	Open innovation ecosystem				
25	CU14I	Business ecosystem		X	X	
26	CC12I	Entrepreneurial ecosystem				
27	CC14R	Knowledge ecosystem	X	X	X	

No	Code	Ecosystem type	Adner, 2006; Adner & Kapoor, 2010	Moore 1993, 1996, 2006	Iansiti & Levinen, 2004a, 2004b	Isenberg, 2010; Prahalad, 2005
28	CT02M	Innovation ecosystem				
29	DM11T	Business ecosystem	X			
30	DC06A	Business ecosystem		X	X	
31	DM15A	Innovation ecosystem	X			
32	EM14T	Business ecosystem		X	X	
33	FI11E	Business ecosystem		X		
34	GC08I	Business ecosystem	X	X		
35	GS08R	Business ecosystem		X		
36	GC14R	Entrepreneurial ecosystem	X			
37	GA15I	Innovation ecosystem	X			
38	GB14R	Innovation ecosystem	X		X	
39	GI14J	Business ecosystem	X	X	X	
40	GH12M	Innovation ecosystem				
41	GE14T	Business ecosystem			X	
42	HE12T	Business ecosystem	X	X	X	
43	HS14J	Business ecosystem	X		X	
44	HS14E	Business ecosystem	X	X	X	
45	IS04H	Business ecosystem				
46	IT04H	Business ecosystem		X		
47	II06A	Business ecosystem		X	X	
48	IA09C	Business ecosystem		X	X	
49	IH10H	Entrepreneurial ecosystem				
50	KK15T	Business ecosystem		X	X	
51	KE12H	Business ecosystem				
52	KC13S	Business ecosystem	X		X	
53	KD14B	Entrepreneurial ecosystem				X
54	LU13D	Business ecosystem		X	X	
55	LI13C	Innovation ecosystem				
56	LP14T	Innovation ecosystem	X	X		

No	Code	Ecosystem type	Adner, 2006; Adner & Kapoor, 2010	Moore 1993, 1996, 2006	Iansiti & Levinen, 2004a, 2004b	Isenberg, 2010; Prahalad, 2005
57	LT09T	Business ecosystem	X	X	X	
58	LB14E	Business ecosystem	X	X	X	
59	MI14J	Business ecosystem	X	X	X	
60	MP93H	Business ecosystem				
61	MT96H	Business ecosystem		X		
62	MB06A	Business ecosystem		X	X	
63	MP13T	Business ecosystem		X	X	X
64	NT07E	Business ecosystem innovation ecosystem		X	X	
65	NE13E	Innovation ecosystem	X	X	X	
66	NO11T	Innovation system			X	
67	NC13I	Business ecosystem		X	X	
68	OH15R	Business ecosystem		X		
69	OV15J	Mobile ecosystem				
70	OT14T	Innovation ecosystem				
71	OC15T	Business ecosystem	X	X		
72	PP06E	Business ecosystem		X	X	
73	PB09S	Business ecosystem		X	X	
74	PT05P	Entrepreneurial ecosystem				
75	PT13H	Entrepreneurial ecosystem				X
76	PT13A	Business ecosystem	X			
77	RV13I	Innovation ecosystem	X	X	X	
78	RO09R	Open innovation ecosystem		X		
79	RB13I	Business ecosystem	X	X	X	
80	RU15I	Business ecosystem	X	X	X	
81	RL13I	Business ecosystem	X	X		
82	RR11J	Business ecosystem		X		
83	RN13I	Business ecosystem		X	X	X
84	RN15J	Business ecosystem	X	X	X	
85	ST13J	Business ecosystem	X	X	X	

No	Code	Ecosystem type	Adner, 2006; Adner & Kapoor, 2010	Moore 1993, 1996, 2006	Iansiti & Levinen, 2004a, 2004b	Isenberg, 2010; Prahalad, 2005
86	SA12S	Business ecosystem	X	X	X	
87	SN13T	Business ecosystem	X	X	X	
88	ST15E	Entrepreneurial ecosystem				X
89	SI14I	Innovation ecosystem				
90	SE12E	Entrepreneurial ecosystem				
91	TI09E	Business ecosystem			X	X
92	TA14T	Platform ecosystem			X	
93	VB15T	Business ecosystem, innovation ecosystem, knowledge ecosystem	X	X	X	
94	VV12R	knowledge ecosystem		X	X	
95	WW15T	Business ecosystem	X	X	X	
96	WT14R	Business ecosystem	X	X		
97	WE05S	Innovation ecosystem				
98	WE12C	Ecosystem	X	X	X	
99	WD13M	Business ecosystem	X		X	
100	WA14T	Business ecosystem, innovation ecosystem		X		
101	XM10M	Innovation ecosystem	X			
102	ZE11A	Innovation ecosystem	X	X	X	
103	ZE12B	Business ecosystem	X	X	X	
104	ZB11T	Business ecosystem	X	X	X	
	TOTAL		47	64	61	7

Appendix VI: Outline of the Key Journals that Sourced Publications for the Content Analysis

Journal	Count
International Journal of Technology Management	6
Research Policy	6
Harvard Business Review	5
Technology Innovation Management Review	5
Technovation	5
Strategic Management Journal	4
Antitrust Bulletin	3
California Management Review	3
Journal of Product Innovation Management	3
R&D Management	3
Technological Forecasting and Social Change	3
Academy of Management Review	2
Business Horizons	2
Canadian Journal of Administrative Sciences	2
Entrepreneurship Theory and Practice	2
Industrial and Corporate Change	2
Journal of Information Technology	2
MIS Quarterly	2
MIT Sloan Management Review	2
The Academy of Management Perspectives	2

Appendix VII: Most Frequent Authors and Co-authors

Author	Count
Rong Ke	9
Shi Yongjiang	9
Gawer Annabelle	5
Nambisan Satish	4
Adner Ron	3
Autio Erko	3
Cusumano Michael A	3
Garnsey Elizabeth	3
Hu Guangyu	3
Iansiti Marco	3
Lin Yong	3
Moore James F	3
Wright Mike	3
Yu Jiang	3
Zahra Shaker	3

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