Surviving in Innovation Ecosystems:

Critical factors behind managers' strategic decision-making rationale and the implications on firms' strategies

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Preface

This project is an outcome of my master's studies for the degree of MSc. Management of Technology, at the Delft University of Technology, between January and August, 2019. The project was supported by Accenture B.V. from start to finish.

I would like to thank my current supervisor at Delft University of Technology, Dr. ing. Victor E. Scholten, for his supervision and feedback at various stages of this project, as well as my chair Dr. Aad F. Correljé. Additionally, I would like to thank, Innovation Consultant, Merle Freeke for her guidance during my internship at Accenture B.V. and all the mental and practical help she provided me for the completion of this project. Prof. Dr. Bedia Yelda Uçkan offered me her academic insights and helped me gain a better scientific perspective. Also, I would like to acknowledge all the help that I received from many other Accenture employees, as well as nameless participants who were willing to share their insights with me.

I do feel great gratitude for the following, with whom I have spent a big portion of my life together. Although we were geographically separated for our own ideals, I thank you all, Anıl, Emirhan, and Emir for being there with me at every stage, showing me your humorous selves.

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Ogan Bekar
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Executive Summary

The twenty-first-century complex technology and innovation systems require firms to adopt untraditional organizational structures, in which the value chains are broken, and non-linear flows of tangible and intangible resources are capitalized. The literature on innovation management and network economics also recognizes that firms' innovation strategies can no longer be described by their operational arms-length, rather it can be defined as an ecosystem that crosses a variety of industries. In these ecosystems, innovations are defined by their complementary features and firms strive to transform from their traditional model to an agile multi-network structure.

Previously, the networked nature of the organizations have attracted increasing attention among academics. In fact, many have touched upon similar multifaceted collaboration models to innovation ecosystems, such as open innovation (Chesbrough, 2003); innovation clusters (Porter, 1998); value networks (Li & Whalley, 2002); and triple or even quadruple helix models (Carayannis & Campbell, 2009; Etzkowitz & Leydesdorff, 2000). Nevertheless, this heterogeneity in the available literature and the multivocality of the term turns the 'innovation ecosystem' concept into a problematic structure, and its implications become indeterminable. Such that the ambiguity in the shared language negatively impacts innovation management scholars and managers when sketching successful innovation strategies.

This thesis strengthens the idea that innovating for 'value creation' urged the innovation management practitioners and scholars to look for novel solutions describing the ways to increase firms' competitive advantage. It argues that a better assessment of the innovation strategy success can only come through enlightening the managers' decision-making rationale as well as external and internal forces to which they respond. In order to provide pragmatic implications for future practice and novel inquiries for innovation management scholars, this thesis takes a caption of today and scrutinizes the readers understanding of the innovation ecosystem concept. Only after that, it goes into questioning why firms follow certain strategies in the context of innovation ecosystems. The problem addressed in this thesis is how certain factors influence managers' decision-making rationale in innovation ecosystems. Accordingly, the objective of this thesis is divided into the following four: (i) it analyses what can be considered as an innovation ecosystem; (ii) it identifies innovation ecosystem actors, their roles and strategies they employ; (iii) it analyses managers' strategic decision-making process in

innovation ecosystems; (iv) it distinguishes the factors influencing the decision-making rationale of managers who are pursuing an ecosystem strategy.

Accordingly, this thesis focuses on 'innovation' as a subject highlighting the growing importance of innovation networks due to the rise of digitalization and information and communication technologies (ICT). On a high level, this study views the innovation ecosystem as a semi-controlled collaborative arrangement through which firms combine their individual offerings to create a customer-faced product/service via the use of contemporary technologies. Here, the emphasis is on the interaction and the present day technologies (e.g. smart technologies, internet of things, platforms, artificial intelligence etc.) that independent players get use of to create and commercialize innovations, and in return benefit the end customer.

To fulfil the research goals this thesis approaches the investigation from two different angles: the energy and construction sectors. Both sectors are going through a strong transformation, due to external turbulences in their markets, such as the rise of environmentally friendly operations and digitalization. Similarly, the previous innovation management literature illustrates both sectors where digital innovative activities progresses rapidly. The reasons in adapting a multifocal approach was, therefore, both practical and necessary to explain what factors affect the underlying reasons in strategic decision-making.

The explorative nature of the addressed problem was investigated through employing a mixed methodology. Through an elaborate literature review the innovation ecosystem concept was located in the theoretical landscape and firms' innovation ecosystem strategies in both energy and construction sectors were scrutinized. At this stage, in line with the main objective of this thesis, a preliminary assessment of the so-called factors were made. The theoretical orientation was supported by 14 expert interviews, conducted with practitioners who actively worked with/in the ecosystem concept. Through the coupling of previous literature and interview data, this thesis introduced a conceptual model depicting eight factors that have an influence on the managers' strategic decision-making rationale in innovation ecosystems. Accordingly, the introduced conceptual model includes the following eight factors: *push for sectoral reconfiguration*, *push for strategic renewal*, *firm's posture*, *ecosystem related uncertainties*, *access to capital*, *legislative impositions*, *innovation culture*, and *availability of a new market opportunity*. The qualitative data was accompanied with a quantitative investigation in order to question the practical relevancy of the each factor and its degree of influence. For this the current thesis employed a survey-based method, called Best-Worst Method (BWM).

The empirical evidence revealed how the managers perceive so-called factors. Below table represents these in a decreasing order of influence: *push for strategic renewal; availability of a new market opportunity; firm's posture; push for sectoral reconfiguration; innovation culture; access to capital; ecosystem related uncertainties;* and *legislative impositions.*

Table

Factors influencing managers' strategic decision-making rationale and definitions

Factors	Definitions
Push for strategic renewal	Actors in an innovation ecosystem are subjected to a constant strategic renewal, in the form of new business models. The value propositions that come with business models also must be dynamic, evolving as the ecosystem network evolves. Some of the constraints that managers face when making appropriate decisions include poor appreciation of interdependencies in/with current business models and dominant path dependencies that restricts renewal.
Availability of a new market opportunity	Firms with diverse value-propositions can find a common ground to serve new value. In some circumstances this ground can be the start of a new market that is yet to exist. When making strategic decisions managers do pay great attention to the expansion of their own firms' current markets. Managers' learnings from different high-tech sectors can be the initiator of such strategic actions.
Firm's posture	The image of an organization can positively or negatively affect its identity, since the managers' decisions are susceptible to priming. Under the influence of emotions and other external signals, strategic decisions can be made quickly and factual information may lose sight of managers' rationale.
Push for sectoral reconfiguration	Increasing inter-dependence in an innovation ecosystem can provide the early signals of significant technological and industrial change. The reconfiguration stands for the re-positioning of a firm through inter-industry knowledge to adapt this change. As a result, managers' knowledge about the current climate in their respective sector, combined with their opportunistic intuitions become relevant when making decisions.
Innovation culture	Collaboration occurs not only on the enterprise level but also on the individual level. Thus decisions are made and actions are taken in the context of existing network ties and cultural fit. An innovation culture that values and rewards innovative experiments may approve managers actions in innovation ecosystems. Thus, could positively influence the managers' decision-making style.
Access to capital	This factor is concerned with the flexibility of firms' innovation budget, which may grant managers the freedom to experiment with new contractual agreements, collaborative research, or development projects. As a result managers' access to innovation capital positively or negatively influences the decisions they are striving for.
Ecosystem related uncertainties	Uncertainties include technological, behavioral, and environmental multivocality in an innovation ecosystem. Managers need to think in terms of multicriteria decision-making as every choice has different outcomes for different actors.
Legislative impositions	Regulators and governmental institutions play an important role in innovations, and so innovation ecosystems. Certain legislative impositions on the ecosystem or firm may alter the managers' strategic decisions of firms and/or kill it all together. Also, the regulator can prescribe certain technologies, which are supported by certain ecosystems.

Accordingly, the analysis unveils important findings both for academia and practice. First, the results drawn from the empirical data are in many ways consistent with previous research. For instance, as the theoretical orientation revealed, innovation ecosystems differ from those previously suggested counterparts in that the they are steered by shared innovation goals and influenced by the current state of the technology. Therefore, the increase of firms' competitive advantage in the market, as a response to value they offer, depends on firms' ability to create a product architecture including concurrent complementarities from various stakeholders. Second, this thesis is able to introduce the link between the concept of innovation ecosystem and new market creation through co-creation and coopetition. The inter-industry knowledge exploitation can help firms in sectors in constant turmoil, such as the energy and construction sectors, to learn from more established innovation ecosystems (e.g. ICT). This search for inter-industrial commonalities has the power to reveal product/service architectures with hidden market opportunities. In addition, an interesting outcome strikes to be the high-level of influence of firms' posture on managers' strategic decision-making rationale. This finding can be attributed to the positive publicity firms and so managers can gain by associating themselves with those innovation ecosystem actors that have positive reputations in terms of technological advancement and innovativeness. Moreover, the results suggest that managers do not consider certain influences (such as regulatory impositions) dominant in their strategic decision-making process, since they cannot manage or anticipate.

The findings of this study have a number of practical implications. First, firms need to acquire agile thinking methods in order to have the muscles to co-create and evolve as the innovation ecosystem evolves. Second, practitioners in both energy and construction sectors should strive for inter-industrial collaborations and knowledge acquisition. Third, executives should ensure sponsorship for inter-industrial knowledge transfer and direct their efforts to constructing an innovation ecosystem image.

A significant contribution of this thesis for the academia is that it expands upon the idea that innovation ecosystems are structures for new market creation through co-evolution and coopetition. Further recommendations for innovation management and network economics scholars include a longitudinal case study-based research to assess the applicability and life-span of the introduced conceptual model. Accordingly, this thesis opens a fruitful area of research on how managers' make their decisions under so-called innovation ecosystem circumstances and which innovation ecosystem strategies are superior to others.

Keywords: ecosystems, innovation ecosystem, ecosystem analogy, strategic decision-making, new market creation, co-creation, coopetition

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Chapter

1 Introduction

In 1619, four Amsterdam-based fur trading companies joined forces, founding the Compagnie van Nieuwnederlant [New Netherland Company]. Previously, the fierce competition among these four firms had increased costs and made it almost impossible to yield profits while competing. As a result, exactly four centuries ago, the Transatlantic fur traders found a virtue in collaborating for a joint purpose, not just along the mid-Atlantic coast, but reaching their network ties in Amsterdam and beyond (Jacobs, 2013).

Fast forward to today, interfirm partnerships remain a driving force behind managerial practice, the global economy, and most importantly, innovation. The increasing role of technology in our lives has only sent new charges through these relationships, presenting new opportunities and with them, new dilemmas. Ironically, theories of innovation also find themselves in a dynamic process of adapting to the current conversations on development and commercialization of new technologies. Accordingly, the locus of innovation shifts away from companies to more expansive networks, and more importantly ecosystems.

1.1 Innovation in the context of ecosystems

Managing the high complexity of technological systems and innovation practices now requires a better understanding of the surrounding environment and an enhanced organizational structure. In a recent report, the World Economic Forum (2015) identified new avenues of innovation as "an 'ecosystem' [environment] conducive to the generation of ideas and their implementation in the form of new products, services, and processes in the global marketplace" (p. 53). In fact, since the turn of the last century, companies, governments, as well as individuals have been increasingly involved in the emergence of multi-stakeholder networks around the technology sector (Smorodinskaya, Russell, Katukov, & Still, 2017). One salient outcome of the emergence of these networks is the degree to which they can bridge competitors and complementors for a shared innovation goal (Powell, Packalen, & Whittington, 2012). Additionally, nowadays positive publicity and economic advantages accrue to those institutions that can pivot from their traditional model to an agile multi-network structure (Russell & Smorodinskaya, 2018). These ecosystems complement the development of shared values and co-creation (Rubens et al., 2011), through which actors can generate new solutions and reflect on continuing market challenges.

Accordingly, innovation has both economic and social outcomes. While the ways and processes in utilizing innovation differ significantly, it cannot be achieved by only one entrepreneur, but with an innovation ecosystem of dedicated partners. A concerted effort given by governments, both for and non-profit organizations, as well as individual entrepreneurs, can accelerate the rate of technological innovation (Williams, 2001). Furthermore, the collaboration between different actors in an innovation ecosystem has the power to foster the rate of innovation while overcoming various organizational challenges that one actor would have to bear. Thus, innovative technologies and transitions which require interdisciplinary skill sets tend to take place within ecosystems that nourish collaboration among a variety of actors.

Previous research on innovation has touched upon similar multifaceted collaboration models, such open innovation (Chesbrough, 2003); innovation clusters (Porter, 1998); value networks (Li & Whalley, 2002); and triple or even quadruple helix models (Carayannis & Campbell, 2009; Etzkowitz & Leydesdorff, 2000). Furthermore, the extant literature on innovation management and network economics have in many ways tried to explain the firms' motive for pursuing various collaborative strategies and their influence on the competitive advantage. These studies collectively outline a critical role for managers' decision-making under uncertainty, yet a key problem with much of the current literature is the absence of a clear explanation about the managers' strategic decision-making styles and factors influencing them since the introduction of the ecosystem concept. Moreover, many of these theories, however, fall short in describing the characteristics of innovation ecosystems as complex and innovative collaborative landscapes.

As of today, the discourse on the definitions and usage of these terms still continues. One common view is that innovation ecosystems bring a new perspective in ways firms assess their positioning in their respective value system and further their own interest. Nevertheless, as opposed to similar terms mentioned above (value networks (F. Li & Whalley, 2002); clusters

(Porter, 1998)) and many others (systems of innovation (SI) (Freeman, 1987); regional innovation systems (RIS) (Asheim & Coenen, 2005)) the use of ‘ecosystems’ may have different connotations in organizational practice. The justification of an ecologic event or an action depends on determinants which are insufficient to explain an organizational action, such as the managers’ decision-making process. Therefore, behavioral aspects of the business environment and the role of institutions should be incorporated into our understanding of innovation ecosystems as a landscape for collaboration. In his seminal study, Moore (1993) notes: “A biological metaphor does not apply to business. Unlike biological communities, business communities are social systems. And social systems are composed of real people who make decisions” (p. 18).

It is important to problematize the strategic decision-making rationale within innovation management for various reasons. First, the uncertainty involved in decision-making processes can occur when “people have different and often conflicting beliefs which can result in many mistakes and errors” (Jalonen, 2012, p. 6). This can cause unanticipated consequences to arise later in the decision-making process if not at the beginning, which can be critical for the future of the focal firms’ strategy and the innovation ecosystem as a whole. Second, firms’ innovation ecosystem strategy is partially determined by their interactions with other members of the ecosystem. This multivocality in return may translate to ambiguity, which may affect the success of the focal firm. Third, firms’ strategic decision-makers include its appropriate executives and project managers, and they base their decisions on the appropriate information about the organization’s performance and environment (Miller & Friesen, 1982). It is, therefore, important to note that innovation in the context of ecosystems are complex, and so managers decision-making styles can be shaped and adjusted according to external and internal factors. Lastly, the previous discourses within ecosystems literature argue that innovation ecosystems are dynamic and prone to environmental inhibitors as well as accelerators. These factors should be addressed in line with firms’ innovation ecosystem strategies, so that we can have a general sense of understanding about why firms follow certain strategies and if they are successful or not.

1.2 Research objectives and relevance

The problem addressed in this thesis is understanding the dynamic factors influencing managers’ strategic decision-making rationale within innovation ecosystems. Since the success of one innovation strategy over the other cannot be determined ex-ante, an ex-post analysis of the changes in managers’ decision-making rationale can provide meaningful insights on what is different in innovation management today under ecosystem circumstances. The previous studies in innovation management literature have touched upon various innovation ecosystem strategies and success factors that a given firm's managers should pay attention to. Many of these studies however cover a short time span in the ecosystem life-cycle and are case-based, making them unable to realize the long-term consequences of managers' strategic decisions (Durst & Poutanen, 2013; Ketonen-Oksi & Valkokari, 2019; Ritala, Agouridas, Assimakopoulos, & Gies, 2013). Therefore, understanding the strategic considerations of firms' managers vis-à-vis firms' strategies in innovation ecosystems, require a retrospective analysis on actual results in multiple sectors, rather than forecasts.

Accordingly, an exploratory research is first needed to understand the managerial boundaries, slopes and scales of innovation ecosystems when it comes to decision-making. As briefly explained before, the last two decades have drawn growing attention to how existing business structures expanded and blended with their complementors and competitors. The growing body of innovation literature recognizes the importance of innovation ecosystems in creating innovations while increasing the competitive advantage of the participating firms through inter-industry expansion. Earlier studies on this rapidly changing domain have demonstrated that the term 'innovation ecosystem' has many different connotations depending on the application and that there is a vast amount of scholarly attention available on this topic. In order to reach to a better level of understanding, this thesis first aims to clarify what are 'innovative' ecosystems and how do they differ from hierarchical network structures (e.g. supply systems). That being said, in order to overcome the conceptual ambiguity arising from the fuzzy definitions of ecosystem analogy, a better conceptual linking is needed between the real world implications, being the firms' strategies, and managers' decision-making styles in innovation ecosystems. For instance, "is the concept of innovation ecosystems to be understood as an analogy of collaboration beyond sectors or clusters" (Durst & Poutanen, 2013, p. 36) or does it also represent a comprehensive shift in managers' decision-making?

Moreover, it is expected that innovation ecosystems will vary from sector to sector, provided that there are technological, regulatory, cultural, and actor-based differences between sectors. According to the subject literature, this gap is even wider when one sector depends on technology-focused outcomes (e.g. information and communication technologies, aerospace etc.) and the other is relatively lagging behind (e.g. construction, oil & gas etc.) (Gassmann, Enkel, & Chesbrough, 2010; Hervas-Oliver, Albors-Garrigos, de-Miguel, & Hidalgo, 2012). Thus, an interdisciplinary focus on innovation ecosystems research can provide a setting which would explain what underlying reasons in strategic decision-making are likely to remain constant under different sectoral conditions and, in return, if the managers' learnings from one sector can be applied in another. By determining the similarities in rationale between managers from different sectors, this thesis then may find an answer to the main research question: *What are the critical factors influencing managers' strategic decision-making rationale in an innovation ecosystem?* Accordingly, the main objectives of this thesis are as follows:

I. To understand what can be considered as an innovation ecosystem and distinguish the different types of 'innovative' ecosystems.
II. To identify firms' motivations to participate in these innovation ecosystems and strategies they employ.
III. To understand managers' strategic decision-making process in innovation ecosystems.
IV. To distinguish the factors influencing the decision-making rationale of managers who are pursuing an ecosystem strategy.

In order to fulfil the fourth and foremost objective of this thesis, the following main research question is raised:

> MRQ: What are the critical factors influencing managers' strategic decision-making rationale in an innovation ecosystem?

To develop a deeper understanding of the subject as well as for theoretical and practical reasons, I raise the following sub-research questions as follows:

> Sub-RQ I: What can be considered as an 'innovative' ecosystem and what are the different types of innovation ecosystems?

> Sub-RQ II: What are the strategies employed by firms in these innovation ecosystems?

> Sub-RQ III: What are some decisions that managers in innovation ecosystems face and how do they make decisions?

Furthermore, the availability of studies on innovation ecosystems extend across sectors, geographies, and even disciplines which requires me to make an initial refinement of the scope in order to place this work within larger scientific dialogue. Thus, this thesis does not only focus on 'innovation' as an overarching subject that is dominating the strategy management literature over a century, but it underpins the growing importance of innovation networks due to the rise of digitalization and information and communication technologies (ICT) (Pellikka & Ali-Vehmas, 2016). Specifically, this thesis addresses the managerial challenges as well as the opportunities emerging through these types of innovation ecosystems.

Additionally, I approach the topic from two different angles: the energy and construction sector. The reason for narrowing the focus down to these two different sectors is threefold. First, a comparative setting can explain what underlying reasons in strategic decision-making are likely to remain constant under different sectoral settings within innovation ecosystems. This, in return, can provide insights on if and how the sectoral dynamics affects managers' strategic decision-making under the innovation ecosystem circumstances. Second, bridging the gap in innovation management literature between two previously disconnected sectors, in terms of their perspective of innovation, can generate valuable implications for further research, such as if the factors affecting the managers' rationale are caused by a change in the value systems, a change in the markets, or otherwise.

Finally, one of the areas where digital innovative activities progresses rapidly is the energy sector. This is due to the fact that energy is an essential human need and an indispensable part of economic development of all nations around the globe. Thus, many groundbreaking digital technologies (artificial intelligence, machine learning, internet of things etc.) and different use of existing ones in this domain transform the whole sector through new waves of digital value propositions and business models. Moreover, improved energy technologies are central to energy transitions toward cleaner and increasingly effective types of energy generation and utilization. Thus, the future of energy systems is at the center of challenges which businesses and societies face. As Miller, Iles, and Jones (2013) argue:

> Energy systems are among the largest human enterprises, comprising 9 of the 12 most heavily capitalized companies in the world. Efforts to transform energy systems involve changes, therefore, not only to energy technologies and prices but also to the broader social and economic assemblages... (p. 1)

Just like the energy sector, the construction sector also carries the weight for a prosperous future. According to a recent report by Buildings Performance Institute Europe (BPIE) within Europe, public buildings, homes and businesses account for 40% of all energy consumed (Bosseboeuf, 2015). Thus, Europe's construction sector is receiving increasing attention to host green buildings while aiming toward efficacy-oriented projects, including promising technologies such as artificial intelligence, machine learning and so forth. For instance, while construction firms focus mainly on digitizing the planning, design and logistics, (e.g. via building data modeling (BIM) software), producers of building materials tend to focus on the digitization of production and distribution, and building material distributers focus more on digital sales (Schober, 2016). Overall, the current sectoral transformation models (Hoppe, Butenko, & Heldeweg, 2018; Kotilainen, Sommarberg, Järventausta, & Aalto, 2016;

Rohracher, 2001) make the energy and construction sector interesting to investigate. It is expected that these transformations will be followed by a change in managers' behaviors and thus strategic decision-making styles to adapt the new norms.

1.3 Research design

Earlier research findings provide a general sense of identity for the innovation ecosystem concept. Yet, they are often not clear and have not been used in the context of managerial decision-making. Since there is no currently available model in the extant literature that captures the factors influencing managers strategic decision-making rationale in innovation ecosystems (Sekaran & Bougie, 2016). Also, there is scarce information about the role of managers in the innovation ecosystems literature. The previous investigations in assessing managers decision-making rationale deployed both qualitative (interviews) and quantitative (survey-based) approaches to data gathering (Busenitz & Barney, 1997; Lease, 2005). While there are advantages and disadvantages of deploying one or another, in order to mitigate the unwanted effects, this research collects data through both interviews and surveys. The research approach, briefly explained here, will be further elaborated in Chapter 3.

That being said, through an extensive literature review, I will first distinguish factors available in the literature that influence managers' strategic decision-making rationale within innovation ecosystems. The conceptual model will help guide the discussions with the experts and the survey structure. Next through, coupling the literature findings and inputs from the practitioner interviews, I will distinguish a final set of factors which will be assessed via expert surveys. It is expected that the insight gained from practitioners through formal talks will support the interpretation of the survey results and practical implications of this thesis. Accordingly, the overarching research design is constructed as a mixed methodology, where I will simultaneously employ qualitative and quantitative approaches to data gathering. While the interviews compose the qualitative component, the quantitative constituent is a survey based Multi Criteria Decision-Making (MCDM) model called Best-Worst Method (BWM) (Rezaei, 2015). The final discussions will be presented through data triangulation. Figure 1.1 shows this approach to data collection and analysis.

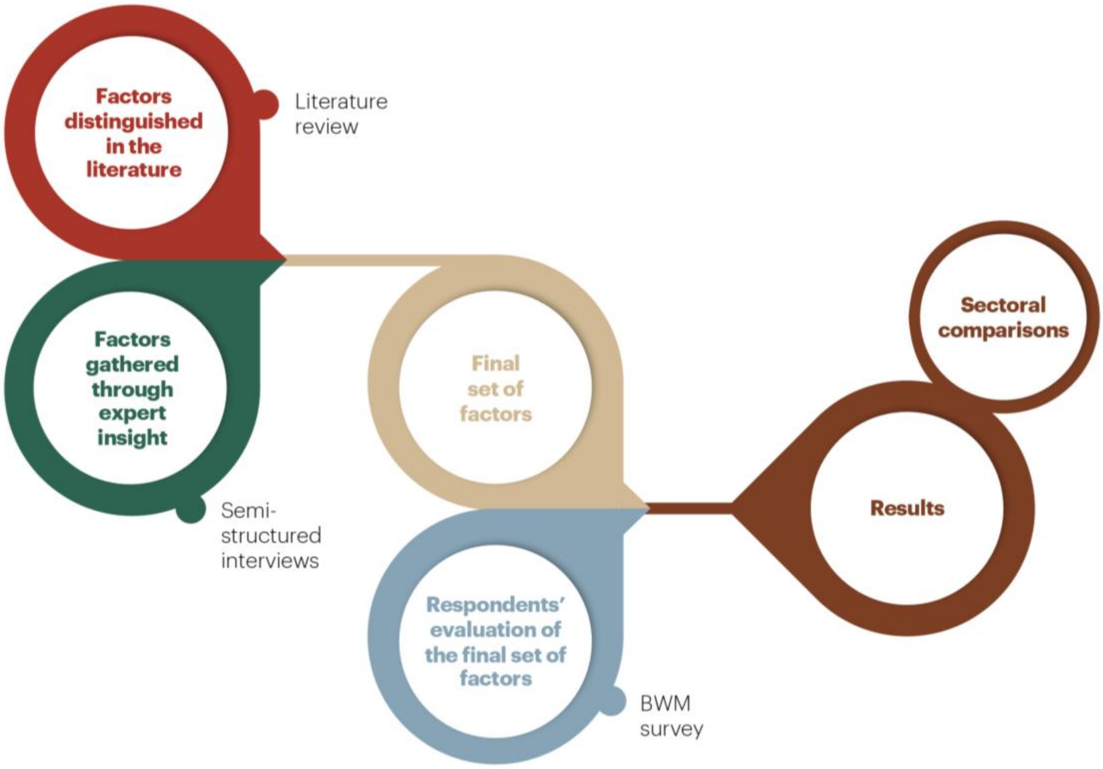

Figure 1.1. Approach to data collection and analysis.

1.4 Thesis structure

The master's thesis is structured in the following way: Chapter 2 presents the reader with the theoretical background; provides definitions for the main concepts in innovation ecosystems specifically. This chapter also includes lines of argumentation for the selected constructs, leading up to the conceptual model. Chapter 3 elaborates on the research methodology, specifying the data collection and analysis processes, including a simplified explanation of BWM model. The following Chapter 4, provides the survey results and the accompanying analysis. Next, Chapter 5 discusses the main findings gathered from the survey analysis. The arguments presented here are juxtaposed with the learnings deduced from expert interviews. Finally, Chapter 6 draws a conclusion by answering the main research question and reflecting on the objectives of this research; presents concluding remarks, including the limitations of the research and implications for further research and practitioners in the field. Figure 1.2 depicts the outline of this master's thesis.

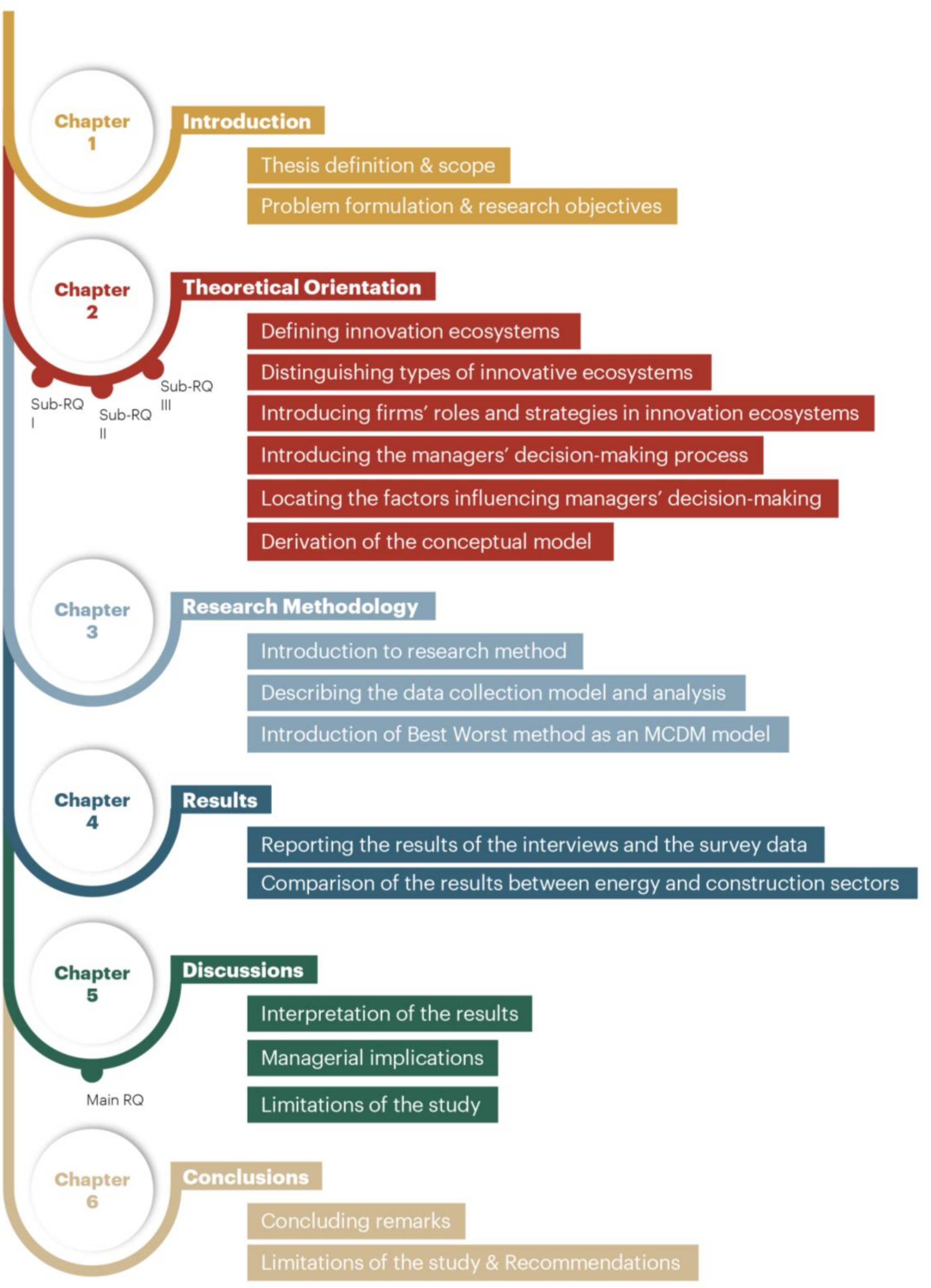

Figure 1.2. Thesis design

Chapter

2 Theoretical Orientation

To establish a well-defined ‘innovation ecosystem’ conceptual model, first, we need to understand the characteristics and limits of the ‘ecosystems’ concept. In this chapter, I do this, first, by unpacking the ecosystem concept and determining the what can be considered as an *innovative* ecosystem (Section 2.1). Only then it is possible to provide a rigorous ‘innovation ecosystem’ definition and scrutinize the firms’ players’ roles and their strategies (Section 2.2).

It is also important to analyze the decision-making styles within the innovation ecosystem context, provided that managers nowadays are facing possible courses of actions about the extent of participation in open and connected networks, platforms and ecosystems (Jalonen, 2012). In essence, these innovation-related decisions are made ex-ante and in a state of uncertainty, since the potential of the so-called innovation may not be realized in the future. I do this by looking at the managers’ strategic decision-making process in relation to their roles in the innovation ecosystem (Section 2.3). This chapter concludes with the proposal of a framework of factors influencing managers’ strategic decision-making rationale in innovation ecosystems (Section 2.4), which will guide the empirical investigation in Chapter 4.

2.1 Deconstructing the ‘ecosystems’ concept

Research on business and management often imports ideas and concepts from other scientific fields in order to simplify and explain theories (Letaifa, Gratacap, & Isckia, 2018). The ecosystem analogy - in this case, first received attention after James F. Moore (1993) introduced the concept of *business ecosystems* which then was further developed by scholars who solely focused on innovation (Adner, 2006), entrepreneurship (Prahalad, 2006), and knowledge (based) ecosystems (van der Borgh, Cloodt, & Romme, 2012). In a recent study, Scaringella and Radziwon (2018) compared the rate of the use of the term *ecosystem* in publications related to business, management, and economics fields over the years. Data from this study suggested that by using the search string ‘eco-system*’ AND ‘busines*’ AND ‘innovat*’ on Web of Science (WoS) online repository, one can find 21 and 26 articles alone in 2015 and 2016, respectively. On the contrary, the same search inquiry scores strikingly low with only 39 articles in total between 1900 and 2015 (Scaringella & Radziwon, 2018). Examples of these studies (such as Clarysse, Wright, Bruneel, & Mahajan, 2014; Iansiti & Levien, 2004b; Rong, 2011) draw upon Moore's (1993) discursive framework.

To introduce his framework of “business ecosystems,” Moore (1993) begins by arguing that knowledge-intensive sectors require firms to carry a collective organizational structure. He contrasts this to what he frames as traditional organizations (e.g. manufacturing, construction, etc.), which are built upon hierarchical architectures. In his subsequent study, he then points out several external factors that led to firms’ need for ecosystems, namely “fast-changing conditions,” “continual waves of innovation,” (Moore, 1993, p. 75) “obsolete economic and social conditions,” and “intensive cooperation” (Moore, 1996, p. 4). According to Moore (1996), these changes, in turn, signal the firms‘ switch to a more loosely-coupled network in which collectivity plays a significant role. As Moore (1993) writes:

> “To extend a systematic approach to strategy, I suggest that a company be viewed not as a member of a single industry but as part of a business ecosystem that crosses a variety of industries. In a business ecosystem, companies coevolve capabilities around a new innovation: they work cooperatively to support new products, satisfy customer needs, and eventually incorporate the next round of innovations.” (p. 2)

So, from an ecosystemic point of view, a firms’ innovation capabilities depend on the degree to which its network links disperse across the ecosystem. This extension in return provides a sufficient environment for interactions based on mutual complementarity (Clarysse et al., 2014). Thus, when a company lacks the internal competency to commercialize a product or service (Scaringella & Radziwon, 2018) or assets (Eisenhardt & Galunic, 2000), the need for ecosystem partnerships becomes remarkably relevant.

Moore’s (1993, 1996) view of ecosystems - business ecosystems as he calls it, captures the potential of the firms’ extended enterprise, shown in Figure 2.1, next to their core-business capabilities. Here, the business ecosystem is formed by an economic community of actors where one actors’ activities has an impact on the others, and thus the constant monitoring of the whole ecosystem is crucial to sustain a competitive advantage in the market. This way, firms can learn to assess their competitors with respect to the ecosystems they are a part of.

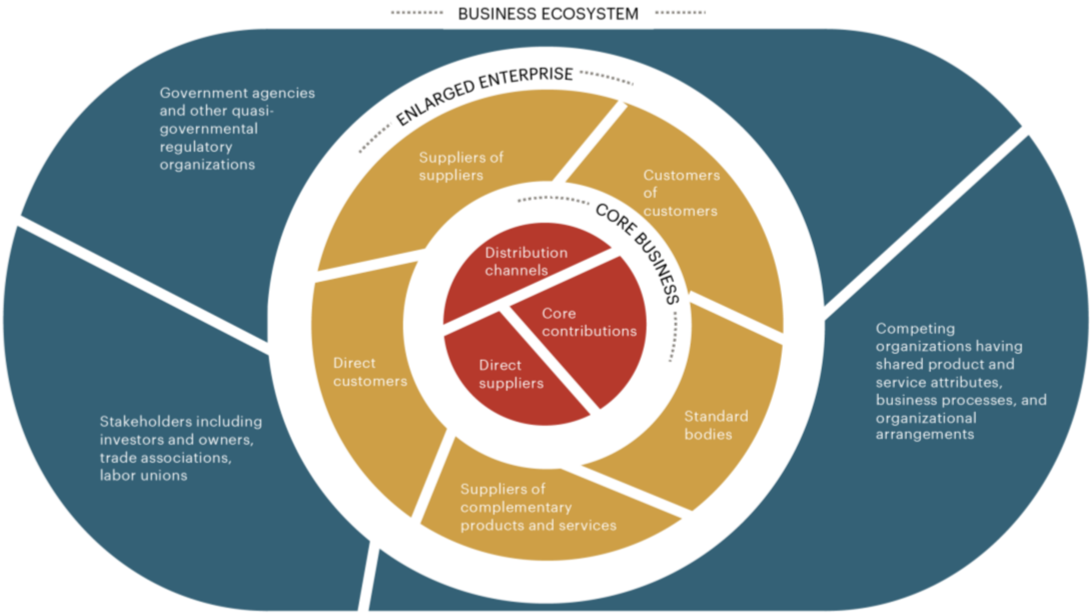

Figure 2.1. Structure of a business ecosystem, adapted from Moore (1996, p. 27).

At the same time, business ecosystems are not limited to a single industry. For instance, Moore (1993) shares the example of Apple as a good representation of the latter since the ecosystem that they a part of goes beyond multiple industries including the personal computers, consumer electronics, and communication industries. In their study, Mäkinen and Dedehayir (2012) highlight that compared to similar concepts, business ecosystems focus on a single firm and the joint effort to create a product, service or technology with the aforementioned surrounding network which goes beyond a single industry. Therefore, the inter-industrial characteristic of business ecosystems is notable, since according to Iansiti and Levien (2004a), every member within a multi-actor network shares the common fate with the rest. Iansiti and Levien (2004a) elaborate on this in their study of the '2000's internet bubble.' They argue that a trend may have a significant impact on a firms' strategy or positioning in the market, yet the intensity and suddenness of an external factor affecting the industry may leave all the players in the same unknown.

Following the fame of ecosystem analogy, literature on innovation management has witnessed a remarkable amount of new conceptualizations linked with business ecosystems. In an investigation into most-often cited papers concerning the innovation ecosystems, Gomes, Facin, Salerno, and Ikenami (2018) found that between the years 1999 and 2016, only after late 2007 there was a significant increase in the number of publications which took innovation ecosystems as their central theme. Notably, by analyzing bibliometric analysis studies (Bassis & Armellini, 2018; Gomes et al., 2018; Suominen, Seppänen, & Dedehayir, 2019), this thesis was able to trace the innovation ecosystem concept back to Adner's (2006) seminal paper.

In his work, Adner (2006) argues that innovation ecosystems are strategic alliances through which firms mutually complement their offerings and thus are able to offer a customer-centric, coherent solution. He takes this concept a step further and frames information technologies as catalysts that reduce the cost of coordination and help innovation ecosystems to become a core element for every firms' growth strategy. It is important to note that this thesis does not make a clear distinction between the publications before and after innovation ecosystems nor it is the intention of this research to find the first use of the term innovation ecosystem within innovation management. However, Adner's (2006) paper stands out because unlike his predecessors, he uses the innovation ecosystem concept interchangeably with business ecosystems. While he was one of the first scholars to do this, he certainly was not the last. Many other scholars have used these two concepts as synonyms (Adner & Kapoor, 2010; Gawer, 2014; Gawer & Cusumano, 2014; Nambisan & Baron, 2013; Overholm, 2015; Vasconcelos Gomes, Salerno, Phaal, & Probert, 2018; Zahra & Nambisan, 2012). Nevertheless, it would not be far-fetched to make the assumption that the innovation ecosystem concept, following the business ecosystems, emerged as a breath of fresh air within the innovation literature. In fact, in an analysis of the most employed keywords in the innovation literature Gomes et al. (2018) suggests that authors started to use the term *'innovation ecosystem'* instead of *'business ecosystem'* more often and this trend continues to grow.

While there are undeniable similarities between innovation and business ecosystems, innovation ecosystems underscore the value creation as a joint effort. It acknowledges the network links between the actors of the ecosystem, their interactions (Rubens et al., 2011), and the environmental factors that have an impact on the "development and diffusion of innovations" (Russell & Still, 1999). Moreover, this greatly enhanced connectivity across players also enables the sharing of once dispersed capabilities and resources. An innovation ecosystem, thus can co-create solutions that can better address human needs (be it social or commercial) while leveraging breakthrough technologies. Table 2.2 shows the previous innovation ecosystem definitions available in the current literature.

Table 2.2

Innovation ecosystem definitions available in the literature

Reference	Definition
(Adner, 2006)	"The collaborative arrangements through which firms combine their individual offerings into a coherent, customer-facing solution" (p. 98).

Table 2.2, Continued.
Innovation ecosystem definitions available in the literature

Reference	Definition
(Carayannis & Campbell, 2009)	"...Where people, culture and technology meet and interact to catalyze creativity, trigger invention and accelerate innovation across scientific and technological disciplines, public and private sectors and in a top-down, policy-driven as well as bottom-up, entrepreneurship-empowered fashion" (p. 202-203).
(Luoma-Aho & Halonen, 2010)	"We define innovation ecosystem as a permanent or temporary system of interaction and exchange among an ecology of various actors that enables the cross-pollination of ideas and facilitates innovation" (p. 4).
(Rubens et al., 2011)	"The inter-organizational, political, economic, environmental and technological systems of innovation through which a milieu conducive to business growth is catalyzed, sustained and supported. An innovation ecosystem is a network of relationships through which information and talent flow through systems of sustained value co-creation." (p. 5)
(Ritala, Golnam, & Wegmann, 2014)	"We view an innovation ecosystem as a business ecosystem, which aims at creating and capturing value from innovation activities (related to either technological or business/entrepreneurial innovation)" (p. 5).
(Dedehayir, Mäkinen, & Roland Ortt, 2018)	"Innovation ecosystems describe the collaborative effort of a diverse set of actors towards innovation, as suppliers deliver key components and technologies, various organizations provide complementary products and services, and customers build demand and capabilities." (p. 18)

In an innovation ecosystem context, value co-creation refers to the collective activity of creating value for the sake of competitive advantage. According to Adner and Kapoor (2010) this value comes through a customer-oriented system of coherent technological solutions, corresponding to a need in the market by the end-user (Walrave, Talmar, Podoynitsyna, Romme, & Verbong, 2018). Value capture, on the other hand, refers to the emerging business models that can help firms to monetize the value created (Scaringella & Radziwon, 2018). More specifically, value capture is a firm-level activity, whereas co-creation is a joint, transdisciplinary, and systematic effort to produce new value.

Moreover, in innovation ecosystems, firms can collaborate and contribute to the same ecosystem with *spatial proximity* (Scaringella & Radziwon, 2018). That is, the territorial boundaries of an innovation ecosystem are not strict. An innovation ecosystem, thus cannot be defined by 'clusters.' So far, some authors have labeled innovation ecosystems as local in their studies (Rubens et al., 2011). While this characterization is sound, it is not sufficient. Since 'local' only represents a sub-national entity, it falls short in explaining an innovation ecosystem which is inherently sub- or transnational - 'regional'. More importantly, when we concretize the meaning of 'local', it conflicts with the dynamic nature of innovation ecosystems. Thus one always need to take into account the ever-changing borders, roles, actors of innovation ecosystems (Valkokari, Seppänen, Mäntylä, & Jylhä-Ollila, 2017).

Moreover, an innovation ecosystem is built on *mutual trust* between the participants (Ritala et al., 2013; Scaringella & Radziwon, 2018). The trust invariant is not only relevant when it comes to lessening the "complex contracts in inter-organizational exchange," (Dedehayir et al., 2018, p. 22), but it also sprouts knowledge and culture exchange between the partners.

The publications analyzed in this section (Dedehayir et al., 2018; Rubens et al., 2011; Scaringella & Radziwon, 2018; Valkokari et al., 2017) and the following work using the innovation ecosystem concept, reveal various features that distinguish innovation ecosystems from those previously suggested collaborative theories. These seem to be:

- The innovation ecosystems literature gives a greater attention to the connections and relationships among the network actors. It shows appreciation to actors from all sorts and backgrounds (competitors, customers, NGOs, etc.) that have an impact on the innovation at stake, which make innovation ecosystems more inclusive.
- Mostly gained attention due to the rise of platforms, digitalization has a central role in developing new technological innovations, business models as well as keeping the innovation ecosystem actors in contact.
- More emphasis is given to the new value capture mechanisms in the form of business models including smart technologies, due to the vertical and horizontal inter-connections between actors from different sectors.
- Innovation ecosystems grant firms a larger market access, thus making the market structure and forces that impact the market pivotal.

2.1.1 Toward a rigorous distinction of 'innovative' ecosystems

Previously, the networked nature of the organizations have attracted increasing attention among academics. In fact, many have touched upon similar multifaceted collaboration models to innovation ecosystems, such as open innovation (Chesbrough, 2003); innovation clusters (Porter, 1998); value networks (Li & Whalley, 2002); and triple or even quadruple helix models (Carayannis & Campbell, 2009; Etzkowitz & Leydesdorff, 2000). Nevertheless, this heterogeneity in the available literature and the multivocality of the term turns the 'innovation ecosystem' concept into a problematic structure, and its managerial implications become infinite. So, the question still remains, what exactly can be considered as the 'innovative' ecosystems?

One way to overcome the contradictions in the extant literature and to homogenize what seems to be a heterogeneous concept is to accept that there is not one type of innovation ecosystem, but several. Therefore, the development of a typology can help to expand our understanding of the innovation ecosystem concept and can reveal different types of innovation ecosystems among which managers can choose from. Also the distinction of what an innovative ecosystem is and is not, can help us understand different innovation ecosystem strategies, managers' decision-making styles, and expand upon the factors influence managers strategic decisions in innovation ecosystems. Accordingly, in their critical analysis of Moore's ecosystem concept, Letaifa et al. (2018) propose a typology of four dimensions, each with different ecosystem definitions, including supply systems, communities of destiny, platforms, and expanding communities. Like any typology development process, the authors begin by determining the characteristics of an initial framework by relying on the existing literature. They degrade the determinant characteristics of all ecosystem types into two, namely 'control of key resources' and 'mode of interdependence.' The coupling of these characteristics reveal a fourfold typology of ecosystems. Figure 2.2 presents an overview of the typology explained so far.

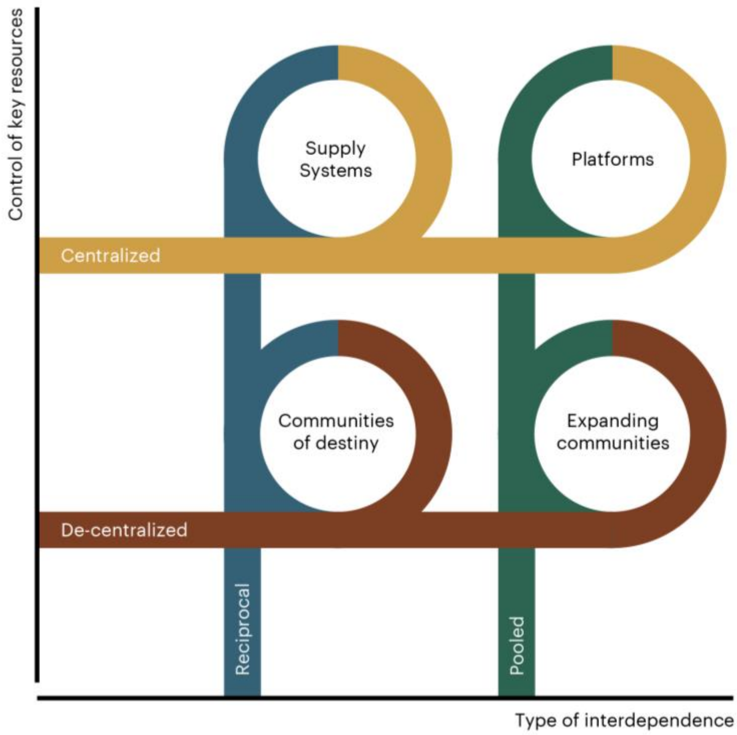

Figure 2.2. Typology of ecosystems, adapted from Letaifa et al. (2018, p. 75).

The significance of resource control comes from the composition of ecosystem members and power distribution. The existing literature branches into two: those who see ecosystems as a strategic intelligence of a peripheral actor, so-called keystone, to increase its competitive advantage (e.g. Walmart, Apple, IBM, Microsoft, etc.); and those who see ecosystems as heterogeneous playgrounds. Whether the former or the latter, this division in the literature shows us the importance of the power structure within an ecosystem. According to Letaifa et al. (2018), "power exerted by one actor on another, comes from the control that the first has over resources that are indispensable to the second and for which letter has no satisfactory alternatives available" (p. 74). Therefore, with regard to the control of the key resources, ecosystems are may be when one actor, called the 'keystone' or 'hub', possesses the sole ownership of a key resource or decentralized when resource ownership is distributed across ecosystem members. The kind of this resource can be manifold, such as a mineral that is used in a manufacturing process, a proprietary knowledge, or technological advancement.

According to Letaifa et al. (2018), the second determinant characteristic arises from a contradiction in Moore's ecosystem definition, which is the exclusion of ecosystem members in some cases and inclusion in others. When it is combined with the first determinant, this inconsistency in labeling ecosystem members leads to a lack of understanding of relationships among them. For instance, in some cases, the contributions of each ecosystem member may be distinct, and in others, they may be intertwined in the sense that one actor's output can be the other one's input. While the prior is called "pooled interdependence" the latter is "reciprocal interdependence."

The first quadrant of the typology introduces the *supply systems* which stands for the relationship between a network of firms where the strategic center of is shared by a small number of important partners who can mobilize, design, and control the system of resources. It is important to stress the fact that the system of resources are not only controlled by one focal firm, but together with partner enterprises (Letaifa et al., 2018). In the second quadrant, the *communities of destiny* emphasizes the "shared fate" of the community as a whole. This shared fate arises when ecosystem members' individual performance is linked to the overall health of the ecosystem (Jacobides, Cennamo, & Gawer, 2018). Authors who previously touched upon these co-evolutionary ecosystem networks (Jacobides et al., 2018; Letaifa et al., 2018; Schroth & Häußermann, 2018a) suggest that when partners contribute to a modular product development, their capabilities evolve together in time. This is due to the fact that an externally open innovation regime requires constant adaptation to changing environment.

The third quadrant, on the other hand, focuses on *platforms*. Previous literature connects the rise of the platform ecosystems to variety of industries, specifically high-tech (e.g. cell-phones, consumer electronics, semi-conductors etc.), in which the information technology is a central actor in driving the business. Accordingly, the platform ecosystems comprises products, services, or specific technologies that provide the hardware/software structures upon which the network of ecosystem can “develop their own complementary products, technologies, or services” (Gawer & Cusumano, 2014, p. 418). According to Wareham, Fox, and Cano Giner (2014), platforms are places that inhibit innovation under the surveillance and direction of a so-called ‘platform sponsor’, who owns the proprietary technology that enables transactions among the users and the complementors of the platform. Notably, platforms differ from other three types of innovation ecosystems as they deal with “network effects”. Network effects arise when the benefits gained by the users’ of the platform increase in parallel with the number of users who adopt the platform (Katz & Shapiro, 1986). This way platforms become more valuable to the owner and users, as both the market access and the complementary innovations around the platform increase (Gawer & Cusumano, 2014).

Finally, the *expanding communities* emphasizes the innovation ecosystems where the actors are peers and possess similar knowledge for an essential objective. Letaifa et al. (2018) argues that this type of innovation ecosystems differ from platforms in that the key resource is non-proprietary. For instance, open-source communities belong to this type of innovation ecosystems in which the dependencies are distributed relatively more even. Some other examples of this type of innovation ecosystems include industry standard and R&D consortiums as well as alliances or dyadic partnerships with other firms in the form of strategic alliances and joint ventures (Nambisan & Baron, 2013).

All four types of innovation ecosystems analyzed above require the planning and alignment of a particular relationship model to create value. Together they address the need of interdependent relationships between entities and, specifically, product/service modularity that can be achieved through inter-firm complementarities. Aside from the aforementioned Jacobides et al. (2018) argue that the strength of innovation ecosystems is because “they provide a structure within which complementarities (of all types) in production and/or consumption can be contained and coordinated without the need for vertical integration” (p. 2263). From this perspective, innovation ecosystems do not rely on strict hierarchical and linear governance mechanisms because they grant the upstream and downstream actors of the ecosystem the decision-making freedom regarding the product/service design, price etc. Notably, innovation ecosystems do focus on a focal product/service innovation and its complements, rather than a focal firm who pursues it.

On a high level, the innovation ecosystem that this study takes as its main subject is a semi-controlled collaborative arrangement through which firms combine their individual offerings to create a customer-faced product/service via the use of contemporary technologies. Here, the emphasis is on the interaction and the present day technologies that independent players get use of to create and commercialize innovations, and in return benefit the end customer (Adner & Kapoor, 2010; Jacobides et al., 2018). Figure 2.3 depicts the aforementioned ecosystem based innovation systems with its players.

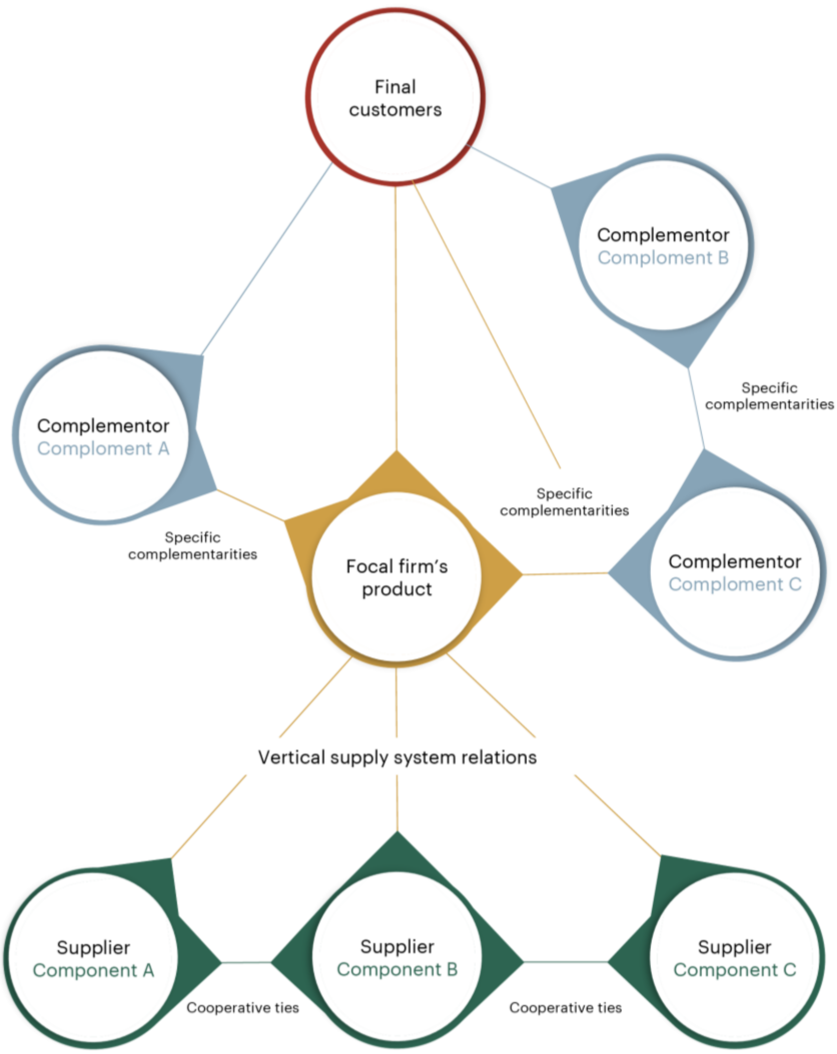

Figure 2.3. Transactions in an innovative ecosystem, adapted from Jacobides et al. (2018, p. 2261).

As explained previously, what makes innovative ecosystems distinct is the product modularity and complementarity between these different modes of a product. According to Jacobides et al. (2018), in innovation ecosystems the product modularity differs from those previously illustrated (Teece, 1986), in that they are 'super-modular'. As opposed to the view that *component A does not function without component B*, super-modularity postulates a state when *component A makes B more valuable*. For instance, in the case of digital application ecosystems, an app cannot function without an operating system and at the same time the very existence of an app increases the value of the operating system platform that it is installed on.

These four innovative ecosystem types include various actors entities and their managers who supervise the ecosystem and make decisions on behalf of their firms. Accordingly, firms' strategies can be multiple depending on their current position in the operating market, long-term goals, financial capabilities and so forth. In the next sections, I will explore the real-world implications of the innovation ecosystems concept through analyzing the different innovation ecosystem strategies. Also, I will reflect on the external and internal motivations that push firms in both energy and construction sectors to look for an innovation ecosystem partner. As a result, the analysis will create a basis for scrutinizing firms' innovation ecosystem strategies; managers decision-making process; and, in return, determining the discrete motivations behind managers' strategic decision-making rationale in innovation ecosystems (see Section 2.3).

2.2 The innovation ecosystem concept in practice

According to Moore (1993, 1996), ecosystems life-cycle includes four phases, from start to end these are: birth, expansion, leadership, and self-renewal (or death). The initial phase (birth phase) is where members of an ecosystem reach a consensus with regard to the value that is offered by the new products or services. During the birth phase, the success accrues to those firms who can best define the value proposition (Dedehayir et al., 2018). In a more recent study, through analyzing emergence and growth of innovation ecosystems, Dedehayir and Seppänen (2015) demonstrate two sub-phases (invention and start-up) that together constitute the birth phase. According to the authors, during the invention stage firms design, test, and release new technology. The start-up phase, on the other hand, covers the time spent from the invention stage until the first commercialization of the technology. This phase is also when the ecosystem spreads into new areas which can be described as a territory war, where the ecosystem is looking for a suitable market for the new technology (Moore, 1993). The leadership stage is when the competition among ecosystem players starts to overshadow the coopetition. Here firms try to consolidate their power and try to take the leadership role of the business ecosystem. Moore (1993) explicitly defines this war as "clone wars" where firms try to use their bargaining power to take over the market. Needless to say, this stage does not resonate well with the main premise of ecosystems, where firms cooperate for breakthrough value propositions. Nevertheless, the third stage sets a clear vision for the future and "enhances the commitment of component suppliers and complement producers, thereby institutionalizing a true network of cooperators" (Dedehayir et al., 2018, p. 19). Finally, at the fourth stage ecosystem players face threats coming from new innovations or ecosystems. These threats also include changes and turbulence in the ecosystemic environment, such as the regulations, market changes, social trends and so forth (Moore, 1993). As a result of these challenges, an ecosystem either renews itself or faces the inevitable consequence and dies.

The aforementioned account of Moore's (1993) ecosystems life-cycle shows strong similarities with that of previously introduced technology (Anderson & Tushman, 1990) and product life-cycles (Stone, 1976). In fact, the previous literature has touched upon the differentiating aspects of ecosystem life-cycles and various authors have argued that due to the central importance given to the technological innovation, ecosystem life-cycles can be considered similar to technology life-cycles (Adner & Kapoor, 2010; Dedehayir & Seppänen, 2015).

Similarly to product and technology life-cycles, managers who make the strategic decisions in innovation ecosystems too face numerous dynamic strategic alternatives that are dependent on or linked to environmental variants. For instance, as was explained in Section 2.1.1 firms in innovation ecosystems attach their offerings to profitable technologies, platforms, and service solutions. The expectation of the managers from these value offerings, however, is dependent on the success of upstream and downstream complementors, as well as the extent to which the new offering resonates with end-customers (Adner, 2006). Therefore, managing an ecosystem and strategic decision-making in such settings is susceptible to technical and sociologic difficulties. As Adner (2006) suggests, when competing in an innovation ecosystem managers must expect and plan for unmanageable circumstances, and know their ecosystems – understand its players, their roles and motivations to participate.

2.2.1 Participating actors, their roles, and strategies in innovation ecosystems

For a complete picture, it is also important to discuss the dynamic blocks, those being the different roles of participating actors within innovation ecosystems. One of the early scholars to investigate this area of research, Iyer and Davenport (2008) argued that actors can own the bridge, hub, and broker roles in an ecosystem. Without separating from its predecessor, Rong (2011) suggested that ecosystem actors can share the initiator, specialist, and adopter roles. In a more recent publication, Zahra and Nambisan (2012) included the importance of corporate-sponsored ventures and independent entrepreneurs as a separate body to the aforementioned list. According to Iansiti and Levien (2004a) firms can own three different types of roles within an innovation ecosystem. With a descending order of the role's influential power, these are keystone, dominators, and niche players.

Conceivably, the most distinguished role in an innovation ecosystem is the '*keystone*', also referred to as *'ecosystem leader'* (Moore, 1993), *'platform leader'* (Gawer & Cusumano, 2002) or a *'hub'* (Valkokari et al., 2017). A keystone organization aims to enhance the wellbeing of its ecosystem by providing "stable and predictable" (Mäkinen & Dedehayir, 2012) sets of resources. The organization who plays the keystone role is also the most influential one. Since they have a responsibility to regulate the overall functionality of the ecosystem, which in turn places them at the center, its actions determine the success of all other members, including its own (Mäkinen & Dedehayir, 2012). As Iansiti and Levien (2004b) highlight, keystone actors are an indispensable part of the innovation ecosystem, so much that their exit will have disastrous after-effects such as the collapse of the entire ecosystem. Accordingly, keystones' power of command extends across the system and they claim a greater share from the economic returns. This, however, is a misrepresentation of their population in a given ecosystem, comparing to the rest of the actors (Iansiti & Levien, 2004b; Mäkinen & Dedehayir, 2012; Moore, 1993). Notably, keystone's power does not come with predominance, but the strategic advantage they hold (Mäkinen & Dedehayir, 2012). Iansiti and Levien (2004b) further elaborates on this strategic advantage and argue that keystone organizations can create and share the value with the wider ecosystem.

At the same time, organizations who have the keystone role in any given point are subjected to constant scrutiny. For one, a keystone needs to focus on the overall integrity of the ecosystem. Innovation cannot be generated in an ecosystem where the technologies, products, or services are not compatible with each other (Gawer & Cusumano, 2002). Second, the ecosystem has to evolve technologically and spread to take advantage of the network externalities (Gawer, 2014). In the long run, the keystone that fails to comply with their strategic advantage is doomed to fail (Dedehayir et al., 2018). Much of the current literature, however, focused on the exemplar cases. For example, while Iansiti and Levien (2004a) looked into WalMart, Gawer and Cusumano (2002) analyzed Microsoft. Some of these longitudinal case studies have concluded that a keystone firm ensures the continued development of the ecosystem productivity with "tools, technologies, and services" (Iansiti & Levien, 2004a). Later, these tools can be deployed by other members of the ecosystem and turned into new value offerings. In the case of Microsoft, this new value offering was an operating system that enabled the generation of many other software related products (Iansiti & Levien, 2004a).

Dominators, on the other hand, try to gain value by capturing better portions of their network and controlling them. Specifically, they are those actors who try to eliminate their rivals and expand into new markets in order to dominate them as well. This drainage of the value, however, diminishes if dominators are the majority species in their respected ecosystem. Unlike keystones, dominators are easily distinguishable due to their abundance (Iansiti & Levien, 2002). The aforementioned description derived from the available literature, however, can lead to misconceptions, such as the commonly held belief that dominators are so to say 'invasive weedy species' (Iansiti & Levien, 2002) or 'wannabes' (Mäkinen & Dedehayir, 2012) of their respective ecosystem. Although at first, this comparison suits the main premise of the 'ecosystems' analogy, it overshadows the dominators' role in an ecosystem. Accordingly, Iansiti and Levien (2002) offer to focus on the ratio of "biomass" to impact when distinguishing dominators from other actors. Specifically, it is important to pay attention to an actor's contribution to its network along with its size when distinguishing whether they have the role of a keystone or dominator.

Lastly, niche organizations, sometimes referred to as *'spoke'* (Valkokari et al., 2017), constitute the larger portion of the ecosystem in terms of size and versatility (Iansiti & Levien, 2004a). This versatility stands for the contribution they make for their ecosystems, such as the innovations and generated value. According to Iansiti and Levien (2004a) what makes dominators stand out is that they are the 'complementors', who offer products that are complementing the keystone's innovation/technology and in return expanding the application base (network externalities). Mäkinen and Dedehayir (2012) argue that a big portion of the firms in an innovation ecosystem can be considered as niche players who are specialized in one holistic feature. Often they are responsible for the creation of new innovations and the most value in an ecosystem, all with the help of keystone resources. Through specializing on one complementary mode, niche players differentiate themselves from the rest of the ecosystem members. For instance, due to their great authority Microsoft can be considered as one of the platform leaders in the PC ecosystem. At the same time, many niche players offer complementary technologies in the form of software and hardware products/services to Microsoft's platform, increasing the platform's overall value and differentiating their offerings from other entities who operate in the same platform (Gawer & Cusumano, 2002).

While many of the previous studies have accepted these three types of actor roles as core and worked with them (Adner & Kapoor, 2010; Dedehayir & Seppänen, 2015; Li, 2009), in their study, Dedehayir et al. (2018) further expand upon this list of three actor roles and offer three additional ones: entrepreneur, sponsor, and regulator. The role of an 'entrepreneur' is often held by individuals and start-up firms, providing economic welfare for regions, sectors, or nations.

Entrepreneurs may arise as a result of opportunistic reasons such as to commercialize discoveries and inventions of academic experts (Nambisan & Baron, 2013). Given that these new ventures often lack resources, they require support from the ‘sponsor’. The support of sponsor includes giving financial assistance, co-developing their products/services and granting the entrepreneur with a wide array of an entrepreneurial network (Dedehayir et al., 2018). The regulators, on the other hand, contribute to the innovation ecosystem by generating optimal economic, political, and regulatory environment (Dedehayir et al., 2018).

According to Valkokari et al. (2017), the above-mentioned roles and ecosystem strategies they carry together are influenced by the firms’ motivations, strategic thinking, and current network position. If the ecosystem context is taken out of the picture, firm strategies often result in a “winner-take-all” situation. This indeed is a dangerous path to take in a multi- and interdependent stakeholder network. In their study, Valkokari et al. (2017) reach a similar conclusion, highlighting a need for differentiated thinking so that the overall health of the ecosystem can be sustained for all members. Furthermore, in an ecosystem, roles are not pre-determined nor static (Iansiti & Levien, 2004a). When the appropriate conditions are in place, the roles of the participating organizations can change at any given time. So, while a dominator can become a keystone and vice versa, an organization can act as a keystone in one domain while acting as a dominator in another. Due to the dynamic nature of innovation ecosystems, drawing a clear line is not easy and it can vary from sector to sector, provided that there are cultural, strategic and actor-based differences between sectors.

Table 2.3 summarizes all of the aforementioned types of innovation ecosystem roles. Here the additional roles, namely entrepreneur, sponsor, and regulator, are out of the reach from managers’ control and decision-making. The core roles which managers can choose among depending on their firms’ status in the operating environment. These variants are numerous, including economic, technologic, and regulatory factors which will be further elaborated in the following section. No matter what the firms’ final strategic decisions are, all of them are taken by managers, through an iterative process of evaluating the focal firms’ performance, including the market forecasts. Therefore, in order to understand the decision-making rationale, it is important to understand what is meant by the managers’ decisions in the context of innovation ecosystems as well as managers’ decision-making styles.

Table 2.3

Innovation ecosystem roles, actors, and activities, extracted from the previous literature

Role	Actor (examples from the literature)	Activities
Keystone (ecosystem leader)	▪ Cisco (Ginsberg, Horwitch, Mahapatra, & Singh, 2010) ▪ Amazon (Ritala et al., 2014) ▪ Semiconductor producer (Adner & Kapoor, 2010)	Enhances the wellbeing of its ecosystem by designing the ecosystem actors, coordinating resource flows, and creating value through bundling the complements.
Dominator	▪ Cisco (Li, 2009)	Increases its market span by mergers and acquisitions.
Niche (complementor)	▪ Biogas producer company (Hellström, Tsvetkova, Gustafsson, & Wikström, 2015) ▪ Smart grid technology producer (Kotilainen et al., 2016) ▪ Buildings material manufacturer (Pulkka, Ristimäki, Rajakallio, & Junnila, 2016)	Produces materials, products, and services and delivers them as complements to the keystone. Defines the need in the market and tries to meet them with the resources the keystone provides.
Entrepreneur	▪ Start-ups (Clarysse et al., 2014)	Founds a venture according to the need in the market and the feasibility and viability of the business model.
Sponsor	▪ Birmingham Science Park Aston (Rubens et al., 2011)	Supports new ventures via granting them with financial capital and resources (office space, network etc.)
Regulator	▪ UK Government (Rubens et al., 2011)	Provides economic and social support via loosening regulations or creating new ones.

2.3 Managers' strategic decision-making

The manager's role in innovation has attracted much interest from researchers over the last few decades, specifically the right allocation of the firms' capabilities and resources to realize strategic objectives (Schneckenberg, Velamuri, Comberg, & Spieth, 2017; Zambrano & Velásquez, 2011). Mainly, the arguments start from the point of firms' strategic capabilities and how to govern them for the sake of the firms' competitive advantage. The firm's strategic capabilities are the collection of actions effectively carried out by the organization to enforce innovation management as a basis for identifying the strategic goals of the firm (Zambrano & Velásquez, 2011). At the core of these actions there is managers' decision-making, since according to Zambrano and Velásquez (2011) a 'strategic innovation decision' expresses what a firm intends to achieve. The process of making strategic innovation decisions, thus, can also be applied to the case of decision-making in innovation ecosystems.

Here, from the firms' perspective, the main goal is to perform a programmed sequence of decisions which will be given by managers and which will be coherent with those of firms' innovation objectives. The managers' strategic decision, on the other hand, stands for the process in which appropriate managers evaluate a set of performance indicators and couple it with their intuitive knowledge regarding the firms' operating market (Zambrano & Velásquez, 2011). In line with the investigated innovation ecosystems concept in this thesis, Bruijn and Heuvelhof (2008) argue that "the greater the differences between actors, the more difficult it is to steer them" (p. 8). As a result of operating in a dynamic interdependent and inter-industrial network, it is assumed that managers in an innovation ecosystem need to overview complex processes when making decisions. This complexity comes from the fact that there are dynamic change of actors and their agendas. As a result managers' approach to decision-making in an innovation ecosystem can be labeled as a *'process management approach'* in line with that of Bruijn and Heuvelhof (2008). Accordingly, the authors suggest that as the number of actors increase in a network increase, there are more possibilities and thus options for managers to evaluate. In the case of process management approach, the managers' decision-making process is rather complex.

A review into managers' strategic innovation decisions reveals the previously discussed behavioral decision theory and with that managers' 'coping mechanisms.' The scholars have defined 'coping mechanisms' as the processes of dealing with the complex decision-making situations (Schneckenberg et al, 2017). Zambrano and Velásquez (2011) suggest that the managers' decision-making is a mechanism that is composed of two consecutive activities. First, where managers select a course of action among several alternatives. This happens as result of aforementioned evaluation of multiple entries of information. Second, the selection of one of the alternative actions. In the case of innovation ecosystems, however, it can be argued that both the former and latter are subjected to constant re-evaluation due to ever-changing ecosystem actors and environmental dynamics. From this perspective, the strategic decision-making in innovation ecosystems requires managers to align the strategic objectives of the focal firm with the external ecosystem actors; allocate the resources of the firm, provided that they are prerequisite for the innovation to be developed, to the appropriate ecosystem actors in an efficient manner; and keep the dynamic relations with the ecosystem actors in sync at all times (Iansiti & Levien, 2004a).

All these tasks of the managers, however, are implemented with certain types of uncertainty. As Schneckenberg et al. (2017) acknowledge, managers make their strategic innovation decisions based on uncertainties and various factors which constitute the innovation objectives of the firm. In the case of innovation ecosystems these uncertainties can include unpredictable market response or issues related to regional politics. Aside from what can be considered as an uncertainty, managers in an innovation ecosystems are also under the influence of various factors that deal with technical or cognitive capabilities, such as product development or managers' perception of the future respectively. A more detailed account of these so-called factors and the conceptual model will be given in Section 2.4.1. When managers evaluate certain sources of inputs before making decisions, the cognitive capabilities play a central role (Kahneman, 2011). For instance, what if managers have a flawed perception of the future? Thus, in the case of innovation ecosystems, managers are expected to perceive a possible push in the firms' sector for a more data-driven business model and/or measure when is the right time to tap into new markets.

For instance in the case of a rapid change (e.g. the increasing usage of smart technologies) in one's sector, Iansiti and Levien (2004a) offer that a strategic decision might include "focusing on a (niche role) narrowly and clearly defined business segment and developing one's own specialized expertise" (p. 7). As a result, the authors argue that firms who are capable of doing such a turn successfully can differentiate themselves from their competitors. In another example from a keystone strategy, the ecosystem leader can assume a central position by securing a platform technology and attracting key organizations to cooperate around it which will provide complementary products and services that will collectively deliver value to the customer.

2.4 Conclusions and the conceptual model

This chapter has provided a theoretical background for this thesis. It began by describing the ecosystem analogy by Moore (1993, 1996) and then went on discussing the concept, taking both etymological and epistemological aspects into account. It argued that there are four aspects which differentiate innovation ecosystems from those previously suggested similar collaborative theories: (i) innovation ecosystems show great appreciation to actors from all sorts and backgrounds (competitors, customers, NGOs, etc.) that have an impact on the innovation at stake; (ii) it mostly gained attention due to the rise of platforms, digitalization, and smart technologies etc. (iii) it gives more emphasis to the new value capture mechanisms in the form of business models, where products/services are an outcome of modular contributions from complementors; and (iv) innovation ecosystems are located at the fringe of industries which grants a greater market access for firms.

Building on previous literature and publications using the innovation ecosystem concept, I argued that the heterogeneity in the available literature and the multivocality of the term turns the ‘innovation ecosystem’ concept into a problematic structure, and its managerial implications become infinite. Accordingly, in all the studies analyzed throughout this research, a coherent definition of innovation ecosystems could not be found. Therefore, I introduced a typology of four to distinguish what can be considered as an ‘innovative’ ecosystem, namely, supply systems, communities of destiny, platforms, and expanding communities. Notably, the innovation ecosystem that this study takes as its main subject views the ecosystem as a semi-controlled collaborative arrangement through which firms combine their individual offerings to create a customer-faced product/service via the use of contemporary technologies.

Next, in order to understand the managerial implications of innovation ecosystems, which is a key theme in this thesis, this chapter went into introducing the following six innovation ecosystem roles, actors and their strategies: keystone, dominator, entrepreneur, sponsor, and regulator.

In relation to the above investigation, managers’ strategic decision-making processes and styles in innovation ecosystems were discussed. One question that still needs to be asked deals with the external and internal factors as well as uncertainty elements that influence managers’ decision-making rationale. In other words, a look at the innovation ecosystem literature and strategic decision-making reveals the main arguments that innovation scholars have used until now. However, just like the conceptual discourses in the field of innovation management, the aspect of practicality should also be addressed. As far as the management practice is concerned, firms’ strategies offer a great venue to scrutinize innovation ecosystems and related gaps in our understanding of factors influencing managers’ decision-making rationale.

2.4.1 Selection of the factors

As it was underpinned in the second section of this chapter, every firm operates in a different context, shaping its motivations and strategies. This contextual difference may be a consequence of sectoral contrasts, managers’ perspective, or uncertainty in collaborating. As Iansiti and Levien (2004a) observe:

> A company’s choice of ecosystem strategy— keystone, physical dominator, or niche— is governed primarily by the kind of company it is or aims to be. But the choice also can be affected by the business context in which it operates: the general level of turbulence and the complexity of its relationships with others in the ecosystem (p. 7).

On the question of the sectoral turbulences and both external and internal factors influencing managers’ strategic decision-making rationale in innovation ecosystems, so far, this thesis was not able to locate a universal list of factors in the extant literature. Nevertheless, by coupling an extensive review encompassing innovation management literature with the insights from the expert interviews, it is possible to situate numerous factors that are argued to have significant influence on managers.

Looking into both decision-making as well as innovation management literature on the factors influencing managers' strategic decision-making rationale is especially relevant to the innovation ecosystem context. This is due to the overlaps between the strategic approaches in networks of collaboration and innovation ecosystems. Moreover, in innovation ecosystems technological advancement strikes as an important determinant in decision-making, and in return firms' relative competitive advantage. Therefore, I propose a framework that aims to shed light on the factors that have roots in the innovation management literature and incorporate the notions of decision-making under uncertainty which are central to the managers' strategic innovation decisions.

Due to the practical reasons in reporting, the following eight factors, bolded and summarized below, are not categorized into descriptive groups or given in any particular order. An overview of the factors matrix, in which the appropriate references from the literature and/or mentions by the experts for each factor is presented in Appendix A.

Push for sectoral reconfiguration has been discussed in several studies on innovation ecosystems (Pellikka & Ali-Vehmas, 2016; Ritala et al., 2013; Teece, 2007) and appears to be one of the factors that is recited the most number of times – 7 out of 14 practitioners have mentioned *push for sectoral reconfiguration* together with *push for strategic renewal* during the expert interviews. According to Pellikka and Ali-Vehmas (2016) "increasing collaboration in an ecosystem can provide the early signals of significant technological and industrial reconfiguration [or a technology shock]" (p.21). Here, reconfiguration stands for the re-positioning of a firm through inter-industry knowledge. As a result, managers' knowledge about the current climate in their respective sector, combined with their opportunistic intuitions become relevant when making decisions. This may reveal itself in practice through either aiming for a platform ecosystem and/or combining learnings from several different sectors to expand the current markets (expanding communities).

For instance, a look at both the energy and construction sectors made it possible to understand the important technological turbulences that drive managers in both sectors to look for ecosystemic relations outside their own habitats. One of the reasons for this is to mitigate the element of uncertainty in decision-making. Another one is that in both sectors firms are not capable of mastering all the technologies and products by themselves, thus complementarities become more important. The underlying reasons for this differ from sector to sector. In the case of the energy sector, energy transitions and regulatory pressures force firms to substitute processes or utilize novel product value capture mechanisms. On the other hand, within the construction sector, innovation is seldom long-lived and often incremental due to low levels of investment in technology, risk aversion, and culture. So far, many initiatives within the construction sector concerning the innovation were taken for transformational reasons vis-à-vis digitalization. Nevertheless, today's developing technologies and concepts (e.g. sensors, drones, robotics, smart building, smart cities, etc.) offer opportunities for both the energy and construction sectors that are not yet explored to their full potential. Therefore, it is argued that managers in an ecosystem should systematically single out organizations with which their future strategic goals are most closely intertwined (Pellikka & Ali-Vehmas, 2016). At the same time managers' assumptions of the future becomes more relevant when making decisions.

Push for strategic renewal is explained by Aarikka-Stenroos and Ritala (2017) as "the ecosystem dynamics that tend to change, disrupt, and replace existing systems, creating opportunities for new actors, technologies, and institutions to emerge" (p. 29). Thus, existing and new actors are subjected to a constant strategic renewal, in the form of new business models. The value propositions that come with business models also must be dynamic, evolving as the ecosystem network evolves. This factor is also closely intertwined with the concept of 'business model innovation'. As Schneckenberg et al. (2017) note "business model innovation creates ambiguity and risks for decision-making" (p. 405). Some of the constraints that managers face include poor appreciation of interdependencies in/with current business models and dominant path dependencies that restricts renewal.

On the question of the energy and construction sectors, previous innovation ecosystem efforts are directed toward the inclusion of smart and data-driven technologies into their value offerings. To become competitive in such networks, firms must adopt value creation mechanisms that are not linear (Nambisan & Baron, 2013) (see Section 2.1.1). This contradicts traditional value chains where value is created through inputs and outputs of upstream and downstream actors; the value is a result of integrated solutions delivered by a group of firms.

One way to execute this process is the utilization of new business models in which maximize the value obtained by the end-user and other stakeholders. While the emphasis is largely given to the inclusion of others, managers still need to ensure sufficient differentiation for their companies via appropriate value propositions in order to sustain their revenue streams even if the particular innovation/technology declines (Zahra & Nambisan, 2011).

Firm's posture can be traced back to Miles, Snow, Meyer, and Coleman (1978) business strategy typology, yet in this thesis I refer to *firm's posture* as put forward by Dhanaraj and Parkhe (2006). In their definition, a firm's reputation is determined by the strategic decisions it follows with the goal of being more innovative than others.

As Luoma-Aho and Halonen (2010) argue, firms' communications with the external stakeholders via images, stories, and experiences are, nowadays, more effective as a result of the convergence between the products and services offered by firms. In this way, the image of an organization can positively or negatively affect its identity, since the managers' decisions are susceptible to priming. Under the influence of emotions and other external signals, strategic decisions can be made quickly and factual information may lose sight of managers' rationale. While this thesis does not directly explore the forms of participation within innovation ecosystems, it is also important to consider that this may create a positive public image for the focal organization's technological initiatives and business models.

When discussing firms' posture, it is important to underpin the possible circularity in the conceptual model. Accordingly, as it is argued here a firms' posture may influence its managers' decision-making rationale and eventually its innovation strategy. At the same time, the very same innovation strategy appears to be the antecedent of firms' posture. Furthermore, with hindsight, it may not be clear whether firms are a part of an innovation ecosystem as a result of their strategic goals or they are inherently in one because their core service/product is an innovation. Therefore, it is important to clearly define when the firms' posture is relevant to managers' decision-making. Scrutinizing one's innovation strategy ex-ante may yield unsound judgements. Bearing this in mind, firms' posture can only be observed only after the strategies are executed by managers. On the same vein, the time span when this thesis was conducted is not lengthy enough to observe a circularity between managers' strategic decisions, firms' innovation ecosystem strategies, and firms' reputations. In addition, firms' reputations do not only depend upon their innovation ecosystem strategies, but also how they interact with the end-customer through marketing and communication channels. While this could be a fruitful avenue for future marketing research, it is not the intention of this thesis to include it in the current conceptual model.

Ecosystem related uncertainties represent both technological, behavioral, and environmental uncertainties concerning the ecosystem and its actors (Möller & Halinen, 2017). The commonalities between firms' outputs start to become more visible and the understanding of the cross-product architectures that can create value for the end-customer increases, as firms establish ecosystem strategies (Schroth & Häußermann, 2018a). However, these new product architectures and strong interdependencies may come with additional costs or cause losses. For instance, Adner and Kapoor, (2010) argue that firms' technology advantage decrease with challenges due to complementors. This is mainly because of the multivocality in an innovation ecosystem. The hardship for managers is that they need to think in terms of multicriteria decision-making as every decision has different outcomes for different actors (Bruijn & Heuvelhof, 2008).

Access to capital was acknowledged by a number of expert interviewees as the flexibility of firms' innovation budget, which may grant managers the freedom to experiment with new contractual agreements, collaborative research, or development projects. Since it is argued that value co-creation is influenced from financial resources of the focal firm (Rubens et al., 2011), depending on the volume of the innovation budget one's intentions and ways to join forces with others may vary.

While *access to capital* is a part of the focal firms' internal organizational context, it also has significant influence on the macro-level capacity of an innovation ecosystem. For instance, on a macro level, many oil producing regions rely on oil and gas firms' revenue to finance development projects (Correlje & van der Linde, 2006). The likelihood of a global economic slowdown may shrink the profitability of energy as well as construction companies and, in return, this could affect the capital saved for innovative activities. This factor's degree of influence may vary depending on the capital intensity of the sector.

Legislative impositions by regulators and governmental institutions have significance impact on the creation of innovations, and so innovation ecosystems. Regulatory processes observe and control innovation with appropriate laws and legislations (Pries & Dorée, 2005). Thus, certain legislative impositions on the ecosystem or firm may alter the strategic decisions of firms and/or kill it all together. Also, the regulator can prescribe certain technologies, which are supported by certain ecosystems. At the same time, impositions of the regulator do not necessarily carry negative outcomes, they may also flourish new partnerships and network ties.

Innovation culture is argued to influence firms' innovation ecosystem strategies on both sectoral and individual levels. This is due to the belief that collaboration occurs on an individual level (Mattila, Eisenbart, Kocsis, Ranscombe, & Tuulos, 2019), thus decisions are made and actions are taken in the context of existing network ties and cultural fit. An innovation culture that values and rewards innovative experiments may approve actions favoring innovation ecosystems. Here, culture comprises the behavior to spark new insights and ideas; welcoming transformation. It can be assumed that the managers are often reluctant to challenge the current norms in firms where the innovation culture is premature. A more entrepreneurial culture, on the other hand, may allow managers to think in terms of the marketplace and adapt to the fluctuating realities swiftly.

Availability of a new market opportunity is grounded in Zahra and Nambisan's (2012) ‘The Orchestra Model.’ According to the authors, the model is explained as “a group of firms coming together to exploit a market opportunity based on one explicit innovation architecture/platform defined and shaped by a dominant firm, or the keystone player” (p. 222).

Accordingly, interdependence and interconnectedness between firms is a well-known phenomenon which is believed to be some of the key attributes of innovation ecosystems. Nevertheless, considering firms’ innovation strategies, neither interdependence nor interconnectedness are new to the academic literature or the praxis. What is new through innovation ecosystems, however, is that firms with diverse value-propositions can find a common ground to serve new value. In some circumstances this ground can be the start of a new market that is yet to exist. The coupling of learnings and technologies from different sectors can be the creators of this new market. Firm ecosystem strategies thus can be directed toward discovery of these new opportunities rather than just being limited to improving internal processes and existing markets. A representation of the complete conceptual model can be seen in Figure 2.4.

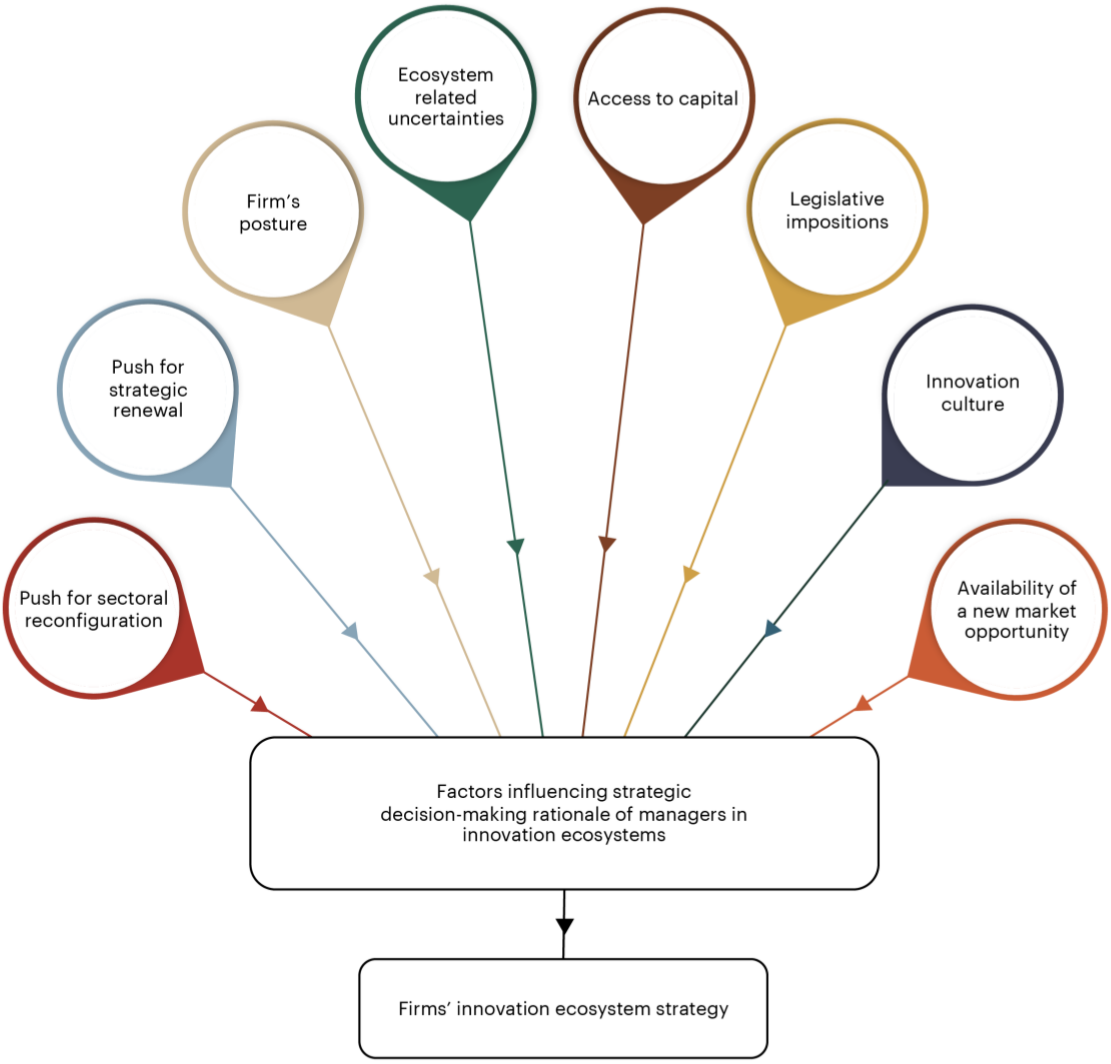

Figure 2.4. Conceptual model.

Chapter

3 Research Methodology

As was pointed out in the introduction to this work, my first and foremost aim is to identify the critical factors (see Chapter 2) influencing managers' strategic decision-making rationale in innovation ecosystems. Accordingly, the main research question raised is exploratory in nature. The reasons to adopt an exploratory inquiry is threefold. First, the topic is highly complex and there is not much is known about the rationale behind managers' strategic decision-making in innovation ecosystems. As it was discussed in the previous chapter, this thesis was unable to identify a previous study in which factors influencing the managers' decision-making (and in return the strategy employed by the firm) was addressed. Second, the existing research falls short on drawing a visible line in between innovation ecosystems and managers role, thus it is not yet clear what are the practical outcomes of innovation ecosystems. Finally, an advantage of exploratory investigations is that they are adaptable and effective in laying a groundwork for future research.

In this chapter, I will start by presenting a more detailed account of the research strategy (Section 3.1) and appropriate data collection methods that are used in this thesis (Section 3.2). This includes the search description and selection criteria for the contextual information, selection of the sample population, and finally how this approach fits the overall research design. Furthermore, I will touch upon the practical limitations of the theoretical framework. Finally, I will explain the data analysis process, including Best-Worst Method used to rank factors' degree of influence, and the mathematical model that was used to process accompanying survey data (Section 3.3).

3.1 Research approach

Previously, this thesis introduced a conceptual model including the eight so-called factors influencing managers' strategic decision-making rationale in innovation ecosystems (see Chapter 2). This conceptual model needs validation. The validation can be made through analyzing either or both qualitative (e.g. interviews) and quantitative data (e.g. surveys). Previous studies on assessing individuals' decision-making rationale have used survey-based data collection methods in order to quantitatively estimate a given conceptual model (Mi, Tang, Liao, Shen, & Lev, 2019; van de Kaa, Fens, & Rezaei, 2018). Nevertheless, some limitations of survey-based data collection methods include respondent bias, incorrect reporting, or incomplete analysis due to errors in the conceptual model. Another issue may be related to the insufficient selection of the respondent sample. If the questions are not asked properly and to the right people, the answers may consist perceptions of the respondent. Since, this study deals with the decision-making rationale of managers, it is vital to distinguish between the perception of the respondent and what actually happens on the ground. Moreover, many widely used survey methods, such as Likert-scale, fall short in capturing the reasonings of the respondents for their answers.

As noted in the introduction to this chapter the main inquiry of this thesis is exploratory. Explorative studies often depend on qualitative approaches to data gathering which may decrease the validity of the data due to respondent bias (Sekaran & Bougie, 2016). Nevertheless conducting interviews with managers and academics from the ecosystems field on such a complex subject can yield more in-depth information about the managers' decision-making rationale and factors influencing them. In fact, previous studies exploring the innovation ecosystem concept have made use of interviews (Ketonen-Oksi & Valkokari, 2019; Rubens et al., 2011; Valkokari et al., 2017). In order to overcome aforementioned constraints of using a single data collection and analysis method, as well as to increase the validity of the collected data, this thesis will use data triangulation. In line with the triangulation principles, the main objective of this thesis requires analysis of multiple data sources (Sandelowski, 2008). Accordingly, the context of the problem was set through a critical literature review in Chapter 2. This made it possible to reflect on the first, second, and third sub-research questions. To contemplate the main research question, it is the intention of this thesis to: first, distinguish the factors influencing managers' strategic decision-making rationale through coupling the data gathered from the *literature review* and *expert interviews*; second, validating the conceptual model via *surveys*.

The latter (empirical evaluation process) can be done through different channels, such as structural equation modelling (SEM). However, this thesis will employ a multi-criteria decision-making method (MCDM) called the Best-Worst Method (BWM). There are various reasons to select the BWM over similar quantitative analyses methods. First, since, the business strategists and nowadays innovation managers are responsible for choosing, creating, and executing one strategic alternative over the other, the problem here can be formulated as a decision-making problem. Therefore, and in line with the main objective of this thesis, relevance, and credibility of the factors that were initially determined can be analyzed using a BWM survey. Recall that this thesis set the boundaries for the current study as energy and construction sectors and innovation as a product. Accordingly, modeling logic behind BWM can provide the researcher, the information about the relative weight of each and every factor in different sectoral contexts. The same modelling logic also makes the interpretation of the survey data less cumbersome compared to other methods (Rezaei, 2015). Further details about the advantages of employing BWM will be discussed in Section 3.3.2.

3.1.1 Selection of the energy and construction sector

As it was mentioned in Chapter 1, this thesis investigates managers' decision-making in two different sectors: the energy and construction. Previously, studies investigating the managerial implications of the innovation ecosystem concept mainly focused on high-tech industries (e.g. aerospace, telecommunication, computing etc.) (Adner & Kapoor, 2010; Chesbrough & Appleyard, 2007; Li, 2009; Ritala et al., 2013, 2014). For instance, in an investigation focusing on the value creation and capture mechanisms in innovation ecosystems Ritala et al. (2013) compare aerospace and ICT sectors. The authors conclude that managers in both sectors are having challenges not because of technological nature, but because of "managing and facilitating the collaborative innovation between many partners (as opposed to just suppliers)" (p.21). In another recent study, focusing on the managers' motivation to participate in innovation ecosystems, Schroth and Häußermann (2018b) look into microelectronics sector in Germany and suggest that innovation ecosystems provide cross-sectoral collaborations between firms which tests firms' managers' adaption capacity.

Furthermore, the gradual inclusion of digital data into a broad spectrum of products and services and the consequent rise in digital innovations has enhanced the significance of innovation ecosystems as a context for inter-industrial collaboration (Nambisan & Baron, 2013). The very same fact also has led firms in some sectors, like the automotive sector, to tap into innovation ecosystem-like structures far before than others (Pierce, 2009). As it was mentioned in Section

2.1.1, value network in an innovation ecosystem is significantly different from a hierarchical (supply chain) system. Pierce (2009) claims that in the automotive industry large car manufacturers are surrounded by a network of suppliers, complementors, and customers which resembles an ecosystem, rather than a strict supply chain. He further argues that in such networks, one key firm's input/output can impact the economics of the whole ecosystem. In fact, for the last couple decades the automotive industry has been showing strong enthusiasm for new value offerings and business models which are data-driven (Pierce, 2009). This in return requires firms and so managers to adapt their market perceptions to the changing realities. Moreover, it also mandates managers to scrutinize their decisions and decision-making processes.

The increasing cooperation through interdependent network structures is a topical issue for a diverse range of sectors, including the energy and construction. Pulkka et al. (2016), argue that the ecosystem concept ought to be generalizable across sectors. Nevertheless, so far the ecosystems literature is lacking the perspective of the energy and, specifically, the construction sector. By looking at the previous literature, it can be drawn that this may be due to slowly moving inclusion of data-driven, digital business models in these sectors. Nevertheless, the increase in the rapid commercialization of the ICT technologies and enthusiasm for digitalization, virtualization, and smart technologies, the energy and construction sectors are transforming from their traditional supply systems into 'innovative' ecosystems (Mattila et al., 2019). Accordingly, if this switch and the previous ecosystem efforts investigated by the scholars are taken into account, the most interesting way to analyze the managers' decision-making rationale in innovation ecosystems is to look into energy and construction sectors, where the governance mechanisms of network structures is only just changing for managers. Notably, this change requires the attention of managers, as they are the individuals who will steer their companies in their respective competitive markets. In the automotive sector discussed before, this switch took place decades ago. Managers in both the energy and construction sectors make strategic decisions under the innovation ecosystem circumstances. This adds additional uncertainty into their decision-making processes and thus is worthwhile to investigate.

3.1.2 Applicability of the innovation ecosystems concept into the energy and construction sectors

Before finalizing the reasonings for the selection of the energy and construction sectors, this thesis also needs to touch upon the applicability of the innovation ecosystem concept into both these sectors. So far, various scholars built their innovation ecosystem frameworks in the energy industry over a traditional value chain structure. This includes production, trade, transmission, distribution, metering, supply and usage by the end consumer. Of course, over the years this view has proven to be correct and in fact a status-quo for the energy markets, yet it falls short in capturing the essence of ecosystems. Until now, much has been discussed and observed in the extent literature about the actors, their involvement and new business venues within the energy value chain, but not explicitly on ecosystems apart from some scholars. Being one of them, according to Yakovleva and Volkova (2018), energy ecosystems are a plateau of entities with much power held by large scale energy production firms, who are not concerned about establishing partnerships. Needless to say, it is possible to observe a change in the industry to a more nonlinear network structure. Accordingly, sectors which are subjected to turbulence (due to regulation, customer behavior etc.) are more prone to transform. In the case of energy sector, this turbulence is a combination of the influence of the circular economy and renewable technologies (Hoppe et al., 2018). Innovation ecosystems offer large scale global energy firms a different lens to capture hidden or not yet existing opportunities in their respective business environment via differentiated business plans, digitalization, and/or technological transitions (Ferrary, 2003).

Previously, strategy management scholars argued that construction firms are cost driven and thus traditional or inward-looking (Pries & Dorée, 2005). Furthermore, some scholars suggested that innovative efforts in the construction industry are seldom long-lived (Dubois & Gadde, 2002). Consequently, the past couple decades, have revealed that innovation in construction industry stems from demands for sustainable development and operational supremacy (Wilson & Rezgui, 2013), be it energy efficiency, smart buildings, choice of materials or smarter digital processes. Thus, construction firms rely on other members who can provide the necessary skill sets or technologies. Therefore, the concept of innovation ecosystem can also be introduced in the context of the construction industry. In fact, in their study where Pulkka et al. (2016) sought to “examine the relationship between ecosystem characteristics and value creation in construction networks...” (p.141), the authors were able to observe nine distinct characteristics of innovation ecosystems within the context of the construction sector.

3.2 Data collection

Just like firms pursuing ecosystem strategies, a research also employs actions to achieve its specific set of goals, pre-eminently answering the research questions. To do so, traditionally, explorative research applies qualitative approaches to data gathering (e.g. interviews, informal discussions, focus groups, and case studies) (Sekaran & Bougie, 2016). Due to the complicatedness of the research, the overall methodological approach for investigating the addressed problem is mixed. That is, the data that has been gathered is both qualitative and quantitative in nature – specifically, secondary sources and semi-constructed interviews, which were followed by expert surveys (see Sections 3.2.2 and 3.2.3 of this chapter).

To begin with, the contextual information discussed in Chapter 2 was gathered through peer-reviewed published work available on the internet. Following this, a preliminary assessment was made on the factors influencing managers' strategic decision-making rationale within innovation ecosystems. Additional data were collected using semi-constructed interviews on sector-specific knowledge and practical implications of ecosystems within innovation management. The data collection in this thesis occurs on the individual level, meaning that the unit of analysis is the managers who make decision. and with the experts in the field who are experienced with/in innovation ecosystems. The interviews were held on multiple online telecommunications applications, namely, Zoom.us and Skype for Business. Interviews were recorded on the researcher's personal laptop and automatically transcribed via an audio transcription software called Sonix.ai.

One's decisions are value-laden and expressing values with numerical data sets with classical mathematical or statistical tools is cursory and thus cannot provide satisfying evidence for socio-political reasonings. To address this issue and to establish whether which of the factors found are more relevant to managers in both sectors, an MCDM tool, namely BWM was used. For this purpose, all participants were sent a BWM survey, through which they were able to assign importance weights on the factors to determine the degree of their influence.

The data collection method used in this work is not without limitations. To start with, given the keywords chosen, a complete scanning of all the relevant articles to this research and innovation ecosystems may not have been achieved. So, published work that addressed innovation ecosystems and its applicability in both energy and construction sectors may have been left out due to different labels used to explain the same phenomenon. As with every data gathering method that deal with real human subjects, respondent bias should be considered as a likelihood that can surface both during the interviews and filling in the surveys. In the same vein, ambiguities are an inherent part of human language, thus the data obtained from the interviews should be approached with care. Additionally, the survey shared with the respondents only represent a specific portion of the companies and managers who work actively within ecosystems. Moreover, since the sample comprises those managers of global companies who only operate within Europe, it is possible that this representation may be limited.

3.2.1 Literature search description & selection criteria

The main research question raised in this thesis not only requires a detailed analysis of the ecosystem concept, but also the existing collaborative landscape, as well as managers' strategic decision-making styles. Thus, to serve the purpose of the main and sub research questions, the search activity was divided in different literature streams, namely, ecosystems (including the historical perspectives and roles of the ecosystem actors); an overview of the firm strategies; and managers' decision-making style in innovation ecosystems.

The literature search was started with the identification of relevant keywords to be searched on online repositories. The literature on 'ecosystems' is scattered and over the years scholars have proposed numerous terms that define the same concept, leading to conflicting analysis. Thus, to provide a robust orientation of the previous literature on innovation ecosystems, attention must be paid to the selection of the search terms. Selected keywords came after a thorough consideration of the discourses in this field and observing various published articles. The keyword search was conducted on the two online publication databases, namely *Scopus* and *Web of Science (WoS)*. Table 3.1, portraits the aforementioned research log including the scope and the daily records of the research. The following arguments were effective in choosing the WoS as the main source of publications used in this research and Scopus as a benchmark. Firstly, scholars argued that WoS provides the largest volume of quality publications and journals (Ball & Tunger, 2007). Secondly, in a study investigating citation tracking, Bauer and Bakkalbasi (2005) considered WoS as the most useful when it comes to retrieving older sources. Lastly, drawing on an extensive set of sources, Hicks and Wang (2011) show that publications included in Scopus are already included in WoS and therefore, are suitable for this thesis.

During the initial inquiry the following keywords: 'innov*', 'ecosystem', and 'business*' were used. Although the keyword 'business' seems indistinct, it was included because of the link between the innovation ecosystem concept and business ecosystems. It is important to notice that prior to this work, number of studies suggested that while in some instances these two concepts are used as synonyms, in others they were depicted differently. Understanding the evolution of business ecosystems and not only innovation ecosystems therefore, might help us to realize the shared attributes and differences between them. By addressing business ecosystems this review will be able to build a rigorous discourse around innovation ecosystems.

Due to the multidisciplinary and everlasting nature of the keywords, there is a strong need to filter the search inquiries. That being the case, this thesis only includes peer-reviewed papers, conference proceedings, books, and top management magazine articles that were published between the years 1999 and 2019. This was done to keep up with the comparatively recent academic knowledge and eliminate the obsolete ones. However, the earliest known application of the ecosystem analogy within business setting dates back to Moore's (1993) seminal paper (Suominen et al., 2019) which is also included within this review. In addition, attention paid to the area of discipline which selected publications belong to.

Table 3.1.

Online database search records

Main subject	Database	Inquiry date	Scope of search	Initially found references	Refining scope	References after refinement	Selected references among the bulk
Innovation Ecosystem	Web of Science Scopus	February 6, 2019	Title: 'innov*' AND 'ecosystem' AND 'business*' Published Papers, Books, Book Chapters 1999 -2019 Title: 'innov*' AND 'ecosystem' Topic: 'literature' OR 'taxonomy' Published Papers, Books, Book Chapters 1999 -2019	*155* *111*	WEB OF SCIENCE CATEGORIES: Management OR Business OR Economics	*58 Papers* *2 Conference Proceedings* *2 Books* *2 Reports*	*27 Papers* *2 Conference Proceedings* *2 Books* *1 Report*
Energy Sector Collaborative Innovation Landscape	Web of Science Scopus	February 20, 2019	Title: 'energy*' AND 'ecosystem*' Published Papers, Books, Book Chapters 1999 -2019 Title: 'energy' Topic: 'innovation' AND 'business*' Published Papers, Books, Book Chapters 1999 -2019	*401* *24*	WEB OF SCIENCE CATEGORIES: Management OR Business OR Business Finance OR Economics	*11 Papers* *11 Papers*	*1 Paper* *N.A.*
Construction Sector Collaborative Innovation Landscape	Web of Science Scopus	April 20, 2019	Title: 'construction' AND 'ecosystem*' Published Papers, Books, Book Chapters 1999 -2019 Title: 'construction' Topic: 'innovation' AND 'business*' Published Papers, Books, Book Chapters 1999 -2019	*104* *130*	WEB OF SCIENCE CATEGORIES: Management OR Business OR Business Finance OR Economics	*1 Papers* *84 Papers* *1 Conference Proceeding*	*1 Paper* *4 Papers* *1 Conference Proceeding*
Decision-making style	Web of Science Scopus	May 20, 2019	Title: 'decision-making' Topic: 'innovation' AND 'business*' Published Papers, Books, Book Chapters 1999 -2019	*69*	WEB OF SCIENCE CATEGORIES: Management OR Business OR Economics	*4 Papers*	*3 Papers*

Accordingly, papers from disciplines other than management, business, and economics; law were excluded. The main reason to exclude other disciplines is to maintain the scope of this review and at the same time eliminate the search results with the secondary importance. On the same note, it was noted that a large majority of articles were published in the publications of management; policy and economics. In addition, the literature search results were scanned to see if they aligned with the required results. If not, this method has been repeated until the required results have been achieved.

All of the initially discovered papers were further evaluated, including the reading of abstract and performing a brief assessment of the paper's journal quality and citation network. At this stage, papers with no-citations were excluded in order to enrich the bibliography. As a result of the whole preliminary process, 125 papers and 1 report were excluded due to the fact that their core research themes fell out of the scope of this literature review. The remaining 36 papers, 3 conference proceedings, 2 books, and 1 report were selected for a comprehensive review including the reading of introduction and conclusion chapters. During the analysis of the chosen readings, 16 more papers and 3 books were also recognized as fitting to the purpose of this research, since they were frequently cited in the references of selected publications (backward search). Table 3.2, reflects the aforementioned backward search record.

Table 3.2.
Backward reference search record

Main subject	Inquiry date	Backward Search	Selected references among the bulk
Innovation Ecosystem	March 1, 2019	*15 Papers* *3 Books*	*12 Papers* *3 Books*
Energy Sector Collaborative Innovation Landscape	March 3, 2019	*2 Papers*	*2 Papers*
Construction Sector Collaborative Innovation Landscape	April 9, 2019	*2 Papers*	*2 Papers*

3.2.2 Selection of the interviewees

This thesis pursues data triangulation in achieving in-depth insights on the topic. The primary data compromises the interviews with practitioners from both energy and construction sectors and academics whose core research area falls into ecosystems and innovation management. The target population for the interviewees includes managers and consultants who currently have active roles in strategic decision-making with regard to multi-partner relationships. The approached population come from leading firms and universities in their respective area who operate in the Netherlands, France, Finland, Germany, and Belgium. Moreover, it was the intention of this research to set a fine balance between the number of approached practitioners and academics in the field. Also, the number of practitioners approached for an interview both from energy and construction sectors are approximately the same. Concerning the sample population, interviewees were selected through the personal network of the researcher acquired during a six months long internship at Accenture, the Netherlands.

Among the initially sent 25 interview invitations, only 14 were scheduled within the allocated time for the data gathering process. In line with the research planning, all of the semi-constructed interviews took place during the month of June and each interview lasted between 45-60 minutes. The themes of the semi-constructed interviews were related to general information about the innovation ecosystems and the research objective. These include, the firms' strategies in ecosystems, the drivers behind firms to join an ecosystem, the differences between then and now about inter-industry partnerships in comparison to previously suggested collaborative frameworks, the internal and external factors influencing the manager's decisions related to ecosystem strategies, as well as the importance of technology and innovation in empowering firms to look for new opportunities outside their core offerings. Table 3.3 shows the interviewee details, including their area of expertise and current role. In line with the grounded theory guidelines, the interview process was terminated after reaching a theoretical saturation point, where additional interviews generated no new insights

Table 3.3.
Interviewee details

#	Background	Expertise	Function
1	Academia	Strategy consulting. Alliances, networks, open innovation and partnerships.	Professor of Management and Organization
2	Academia	Collaboration models, innovation, and ecosystems.	Research Manager
3	Academia	Emergence of innovation ecosystems and entrepreneurial ecosystems. Strategic implications of technological evolution and diffusion of innovations	Research Fellow
4	Industry	Business, technology and ecosystem strategies.	Innovation Lead

Table 3.3, Continued.
Interviewee details

#	Background	Expertise	Function
5	Industry	Ecosystem strategies, focused on technology partners. Experienced in business process, business transformation, and enterprise architecture.	Ecosystems & Ventures Lead
6	Industry	Former architect. Expertise in urban planning projects. Nowadays focused on growth strategies and leveraging new technologies.	Business Strategy Consultant
7	Industry	Expertise in energy utilities as well as oil and gas sectors, specifically digital transformation projects.	Managing Director
8	Industry	Expertise in digital business transformation, from strategy, business process, people, organizational change and technology.	Senior Manager,
9	Industry	Business strategy on construction and energy utilities sectors.	Senior Manager
10	Industry	Construction related digitalization projects. Several publications on innovation management related topics.	Project Manager, Research & Digitalization
11	Industry	Corporate mergers and acquisitions strategies	Strategy Director
13	Industry	Expertise in the energy and construction sectors. Leading global digital transformation projects.	Group Executive Innovation & Transformation
14	Industry	Former experience in corporate strategy and business transformation consultancy focused on construction sector. Nowadays R&D projects, SME partnerships, and open innovation.	Startup Accelerator Manager

During the semi-structured interviews, it was the intention of the researcher to ask questions that will trigger interviewees to participate eagerly. At the beginning of the interviews the interviewees were purposefully asked general open-ended questions to help the researcher get a broad idea about the interviewee’s stance regarding the innovation ecosystem concept. Once the meet and greet and open-ended questions are covered, the interviewees were briefed about the researcher’s findings from the available literature and informed about the definitions of concepts in this study. In order to ensure the interviewees’ credibility throughout the interview, the researcher repeated and/or paraphrased some of the answers given by interviewees. Due to the nature of the semi-structured interviews, not every interviewee was asked the same set of questions. Moreover, depending on the background of the interviewee (academic, manager, consultant etc.) some questions were modified to fit the context. For instance, on the subject of ecosystem collaborations in their own sector, interviewees with a construction background were asked *in what ways do they think the ecosystem collaborations formed in the construction sector have changed due to digitalization in recent decades?* On the other hand, interviewees with an energy background were asked *in what ways do they think the ecosystem collaborations formed in the energy sector have changed due to energy transitions in recent decades?*

3.2.3 Selection of the survey respondents

The survey invitation was sent to practitioners with substantial expertise in the energy, utilities, and construction sectors, as well as academics of innovation management. The respondents were selected according to their current positions in their respective sectors, and familiarity with the ecosystem strategies. Due to the researcher's personal network at Accenture B.V. initial selection of the respondents include Accenture employees from Netherlands, France, Belgium, and Germany and as well Accenture client companies from the respective sectors. To reach a sufficient number of respondents, this thesis also used snowball sampling along with convenience sampling. Accordingly survey invitations were sent to 30 experts via private e-mail and LinkedIn. Many of them were followed by three reminder e-mails over a period of one month. The effective responses after this period was 7. The survey template can be found in Appendix B.

3.2.4 Validation

To ensure the construct validity, in addition to the semi-constructed interviews, multiple other data sources such as news media, web articles, the presentations provided by the practitioners' companies are reviewed. Furthermore, in order to prevent any misunderstandings, the interviewees were sent an interview protocol prior to the meeting. Due to the nature of the semi-constructed interviews not all 14 interviewees were asked the exact same questions. Nevertheless, to ensure the internal coherence of the study the researchers findings from the theoretical orientation and the current conceptual model were shared with the interviewees. Moreover, to keep the same level of judgement about the discussed concepts, every interviewee, first, was asked about their own perspective of innovation ecosystems and was told what the researcher means by the innovation ecosystem concept.

In addition, the validity of the data collected through expert interviews needs to be approached with caution due to several reasons. Firstly the interviewed experts do not represent the overall population of innovation managers. This is not only because of the sample size, but also because all interviewees were selected according to their backgrounds, specifically if they had any experience with the innovation ecosystems concept. Accordingly, collecting qualitative data only through experts, can mislead our understanding of the current situation in the industry and whether the majority of the managers think in terms of the ecosystems or they have other types of conceptualizations. Second, and in line with the previous, the interviewee answers may be loaded with perceptions due to their proficiency in the ecosystems concept. However, these perceptions of experts and actual behaviors of managers may differ in practice. Therefore, in order to minimize the possible interviewee bias, the interviewees were specifically asked about their decision-making processes, and experiences with innovation ecosystems concept.

3.3 Data analysis

Data analysis was carried on both for the qualitative (interview) and quantitative (BWM survey) data. The qualitative data were analyzed in accordance with the grounded theory practice (Sekaran & Bougie, 2016) and the quantitative data were analyzed in two levels: within and between the energy and construction sectors in order to compare the hidden patterns and peculiarities among sectors.

3.3.1 Data coding process

The interviews were recorded and then transcribed before being analyzed for intersecting topics/keywords among each other. This analysis was done in accordance with grounded theory practice using the ATLAS.ti software. Accordingly, the following step-by-step approach is pursued: Firstly, data gathered from the interviews were compared to the data obtained from the extant literature, in order to identify the list of common themes. Secondly, the transcribed interviews were broken down into line-by-line sentences. Next, each line (quotations) were explained using a word or word group (open coding). The following stage of the analysis process included the narrowing down the long list of codes into overarching groups (axial coding). During this process some codes were disqualified due to meager data points (selective coding). These steps were repeatedly applied to all 14 interview transcripts. In the end, the factors that are mentioned both in the extant literature and by interviewees were deemed as critical factors influencing the decision-making rationale of managers and used in the empirical investigation.

Appendix C depicts an example coding network (C.1) and a list of codes with the accompanying number of quotes (C.2). The conceptual model first derived from an exhaustive literature review and then discussed with interviewees. Accordingly the code families represent this conceptual model introduced in Chapter 2. In the case of *push for sectoral reconfiguration*, for instance, one interviewee quotes:

> The important part [of innovation ecosystems] is your go-to market. For instance, do you have a partner or client who already has a network of [desired] clients, or is there a [specific] client you want to include in your network?

As a result this quote was awarded by the researcher with the following two codes: 'market orientation' and 'go beyond the current customer.' It is important to note that the insights gathered from the interviewees during the course of the research did not result in any change in the conceptual model due to two reasons. First, all of the interviewees agreed upon the discussed factors that were initially located by the researcher and none opposed to any of the suggested eight factors. One (access to capital) but all of the eight factors were initially located in the extant literature by the researcher. After multiple experts mentioned the significance of access to capital in making their decisions this factor is also added to the conceptual model. On the other hand, through an iterative process of revising the theoretical discussions in the ecosystems literature, the factor access to capital was also located (Rubens et al., 2011).

Accordingly, the following three criteria were taken into consideration before including a factor proposed by interviewees (see Appendix A):

- The number of interviewees that mention the same factor needs to be more than one, in order to increase the validity.
- If the interviewees contradict among each other, a further analysis by the researcher is made to understand the differences in opinion. The choice to include or dismiss the suggested factor was, then, made according to the available literature (if exists) and the researchers analysis.
- In any case, the proposed factor by the interviewee, at least, needs to be explicitly stated in the extant literature.

3.3.2 Best-Worst Method (BWM)

The MCDM method that will be utilized in this thesis is BWM. First put forward by Rezaei (2015), BWM helps the decision-maker to solve multi-criteria decision-making problems by identifying which one of the criteria is more favorable than the other. Thus, it grants decision-makers the chance to evaluate a number of alternatives with respect to a number of decision criteria. This method is particularly useful in this thesis for various reasons. Firstly, as opposed to other comparison methods that are matrix-based,[1] BWM employs a vector-based comparison method which in turn requires fewer data, to begin with, and streamlines the data analysis

[1] The general rule of BWM requires only $2n - 3$ comparisons, provided that 'n' being the number of factors to compare, while, for matrix-based MCDM methods this value is higher.

process. Secondly, due to the structured process of gathering data and the pairwise comparison technique, the results of the BWM is more consistent and reliable. This pairwise comparison technique is the point of departure for BWM.

According to the BWM, first, the best and the worst (the most and least influential in this case) criteria are selected by the decision-maker and then the appropriate weights of each criteria are assigned through pairwise comparison. This process can simply be explained by determining one factor's dominance over the second one, through a third and relatively objective factor. In his seminal study Rezaei (2015), describes this technique by comparing multiple trees based on their heights. In the same line with his initial description, Figure 3.1 explains the same phenomenon and the underlying mathematical reasoning through geometric circles. Accordingly, when deciding on the direction and the level of magnitudinal difference (1 being the shortest and 9 being the tallest) between two trees (circles or factors), the decision-maker simply expresses their preference, i over j.[2] This comparison is rather easy when the decision-maker expresses which tree is taller than the other (e.g. $i > j$), but it becomes cumbersome when they try to assign the strength of the preference for each comparison they make (as in if we also include tree k in the list of trees). In other words, if one has to decide between one of the two extremes (e.g. shortest tree) and a third tree (k), it is most definite that they will assign number 1 to the shortest tree (j) and a number between 1 and 9 for the third tree (k). As a consequence, the set of comparisons can be divided into two groups, namely, reference comparisons and secondary comparisons. Reference comparisons can be defined as comparisons (a_{ij}) where i is the best element and/or j is the worst element. Secondary comparisons, on the contrary, are those (a_{ij}) where neither i nor j are the best or the worst elements. Below Figure 3.1. also depicts the reference comparisons (green) and secondary comparisons (red) for the same example explained above.

This logic also explains why BWM requires less data and is relatively easy to analyze as opposed to the other MCDM methods. Since, BWM relies on a vertical comparison scheme and deals with integers (from one to nine) instead of fractures, the contingent calculations are easier. More importantly, the consistency comes from depending on the secondary comparisons. Specifically, "while in most MCDM methods, consistency ratio is a measure to check if the comparisons are reliable or not, in BWM consistency ratio is used to see the level of reliability as the output of BWM is always consistent" (Rezaei, 2015, p. 58).

[2] The mathematical notation for this comparison is represented as 'a_{ij}'.

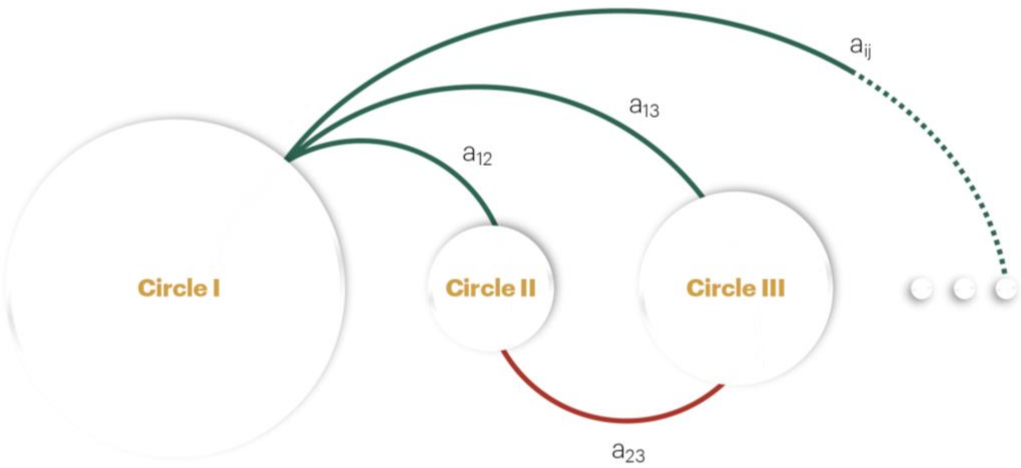

Figure 3.1. Reference and secondary comparisons.

BWM uses a five step approach in order to derive the weights of the factors (Rezaei, 2015). The steps are as follows:

I. Defining a set of factors. This step is done by the researcher through coupling the data gathered from literature review and expert interviews. A set of factors influencing the decision-making rationale of managers were identified and explained to the survey respondents.

II. Deciding on the best and the worst influential factors. The survey respondent decides on which of the factors presented influence the decision-making rationale when employing innovation ecosystem strategies.

III. Determining the degree to which the most influential (best) factor is stronger than all other factors (e.g. j) by using a numerical value from 1 to 9. Here the value 1 signifies that the most influential factor (B) is as equally influential as j, and 9 that it is extremely more influential than j. This results in a best-to-others vector, represented as:

$A_B = (a_{B1}, a_{B2}, a_{B3}, \dots, a_{Bj})$. It can be drawn from this representation that $a_{BB} = 1$.

IV. Implementing a similar approach for the least influential factor (worst). Accordingly, the comparison of all other factors to the least influential one will result in a others-to-worst vector, which can be illustrated as:

$A_W = (a_{1W}, a_{2W}, a_{3W}, \dots, a_{jW})$. Similarly, it is clear that $a_{WW} = 1$.

V. Finding the optimal weights $(w_1^*, w_2^*, w_3^*, \dots, w_n^*)$, through below mathematical model:

where $\sum_j w_j = 1$ and $w_j \geq 0$, for all j (1)

$\{|w_B - a_{Bj} w_j|\} \leq \xi^L$, for all j

$\{|w_j - a_{jw} w_w|\} \leq \xi^L$, for all j

By solving this equation it is possible to obtain the weights for each factor as well as the consistency ratio (ξ^{L*}). The more this ratio is closer to zero, the more consistent the respondent's answers are.

To translate the BWM survey outputs into meaningful results, the step-by-step computation explained above was done using the SOLVER extension on Microsoft Excel software. Next chapter introduce the results of the empirical investigation.

Chapter

4 Results

Returning to the subject of factors influencing managers' decision-making rationale in innovation ecosystems, this work previously discussed and proposed a conceptual framework based on the available literature and expert interviews. According to the methodology employed (see Chapter 3), now is the time to direct our attention to the empirical questioning of the conceptual model based upon the information gathered through the BWM surveys, and to analyze whether the predicted factors support the problem underpinned in this thesis.

The survey outputs were used to compute the weights and, by extension the significance rank of each factor. The overall response rate of the survey was poor, with only seven returned surveys out of 30. These results, therefore, need to be interpreted with caution. The scientific and social implications of the poor response rate will be discussed further in Chapter 5. Table 4.1 represents each respondents' consistency ratio (ξ^{L*}). A numerical value close to zero translates to a higher consistency of the respondent and vice versa (Rezaei, 2015). As far as the sample size is concerned, all the respondents have shown acceptable consistency in their answers: the average consistency ratio is 0,04 and the highest individual consistency ratio is 0,20.

Table 4.1.
Respondents' consistency ratios (ξ^{L*})

	Respondent (#)						
	1	2	3	4	5	6	7
Consistency ratio (ξ^{L*})	,05	,06	,05	,04	,20	,05	,05
Average (Av.) consistency ratio		,04					

To begin with, Table 4.2 provides an overview of the weights and the ranking of each of the eight factors in accordance with each respective respondent. As can be seen from the table (below), the results indicate that respondents perceive the *push for strategic renewal* as the most important factor influencing managers' strategic decision-making rationale in innovation ecosystems. Furthermore, from a decision-maker's point of view, following *push for strategic renewal*, *availability of a new market opportunity*; *firm's posture*; *push for sectoral reconfiguration*; and *innovation culture*; appear to be the most influential factors, consecutively. On the other hand, *access to capital*; *ecosystem related uncertainties*; and *legislative impositions* strike to be the least influential factors, in the order of descending importance.

Table 4.2.
Average weights and importance rank of the factors

	Calculated weights per respondent (#)							Av. weight	Rank
Factors	1	2	3	4	5	6	7		
Push for sectoral reconfiguration	,136	,121	,241	,153	,101	,041	,114	**,129**	4
Push for strategic renewal	,062	,311	,151	,153	,201	,268	,282	**,204**	1
Firm's posture	,091	,182	,151	,153	,101	,162	,114	**,136**	3
Ecosystem related uncertainties	,091	,073	,060	,102	,057	,108	,068	**,079**	7
Access to capital	,222	,073	,151	,037	,080	,108	,114	**,112**	6
Legislative impositions	,136	,029	,020	,061	,057	,024	,025	**,050**	8
Innovation culture	,091	,091	,075	,077	,201	,162	,171	**,124**	5
Availability of a new market opportunity	,173	,121	,151	,263	,201	,127	,114	**,164**	2

According to the comparison of the factor weights, presented in Table 4.2, it can be drawn that respondents do not share a unanimous opinion on the selection of the most influential factor. Nevertheless, it is significant that both *push for strategic renewal* and *availability of a new market opportunity* are ranked most highly influential across surveys. A possible explanation for this might be that both of the factors have roots in the emergent norms that the innovation ecosystem introduced to the innovation management practice (see Chapter 2). Furthermore, respondents who reported higher levels of *push for strategic renewal* also reported significantly higher levels of *innovation culture*.

What is interesting about the data in this table is that, when observed closely, every respondent individually deemed *legislative impositions* and *ecosystem related uncertainties* as the least favorable factors to influence the managers' strategic decision-making rationale. While the influence rank of these factors may vary for each respondent, it is certain that this result is somewhat counterintuitive compared to what has been argued in the innovation management literature so far. This discrepancy could be attributed to the respondents' stance in their current roles and interests, working as senior managers on innovation projects. In such a population, the element of uncertainty together with legislative supervision are perceived as colliding with the possibility of the value created by the innovation.

Surprisingly, no strong evidence was found for *innovation culture* having a substantial degree of influence. Only a minority of the respondents (#5, #6) considered *innovation culture* as more influential than some other factors, and even then, the level of importance could not make it to the top of the chart. In general, however, the differences between the relative importance of the analyzed factors were narrow. This may indicate the interdependence of the factors when considered under the innovation ecosystem context. While the reasons for this and the aforementioned findings can be multifold, an exhaustive discussion of the results will be made in Chapter 5.

Until now, the interpretation of the empirical evidence was done based on the calculated average weights of the factors. However, one shortcoming of this approach is that average weights are susceptible to outliers. For instance, the mean value will presumably be affected in the case of a calculated weight that is far away from the rest of the data. Thus, both the median and standard deviation values should be analyzed along with the average to allow a better understanding of the concentration of respondents' answers. It is important to note that this approach does not try to infer *why* the respondents' selection of a specific factor is dominant over the other. Rather, my intention lies in the reliability of the factor comparison. Specifically, it is useful to compare the calculated average weights with the median values which are refined from the so-called outlier effect. From a behavioral aspect, behind managers' strategic decision-making rationale, a small standard deviation value translates into greater harmony between the individual answers, while a large deviation indicates the difference in opinions between the respondents. Table 4.3 provides summary statistics for each factor. Accordingly, based on the median values, the order of the importance among factors remains the same. This lack of change in the factors' ranking validates the initial interpretation of the results.

Table 4.3.
Mean, standard deviation, and median values per factor

	Factors							
	Push for sectoral reconfiguration	Push for strategic renewal	Firm' s posture	Ecosystem related uncertainties	Access to capital	Legislative impositions	Innovation culture	Availability of a new market opportunity
Mean (Av.)	,129	,204	,136	,079	,112	,050	,124	,164
Standard Deviation (σ)	,060	,088	,034	,020	,060	,041	,052	,053
Median	,121	,201	,151	,073	,108	,029	,091	,152

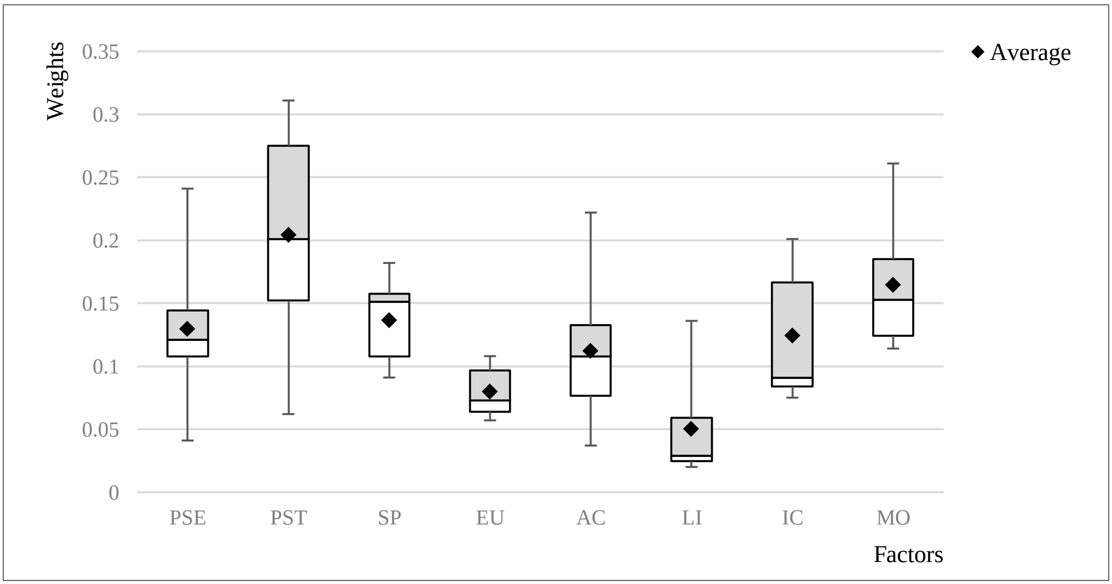

Figure 4.1. Average and median factor weights

In some cases, however, the standard deviation values are relatively larger (PST: 0,089 and AC: 0,066), indicating a widely distributed data set, and so, a large variation among individual responses. While this may be attributed to the respondents' individual rationale, it is strongly correlated with the small sample size analyzed in this thesis. As can be seen in Figure 4.1 (above), for instance, the box-plot for the factors *legislative impositions* and *innovation culture* shows how much an individual respondent's answer can tweak the standard deviation value for the same factor. Therefore, a larger sample size would give us more reliable data, since the representation of the population increases in parallel with the increase in the sample size.

The data gathered is not without outliers. For instance, in the case of *push for strategic renewal, access to capital,* and *legislative impositions,* respondent #1 gave significantly different answers than the rest of the respondents. Although the fact that *push for strategic renewal* and *legislative impositions* are almost unanimously considered as the most and least influential factors respectively, respondent #1, specifically, noted that the managers show opportunistic behaviors when making decisions and thus they do consider controllable and tangible factors more during the decision-making process.

This is also the single most striking observation to emerge from the data comparison. Specifically, the reason why respondents with an industry background do not find the legislative impositions as influential as an academic may be due to the fact that managers cannot control the regulatory processes and thus they do not believe that it is as influential as other factors. In many cases, regulation is taken for granted and considered as an uncertainty in strategic decision-making. Thus managers only do take actions following a certain regulatory change. Nevertheless, this still does not indicate why respondent #1 with an academic background finds *push for strategic renewal* less and *access to capital* more influential than others. An explanation for this may be the individual's assumption of managers.

4.1 Sectoral comparison

The following analysis is concerned with the respondents' perspectives in their respective sectors and whether there will be any differences in factors' influence ranking between the sectors. Table 4.4 provides an overview of the average factor weights for each sector. Accordingly, the survey data is first categorized into two sectors, depending on the respondents' prior experience within the sectors that are under study. As a result, except for respondent #1, who has an academic background, the remaining six respondents were distributed into even groups of two.

Table 4.4.
Sector specific weights and ranking of factors

	Sector (*N responses*)					
	Energy sector *(N=3)*			Construction sector *(N=3)*		
Factors	Av. weight	Rank	Consistency ratio	Av. weight	Rank	Consistency ratio
Push for sectoral reconfiguration	,092	6	,05	,125	4	,10
Push for sectoral renewal	,287	1		,221	1	
Firm's posture	,152	2		,145	3	
Ecosystem related uncertainties	,083	7		,077	6	
Access to capital	,098	5		,063	7	
Legislative impositions	,026	8		,049	8	
Innovation culture	,141	3		,123	5	
Availability of a new market opportunity	,112	4		,195	2	

In the case of the energy sector, the results showed that *push for strategic renewal* and *firm's posture* are deemed the most influential factors among others. On the other hand, experts perceived *ecosystem related uncertainties* and *legislative impositions* as the least influential factors with a high margin. Moreover, the factor *push for sectoral reconfiguration* is found significantly less influential than others except for the aforementioned two. This result not only contradicts previous research on ecosystem management, but also raises the possibility of a new discursive inquiry into the strategic aftermath of managers' awareness.

Both in the case of energy and construction sectors, the factors *push for strategic renewal* and *legislative impositions* are considered as the most and least influential factors, respectively. This similarity may be related to comparable sectoral dynamics, such as the centralization of power around a keystone and network boundaries that rely heavily on physical proximity. In order to increase their competitive edge, managers are looking for new ways to create and capture value, and by extension of the new revenue mechanisms. On the question of regulations, managers unanimously agree that it does not influence their strategic decision-making. A reason for this could be the fact that in the conceptual model the factor *legislative impositions* is the only factor which managers cannot exert control on and regulations are often taken for granted. It should also be noted that the average consistency ratio of experts' answers within the construction sector is relatively high ($\xi^{L*}: 0{,}1$), yet this is within an acceptable threshold (Mi et al., 2019).

Moreover, while the data must be interpreted with caution due to its meager sample size, an interesting outcome is that, except for *push for strategic renewal*, *legislative impositions*, and legislative impositions, the most and least influential factors respectively, the ranking of a factor in the energy sector does not correlate with its counterpart in the construction sector. This result suggests that managers' strategic decision-making rationale in both sectors is similar at the extremes. A contradictory result can be seen in the case of *access to capital*. According to current literature and expert interviews, limited financing for innovation projects are more likely to restrict ecosystem strategies in the context of the construction sector. However, the results show that *access to capital* is considered more influential within the energy sector in comparison to construction sector.

Figure 4.2. depicts the conceptual model after the influence degree of every factor is applied. While the above analysis included the responses of those with an industry background, the sample size also includes academics. Therefore, the next section will further scrutinize the differences in answers given by these two populations and also the outliers.

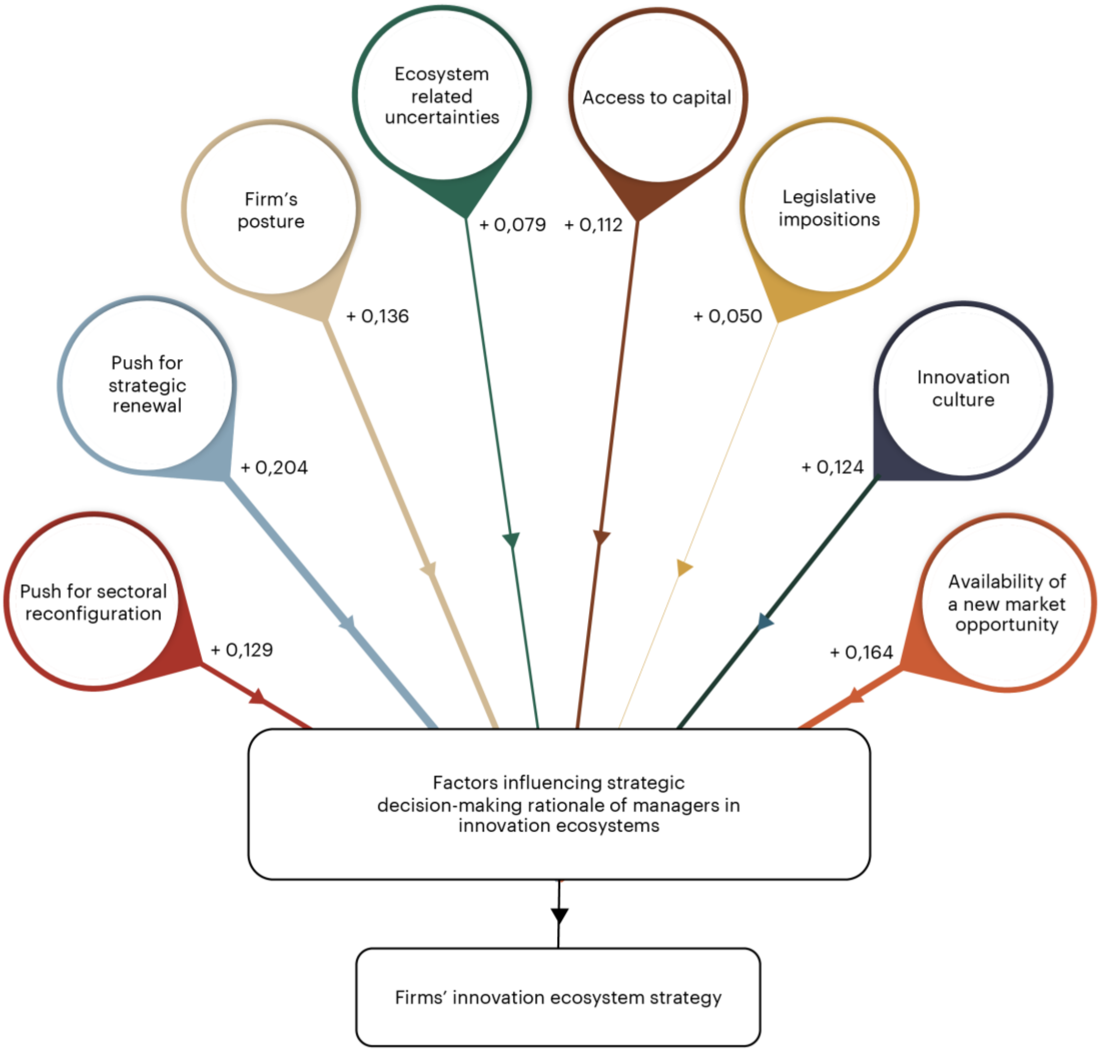

Figure 4.2. Conceptual model with the influence weights of the factors

Chapter

5 Discussions

The problem addressed in this thesis is how the dynamic factors influence managers' strategic decision-making rationale within innovation ecosystems. So far, this thesis looked into the innovation management, network economics, and decision-making literatures to situate the problem and explore its scope. However, the current investigation does not only respond to the current literature, but also incorporates insights from academics and managers who are experienced in the field. Combined, these inquiries underscore the following four objectives of this thesis: to understand what can be considered as an innovation ecosystem and distinguish the different types of 'innovative' ecosystems; to identify firms' motivations to participate in these innovation ecosystems and strategies they employ; to understand managers' strategic decision-making process in innovation ecosystems; and to distinguish the factors influencing the decision-making rationale of managers who are pursuing an ecosystem strategy.

In accordance with the aforementioned objectives, the conceptual model introduced in Chapter 2 guided the questioning of practitioner's decision-making rationale on empirical grounds. After reflecting on the quantitative investigation in Chapter 4, this current chapter, first, compares the findings from the expert surveys with previous assumptions from the literature (Section 5.1). It further discusses these findings under the light of the main and sub-research questions. It then focuses on the two major findings: the new market creation through innovation ecosystem collaborations and the influence of innovation culture, regulations, and uncertainties on ecosystem strategies (Sections 5.2). Then, this chapter derives practical implications for managers (Section 5.3) and addresses both the limitations of the thesis and future research avenues (Sections 5.4 and 5.5, respectively).

5.1 Elaborating upon factor rank

The results drawn from the empirical data are in many ways consistent with previous research. To start with, respondents perceive the *push for strategic renewal* as the most important factor influencing managers' strategic decision-making rationale. As the theoretical orientation revealed, ecosystem dynamics tend to disturb and substitute existing systems, inspiring new technologies to emerge. Echoing Dattée and Alexy (2017) this can be simply explained as the need of concurrent complementarities from various stakeholders to create an architecture that will serve new technological development. As a result, the current state of technology creation, and in return, value for the end customer, depends upon whether firms will renew their sectoral positioning. This is done not just to transfer or acquire knowledge outside-in, but more importantly, to align their products and services in relation to the tangible (component) and intangible (knowledge) value placed by the upstream and downstream players.

On the question of what firms can do to renew their strategies and in return sustain or gain competitive advantage, the theory implies the dynamic use of business model elements. For instance, the inclusive actor composition in innovation ecosystems evolves as firms identify more actors with whom they can collaborate. This multivocality helps firms evolve their business models in parallel with the networked ecosystems they are a part of. In fact, one interviewee agreed that innovation ecosystems are essential for the shopping of new innovative and business model ideas to stay relevant in the marketplace.

The second most influential factor according to the respondents is the *availability of a new market opportunity*. So far, little was found in the literature on the role of 'markets' during the innovation ecosystem creation (Dedehayir & Seppänen, 2015). Several papers have shown that the expanded market access, reduced market uncertainty, and shortened time to market are among the few most important drivers of firms to participate in innovation ecosystems (Pellikka & Ali-Vehmas, 2016; Ritala et al., 2013). One interviewee, when asked about the above subject, stated that:

> The important part [of innovation ecosystems] is your go-to market. For instance, do you have a partner or client who already has a network of [desired] clients, or is there a [specific] client you want to include in your network?

Accordingly, the above statement implies that collaboration between firms can be a beneficial strategy in terms of the innovation ecosystem concept. Specifically, the inclusion of competitors in the picture may increase the firm's overall market reach. This finding is also consistent with that of Ritala et al. (2014) who previously investigated the innovation-related advantages of coopetition through platform ecosystems (e.g. Amazon). However, as explained above, the current literature falls short in capturing the innovation ecosystem-related advantages on markets. I argue that these new market opportunities are an outcome of innovation ecosystems through which competitors and complementors from different sectors collaborate, creating new opportunities over which to compete. For instance, one interviewee alluded the notion of new market creation in the following way:

> I fully believe that on the intersection (or in the fringe) between two industries you have a new market developing. When they [the two industries] meet, it is not only a new market, but an augmentation of the two markets' synergy.

This result corroborates the investigations in a great deal of previous works (Ritala et al., 2013), not only in innovation ecosystems, but also in issues related to value creation and capture. Understanding how markets came into existence and how various actors collaborate for common business goals in this new context has the potential to fulfil our curiosity about which innovation strategies are superior, and able to create sustainable value.

5.2 The relative influence of the factors and sectoral implications

In the case of energy sector the relatively low influence of legislative impositions accords with the interviewee responses. When the interviewees were asked about it, none of them mentioned the role of legislative bodies in relation to their motivations, or efforts to be present in innovation ecosystems. This result may be explained by the fact that the regulatory environment is seen as a laggard when compared with the pace of commercialization of new innovations. Thus, many mid and senior-level managers who supervise the innovation projects in their respective companies, are reluctant to make a trade-off between the perceived gains that innovation ecosystems may bring to the company and the time and opportunity they may lose by complying with the legislations. On the same line with the previous point, the current literature takes our attention to the ever-increasing tempo of technology markets, catalyzed by energy transitions (Hoppe et al., 2018). This drastic switch and disruption brings the question to the influence of legislative infrastructure on managers. The empirical results offer a contradicting finding in the case of the construction sector. While a couple interviewees explicitly stated that they were under the influence of legislative bodies when thinking about innovation strategies, the empirical results failed to capture this. A reason for this could be the fact that managers do not have control over regulatory processes which are mandated by governments or regulatory institutions. Thus, managers' do believe that regulation is not as influential as other factors when making decisions. Often managers do make strategic innovation decisions is to reflect on the changes or new standardized procedures. As one interviewee with a background in the construction sector commented: “Sometimes due to the hardships [legislations] imposed on us by regulators, we try to find answers through civil partnerships.” This remark is on the same line with previous studies which have suggested that innovation ecosystems cannot succeed alone in fighting the modern-day problems without proper regulations in place to support them (Dewick & Miozzo, 2002).

An interesting outcome of the research is that it demonstrates the high-degree influence of firm’s posture on managers’ decision-making rationale. For instance, in the case of the energy sector, the estimated conceptual model shows that firm’s posture is second to first in the influence ranking. This research was unable to identify any previous research discussing the role of firm’s posture as being the reputation it holds in the innovation ecosystem context. Notably, the correlation between the firm’s posture and its influence on firms’ innovation ecosystem strategy is new to the innovation management literature. The triangulation of the qualitative and quantitative data reveals possible explanations for this phenomenon. Firstly, a firms’ posture is an outcome of the emphasis it gives on technological advancement and innovativeness. In the energy sector for instance many oil and gas companies started to think in the terms of sustainability-related products and services as opposed to their traditional methods. Commenting on new innovative and collaborative sustainable energy models, one interviewee noted: “It is important for a [energy] company to think about how much they are building their brand image through these kind of initiatives.”

Second, it seems possible that this result is due to firms’ installed image. Some firms may try to project themselves as more innovative than their rivals, and others may implement a new aggressive brand strategy to change the current perception about their firms all at once. The innovation ecosystems give firms the chance to associate themselves with those actors with positive reputations and collaborate for a common objective that would resonate positively in the minds of society at large. The advantages of a positive brand image would result in increased market access, and possibly the keystone advantages, such as having a substantial bargaining power of the ecosystem coordination. For instance, one interviewee reported that: “Nobody wants to admit that they are giving up on being the central organization [keystone], which would decrease everybody’s commitment to the ecosystem.” Third, from the managers’ point of view, a firms’ strategic decisions are ideally an outcome of a thorough thought process. When intangible signals such as image is involved in this thought process, there is a likelihood of overlooking the factual information. Finally, it is also important to bear in mind the possible bias in these responses. Some managers who were asked about the image of the company they work for may have had personal vested interest.

An unexpected result of this research is, according to practitioners from both energy and construction sectors, the factor *push for sectoral reconfiguration* is not seen as influential as various others. As underpinned in Chapter 4, this result is contradictory to what has been argued in the literature so far as well as the researcher's expectations. The sectoral and technological convergence is an increasing topic of interest in the current literature and managerial practice (Geon Kim & Ok Choi, n.d.; Mäkinen & Dedehayir, 2012). The reason managers do not share the same belief may be because of the

The dynamics of push for reconfiguration in sectors are due to technological advancement, arising from convergence of new technologic trends. For instance, in the case of the construction sector, this can be explained by the rise of digitalization through new applications, such as Building Information Modelling (BIM), a combination of intelligent tools allowing digital representation of physical and managerial aspects of construction projects. Another example can be given from the integration of Internet of Things (IoT) into energy sector. As information and communication technologies (ICT) became more affordable, so did the omnipresence of digitalization within the energy sector (Kotilainen et al., 2016). These and many other instances of sectoral convergence due to specific technological innovation become more visible with innovation ecosystems. Nevertheless, an innovation ecosystem strategy cannot realize the benefits of the aforementioned, unless managers identify and react on the industries' key trends. This also raises the possibility of a new discursive inquiry into the strategic aftermath of managers' awareness.

These present results are significant in at least two major respects. First, new market creation through innovation ecosystems promises to be a fruitful inquiry for further innovation management research. Second, the fluctuating influence rank of critical factors, *namely innovation culture*, *ecosystem related uncertainties*, and *legislative impositions* reveal important insights into managers' perspective of innovation ecosystems in both energy and construction sectors. Therefore, the following two sub-sections discuss these two topics further in detail.

5.2.1 New market creation and renewal

This thesis found that in both energy and construction sectors new market creation and strategic renewal have significant impact on managers' strategic decision-making rationale. This finding needs to be further scrutinized in order to understand the managers strategic decisions.

Firstly, the majority of the interviewees from both sectors perceive their sectors as lagging behind in terms of innovative business models and capitalizing on novel technologies such as IoT. This, in fact, is an existential threat to their firms' presence in the age of digitalization, and platforms. The rise of the cross-sectoral collaborations, as in the case of semi-conductors, urges traditional sectors like energy and construction to imitate what successful companies in other sectors are doing. This strategy is dependent on the innovation ecosystem coordination and vision.

In practice, the case of both energy and construction sectors show that the innovation ecosystem efforts are centered around a keystone which possesses much of the resources to be utilized by every ecosystem member. Zahra and Nambisan (2012) explained this model of innovation ecosystems in their seminal study and called it 'The Orchestrator Model.' However, the current model does not necessarily assume that this so-called keystone view has the vision to coordinate the innovation ecosystem for a joint innovative perspective. Moreover, the so-called vision and coordination may not be echoed by the other members of the ecosystem. In fact, one interviewee commented:

> Centralized ecosystems have the danger of not obtaining the full potential. Because the central actors will always try to pull ecosystems in one direction and the synergy will be lost… At the end of the day, if you want an organic ecosystem you need to give more and more freedom to grow to something that actually responds to a need.

For instance, a well-documented example of keystone firms, coordinating a so-called organic innovation ecosystem can be IBM, Amazon, or Apple. Of course, all three firms operate in a significantly different area, and are subjected to different market conditions than any firms within the energy or construction sectors. Yet the similarity in terms of the push for sectoral renewal and the need for new markets are shared among sectors. In the case of ICT, it is possible to observe that these three aforementioned firms realized the strength of ecosystem alliances a decade ago. Accordingly, in an instant, these firms used their keystone advantages in order to design, manufacture and commercialize a new generation of microprocessors (Ritala et al., 2014).

What is significant about this example is that, the three firms did not create a breakthrough innovation, yet the complementarities and co-evolution of capabilities allowed them to create new offerings that customers wanted to adopt. This also aligns with that of Jacobides, Cennamo, & Gawer (2018) who argue that in innovation ecosystems value is created through ‘non-generic’ and ‘super modular’ complementarities which demands a unique network of relationships.

Reflecting on the energy and construction sectors, this thesis concludes that practitioners in both sectors could search for common practices in established sectors such as ICT and learn from them. In addition, looking for the commonalities among sectors in terms of market and product/service architectures could reveal hidden market opportunities. The qualitative and quantitative data gathered in this thesis, also supports this claim. Especially, the emphasis given on the strategic renewal and new market opportunities, show that both managers in the energy and construction sectors can learn from more established innovation ecosystems.

Second, and in line with the above, inter-sectoral information sharing is a pivotal pillar for innovation ecosystems. For instance, both in the case of energy and construction sectors digitalization has led to a wide spread phenomenon such as open networks, connecting processes and people. In the former, digitalization allows smarter power distribution, energy storage, grid monitoring etc., through IoT applications. In addition, a durable and sustainable consumption of natural resources for the sake of energy transitions became easier than ever before. In the former, digitalization is being adapted for operational easiness and transactions (e.g. BIM software).

Another important aspect of this result is that they reflect those of Ritala et al. (2013), who also found that coopetition has a significant role in value creation and capture in the innovation ecosystem context. As opposed to traditional collaborative settings, in innovation ecosystems the keystone firms are not only responsible from leading the ecosystem to optimize their businesses, but also try to create unprecedented business models that share opportunity among ecosystem members.

According to Ritala et al. (2014), these unique and hard to imitate value propositions can come through coopetition-based innovation strategies. In fact, in the case of construction sector one interviewee echoes this in the following way: “What I am really interested in is the coopetition.” Through coopetition, firms can share common hurdles since they operate in similar domains. As a result, similar insights and knowledge on particular subjects could help firms to realize new avenues to explore. Moreover, co-creating with a partner has the impact to reduce the associated costs, since this way firms can use their resources together and more wisely.

5.2.2 Culture, regulations, & uncertainties

As was discussed, the estimated conceptual model was not able to obtain a powerful result depicting the influence of regulators on managers' rationale. At the same time, it is important to note that this does not disprove the influence of legislative impositions. Of course, both the energy and construction sectors are strictly regulated, especially, within the EU where the majority of the experts were located during the time of this research. Therefore, the possible interference of legislative impositions cannot be ruled out. Here, it is important to notice the fact that respondents consider legislative impositions relatively less influential, while in reality the presence of legislation in almost every part of daily processes is taken for granted. This hints toward encouraging findings on the quest for mapping out managers' strategic decision-making rationale in innovation ecosystems. First, building on the previous discourse from (Dedehayir et al., 2018), it can be understood that managers expect regulators to act as sponsors, such that they provide economic reforms and re-arrange legislations to support entrepreneurial activity and ecosystem emergence. As opposed to taking regulation as a driver for innovation, in innovation ecosystems, legislation has a secondary importance. Second, as argued previously, managers perceive legislation as out of their control, thus the managers' strategic decision-making rationale is affected from those factors that managers can supervise and steer.

The strategic hardship in innovation ecosystems for managers is finding the right balance between the navigation of the ecosystem strategy and execution under uncertainty. For instance, in the case of the construction sector, interviews showed that the majority of the respondents accord with the heaviness of the consequences in case of a failure. A cultural setting that embraces uncertainty is as important as the value offered by the firm. In such inclusive and forgiving cultural settings, managers have the freedom to try their bests. Thus, managers' strategic decisions are less likely to be hindered or negatively influenced. As opposed to traditional structures, innovation ecosystems require entrepreneurial settings, since value is created through (invisible) inter-sectoral networks and the coupling of offerings. This is mainly because, as far as the managers' decisions regarding the innovation strategy is concerned, one can only act based on their future anticipation of the value to be created and captured. Therefore, a culture with flexibility toward failure would encourage hypotheses testing and prevent ex-ante decisions to become mistakes. These results also corroborate the ideas of Dattée and Alexy (2017), who suggest the *'managers' option trap'* as being limited in creating future assumptions.

These findings are without a doubt open to scrutiny, but there are some immediately dependable conclusions for the estimated conceptual model. First, the estimated conceptual model holds true in the case of energy and construction sectors. This is because none of the respondents and/or experts who participated in this thesis condemned any so-called factors. Second, the conceptual model does not only reveal the eight factors that describe why managers make certain strategic decisions, it also builds on our understanding of how the value is created in innovation ecosystems. Third, by ranking the influence power of the factors, the above analyses not only called a discursive inquiry on the eight critical factors, but also allowed us to understand the managers' perception when making strategic decisions.

5.3 Managerial implications

The findings of this thesis have a number of important implications for future practice. First, still, in many sectors technology development and innovation is hindered by hierarchic structures fabricated by the past. Firms from all sectors facing dynamic turbulences, and need to act quickly, in order to continue create value and so, revenues to exist. This value is created by answering an epidemic need in the market or exploring others' needs. To tap into new business models and create new markets, firms need to internalize ecosystem thinking among innovation managers. The ecosystem thinking, requires continuous awareness of the upcoming trends and understanding business in terms of networks, rather than value chains.

Second, uncertainty is an intrinsic part of innovation ecosystems. This uncertainty may be due to market, technology, actor-to-actor relations and so forth. Under situations where managers face ecosystem related uncertainties, the managers' awareness should not only be concerned with the technical details of the innovation strategy (e.g. contracts), but also with the possible future stages of innovation ecosystems. When managers assess the contemporary trends and position themselves according to capitalization of the future key trends. In order to enable this, innovation managers require executive level support, in terms of investments and resources, in identifying key enabling trends which may be a source of possible value for the firm.

Another important practical implication is that managers in both energy and construction sectors should strive for inter-sectoral knowledge exploitation, in order to accelerate growth of their own firms and sectors. Especially, by looking at the actors from different sectoral backgrounds with different a lens, managers can change their approach and see inter-sectoral commonalities which is argued to be more fruitful in the context of ecosystem collaborations. Since the findings in this thesis stress the fact that new market creation is a possibility at the intersection of sectors, a traditional acquire and implement strategy is less impactful and more cumbersome due to bureaucratic processes.

On the question of the critical factors influencing managers' strategic decision-making rationale, managers should pay attention to the strategic renewal and new market opportunities when deciding on innovation strategies within their given innovation ecosystem. Moreover, greater efforts needed to ensure how managers can expand their firm's posture in their ecosystem. Since the results of this thesis show that managers' do also consider their firms' image when making strategic decisions, firms can try to build on their own innovative image, together not only through innovative business development but also collaborating with marketing and communication departments.

5.4 Limitations of the study

This thesis is not without limitations. Firstly, there are practical issues concerning the limited sample size. The time and cost constraints made it difficult to reach a sufficient number of responses for the BWM survey. The current sample size for the interviews and surveys was mostly achieved through the researcher's network while working at Accenture B.V. The small sample size implies that the population sample is relatively inaccessible, which may be due to several reasons. To start with, this research acknowledged hardships in locating individuals who have substantial experience in innovation ecosystems or companies whose innovation departments are interested in ecosystem alliances. Although in some cases the interest of the company has been validated and the privacy-related concerns were addressed, due to the sensitivity of the data, for instance, an energy company declined to provide insight for this research. Moreover, during the time of this project, it was observed that addressing mid and senior-level managers is likely to yield fewer responses. Also, as a special circumstance, during the time the expert surveys were sent out, the majority of key personnel were found to be out of the office for vacation purposes. As a result, being limited to empirical data, it is still debatable whether this thesis lacks predicting powerful results, since to date there has been no commonly-held size threshold available for studies using BWM.

In addition, all but one interviewee and all survey respondents were stationed within European Union countries. The political, social, and economic influences of the managers' operating environment cannot be neglected. Considering the dynamism and externality of the factors, it is possible to assume that a change in location and time may yield different results.

Secondly, the ecosystem typology by Letaifa et al (2018) presented in Chapter 2 is characterized by a binary opposition, which may appear restrictive considering the nature of this field, which is ever-adapting and growing with new technologies and practical implications. Moreover, a two-dimensional representation for the ecosystem concept does not allow for the representation of other related themes that are interlinked with but also differentiated from innovation ecosystems.

In line with the above discussion, the findings from the theoretical orientation guided the interviews with practitioners. As a result, there is a likelihood of an unwanted effect by the moderator's questions which may have shaped the interviewee's answers. The same possibility accrues to the factor definitions that were presented to the survey respondents. Similarly, the wording of the questions and the explanation of the factors may have exerted an indirect influence on the results. While an attempt was made to prevent this by providing concise, neutral, and explicit definitions, it cannot be said with utmost certainty if the wording had an impact on the results.

Finally, the thesis has several limitations due to the methodology employed. The conceptual model used in this thesis is grounded in the current literature on innovation management and network economics, as well as the insights of fourteen practitioners in the field. As a result, the applicability of the conceptual model relies on the scope of these sources and the best of the researcher's ability to translate related factors into the context of innovation ecosystems. Due to time and research constraints, the number of factors that are argued to have a significant influence on managers' strategic decision-making rationale were limited to cover the most relevant and interesting.

5.5 Future research avenues

In spite of its limitations, this thesis certainly adds to our understanding of the innovation ecosystems concept. First of all, this research helps to build onto what was already known about the managerial implications of the innovation ecosystem concept. Moreover, as mentioned in the theoretical orientation, the snapshot of the current innovation ecosystem definitions which generated the conceptual model offers a guide to explain the rationale behind firms' strategic behaviors in innovation ecosystems. If the debate is to be move forward, more research needs to be done on the practical implications of innovation ecosystems. This would be a fruitful area for further work not only for practical purposes, but also for academic impetus.

Concerning the restrictive nature of the ecosystem typology, questions arise about the applicability of the conceptual model introduced in Chapter 2. For instance, the innovation ecosystem typology only considers two dimensions when expressing the characteristics of ecosystems. Further research could also look into if the there are any other distinct dimensions to innovation ecosystems that can be added to the typology.

In addition, further research may explore the dynamism of the so-called factors described in this thesis. For instance, longitudinal work needs to be done to establish if these factors change in time and if so, how they evolve. A phase-by-phase study of these factors may reveal how the managers rationale and strategies change during the different stages of the ecosystem life-cycle previously studied by Dedehayir and Seppänen, (2015). A similar study could also assess the long-term influence of the eight factors identified in this research. Specifically, it is worth investigating whether the same factors hold true in other countries and economic regions. These future inquiries may reveal additional factors beyond those put forth in this thesis. Moreover, this thesis specifically focused on the energy and construction sectors. Therefore, other sectoral contexts remain as an open and interesting area to research. Extending this research to cover other sectors would help researchers learn more about the differences between sectors vis-à-vis interdependent innovation strategies.

Due to the practical limitations, this research has put forward many questions in need of further investigation. First and foremost, regarding the limited sample size, this thesis could be considered as preliminary. Therefore, it is suggested to repeat this research in the future with more participants, and in return derive more robust results. In addition, the time constraints did not allow a full representation of the factors. However, I argue that there are still other factors that should take into account. One may be the *current technological competency* of the focal firm. For instance, the construction sector has been perceived as a low-tech sector. Nevertheless, as digitalization shifted how the end-consumers utilize new products and services, construction firms started to see technological development as fundamental in offering better products and exceling their operations. On the same line, just like in the construction sector, innovation managers in the sectors with an engineering core also have a tendency to start with what is technologically possible, and then build a business case around it. This is why it may be valuable for scholars to further understand how technological sufficiency influences managers' strategic decision-making rationale in ecosystem circumstances. Moreover, other additional factors such as the *knowledge dissemination within the innovation ecosystem* and *external competencies*, came up during off the record conversations with the practitioners. Of course, more theoretical research needs to be done to investigate the relevance and applicability of these factors. Another option which would increase the robustness of the research is to divide the influential factors according to overarching categories (e.g. internal, external, tangible, and/or intangible).

Besides, further studies need to be carried out in order to validate the applicability of the BWM method in assessing the factors influencing managers' strategic decision-making rationale.

According to Guo and Zhao (2017), the vagueness of the data collection process and the unreliability of the decision-maker (respondent) may result in scattered data. The authors further propose involving the fuzzy set theory into the already established BWM in order to obtain more reliable results through more consistent comparisons. Thus, I suggest that a study similar to this one should be carried out with a fuzzy BWM (e.g. (Guo & Zhao, 2017; Mi et al., 2019))

Finally, a greater focus on the new market creation could produce interesting findings that better account for the role of innovation ecosystems in creating economic value. While this thesis was unable to provide strong correlation between innovation culture, regulations, and uncertainties, I believe this does not hold true in every geographic or sectoral setting.

Chapter

6 Conclusions

This thesis has been shaped by the long-standing discourse surrounding firms' innovation strategies, dealing with today's innovation challenges. It was argued that firms are in need of a better conception of their surrounding environment, including the actors and the playing field, in order to tackle contemporary complex technology systems. Furthermore, this thesis stood with the scholars who also frame innovation as a prerequisite for firms, rather than an option. In the economics and strategy literature this has been explained through the positive correlation between the firms' innovativeness and competitive advantage. Thus, the innovation ecosystems concept has been recognized as an important pillar.

Nevertheless, one missing aspect of past research is the lack in capturing the fuzzy innovation management operations taking place in headquarters. Many instead focus on the 'created value,' which simplifies the commercialization process of innovation. Moreover, the innovation ecosystem concept is ambiguous due to the multivocality in the literature. Therefore, to determine the success of one innovation strategy over the other, it is crucial to examine different perspectives in innovation management today within ecosystem circumstances. Ultimately this approach can yield a necessary rationale to scrutinize firms' innovation strategies. Schneckenberg et al. (2017) argue that understanding of the strategy branches into two: the first branch, considers strategy as an objective or motivation, and the other as execution. In line with this argument, this thesis considers strategy both as a product of managers' objective and as a sequence of actions to realize those objectives.

Accordingly, the problem statement of this thesis was formulized as how the dynamic factors influence managers' strategic decision-making rationale within innovation ecosystems. In line with the aforementioned, this thesis set out to analyze what can be considered as an 'innovative' ecosystem and the factors that play a role in managers' decision-making mechanisms in these ecosystems. In order to construct a detailed inquiry into the subject, this research further looked into managers' strategic decision-making process in innovation ecosystems and different innovation ecosystem strategies that they consider.

To fulfil these objectives the following main research question was posed: *What are the critical factors influencing managers' strategic decision-making rationale in an innovation ecosystem?* This main inquiry was accompanied by the following three sub-research questions to develop a deeper understanding of the subject under study: *What can be considered as an 'innovative' ecosystem and what are the different types of innovation ecosystems?; What are the strategies employed by firms in these innovation ecosystems?;* And *What are some decisions that managers in innovation ecosystems face and how do they make decisions?*

In line with the first sub-research question, this thesis has discussed a fourfold innovative ecosystem typology introduced by Letaifa et al.'s (2018). First, is the *supply systems* which stands for the relationship between a network of firms where the strategic center of is shared by a small number of important partners who can mobilize, design, and control the system of resources. Second, is the *'communities of destiny'* when ecosystem members collaborate as a result of the super-modularity between their individual offerings. Here, every single actor has an impact on the faith of the ecosystem. Third, focuses on the *'platforms'* that are simply defined as a proprietary technology that enables transactions among the users and the complementors of the platform. Finally, the expanding *communities* emphasizes the community of actors possessing similar knowledge for an essential objective, as in the case of open-source coding networks.

On the second sub-research question, this thesis conducted an elaborate literature review and Identified six ecosystem roles, including keystone, dominator, niche, entrepreneur, sponsor, and regulator. Moreover, it discussed the strategic alternatives that these actors may choose among. On the third sub-research question this thesis argued that managers' decision-making process in an innovation ecosystem can be considered as *'process management approach'* (Bruijn & Heuvelhof, 2008). In the process management approach, managers first evaluate a set of performance indicators and couple it with their intuitive knowledge regarding the firms' operating market.

For the main inquiry, by coupling the data gathered from both qualitative and quantitative outlets, this thesis was able to distinguish the following eight factors as being critical for managers' strategic decision-making rationale in innovation ecosystems, in a decreasing order of influence: *push for strategic renewal; availability of a new market opportunity; firm's posture; push for sectoral reconfiguration; innovation culture; access to capital; ecosystem related uncertainties;* and *legislative impositions.* Table 6.1 presents these factors with their definitions.

Table 6.1

Factors influencing managers' strategic decision-making rationale and definitions

Factors	Definitions
Push for strategic renewal	Actors in an innovation ecosystem are subjected to a constant turbulences in the market. The value propositions that come with business models also must be dynamic, evolving as the ecosystem network evolves. Some of the constraints that managers face when making appropriate decisions include poor appreciation of interdependencies in/with current business models and dominant path dependencies that restricts renewal.
Availability of a new market opportunity	Firms with diverse value-propositions can find a common ground to serve new value. In some circumstances this ground can be the start of a new market that is yet to exist. When making strategic decisions managers do pay great attention to the expansion of their own firms' current markets. Managers' learnings from different high-tech sectors can be the initiator of such strategic actions.
Firm's posture	The image of an organization can positively or negatively affect its identity, since the managers' decisions are susceptible to priming. Under the influence of emotions and other external signals, strategic decisions can be made quickly and factual information may lose sight of managers' rationale.
Push for sectoral reconfiguration	Increasing inter-dependence in an innovation ecosystem can provide the early signals of significant technological and industrial change. The reconfiguration stands for the re-positioning of a firm through inter-industry knowledge to adapt this change. As a result, managers' knowledge about the current climate in their respective sector, combined with their opportunistic intuitions become relevant when making decisions.
Innovation culture	Collaboration occurs not only on the enterprise level but also on the individual level. Thus, decisions are made and actions are taken in the context of existing network ties and cultural fit. An innovation culture that values and rewards innovative experiments may approve managers actions in innovation ecosystems.
Access to capital	The flexibility of firms' innovation budget may grant managers the freedom to experiment with new contractual agreements, collaborative research, or development projects. As a result managers' access to innovation capital positively or negatively influences the decisions they are striving for.
Ecosystem related uncertainties	Uncertainties include technological, behavioral, and environmental multivocality in an innovation ecosystem. Managers need to think in terms of multicriteria decision-making as every choice has different outcomes for different actors.
Legislative impositions	Regulators and governmental institutions play an important role in innovations, and so innovation ecosystems. Certain legislative impositions on the ecosystem or firm may alter the managers' strategic decisions of firms and/or kill it all together. Also, the regulator can prescribe certain technologies, which are supported by certain ecosystems.

After conducting interviews with the academics and practitioners from the industry who are working in/with the concept of innovation ecosystems this thesis gathered the final results. These results echo some of the previous findings in the innovation management and network economics literatures. Bringing together the insights obtained from both of these discourses, it is likely that the ecosystem analogy is a good representation of networks of innovation in which inter-dependence, modularity and coopetition are the dominant traits.

Moreover, through the empirical investigation, this thesis examined the influence rankings of the so-called factors and the validity of the conceptual model. Overall, the survey data confirm that the aforementioned eight factors are relevant for managers' strategic decision-making rationale in innovation ecosystems. In terms of the energy and construction sectors, this thesis further analyzed similarities and differences between managers' strategic rationale. The results of this investigation showed that, in both sectors, managers give a great emphasis on the renewal of innovation strategies, and the availability of a new market opportunity. The renewal of the strategies do take forms via the integration of new business models. These new business models in many cases arise from new technology development, specifically internet of things, artificial intelligence, and smart technologies, or by translocating an existing innovation from another sector.

One of the most significant findings to emerge from this thesis is that managers pay great attention to the possibility of a new market opportunity. This drives managers to align their innovation strategies with the greater innovation ecosystem. As opposed to the traditional view, in which sourcing and commercializing value is considered stagnant, in innovation ecosystems, firms create new markets by co-operating with competitors and complementors. So, the agility is intrinsic in these dynamic networks where firms become network partners with their rivals. Notably, innovation ecosystem as a concept can be an enabler for firms to expand their current markets and create new ones. In detail, with the industry convergence, innovation ecosystems allow a greater market access where firms can showcase their innovative selves. Nevertheless, the degree to which firms can showcase themselves in innovation ecosystems are also subjected to firms' innovation culture, the current legislative framework, and ecosystem-related uncertainties. Another important finding is that managers do not consider those factors that they do not have control over as influential as others. For instance, in the case of legislative impositions, since managers cannot supervise or foresee the actions of regulatory bodies, they take regulatory actions taken for granted.

These findings suggest several courses of action for managers. First, firms need to internalize ecosystem thinking and spread agile methods among their innovation managers. Second, practitioners in both the energy and construction sectors could search for common practices in established sectors such as ICT and learn from them. This would conclude looking for the commonalities among sectors in terms of market and product/service architectures, possibly revealing hidden market opportunities. Moreover, ensuring appropriate resources, funding and support for inter-sectoral knowledge exploitation should be a priority for the executives.

Of course, this research is not without limitations. Despite practical constraints, this thesis offers a robust methodological approach and opens new avenues for further research for innovation management and network economics scholars. Considerably more longitudinal research and case-studies will need to be done to determine the longevity and robustness of the conceptual model. In addition, further scrutiny should focus on the role of innovation ecosystem collaborations in new market creations as well as the role of firms' posture on innovation strategies. Only then we can locate the grey areas in these discourses and in practice.

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Appendices

Appendix A

Factors matrix

Table I.1

Factors matrix

		References from the literature																		Experts interviewed (#)													
#	Factors	(Pries & Dorée, 2005)	(Smith, 2006)	(Dhanaraj & Parkhe, 2006)	(Carayannis & Campbell, 2009)	(Adner & Kapoor, 2010)	(Rubens et al., 2011)	(Zahra & Nambisan, 2012)	(Jalonen, 2012)	(Ritala et al., 2013)	(Nambisan & Baron, 2013)	(Ritala et al., 2014)	(Pellikka & Ali-Vehmas, 2016)	(Aarikka-Stenroos & Ritala, 2017)	(Möller & Halinen, 2017)	(Scaringella & Radziwon, 2018)	(Dedehayir et al., 2018)	(Schroth & Häußermann, 2018a)	(Mattila et al., 2019)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Push for sectoral reconfiguration									X			X							X	X		X		X			X				X	X
2	Push for strategic renewal							X			X		X	X						X	X		X	X	X			X				X	X
3	Availability of a new market opportunity									X		X												X					X				X
4	Firm's posture			X																			X	X	X				X				
5	Legislative impositions	X															X						X						X	X			
6	Access to capital						X																			X		X					
7	Innovation culture		X		X										X				X							X	X					X	
8	Ecosystem related uncertainties					X			X						X	X		X		X			X						X				

Appendix B

BWM expert survey template

RESEARCH SURVEY

Dear Respondent,

First of all, I would like to thank you for agreeing to participate in this research project.

What is it for?

With this letter you are being invited for a survey (which will approx. take 7-10 min.) on a research study titled **'Surviving in Innovation Ecosystems: Critical factors behind managers' strategic decision-making rationale and the implications on firms' strategy'**. This study is being done at the Technology, Policy and Management Faculty, TU Delft, in partial fulfilment of the requirements for the degree of MSc. in Management of Technology. I am conducting this thesis project under the supervision of Dr. Victor Scholten, Dr. Aad Correljé, and Merle Freeke.

This project which takes innovation ecosystems as its focal point. Accordingly, with this study I aim:

I. To distinguish the factors influencing the decision making rationale of managers who are pursuing an ecosystem strategy.
II. To analyze whether and how innovation ecosystems differ from previously suggested collaborative networks.

Accordingly, concerning the first aim of this study, this survey aims to collect your insights on factors that influence manager's strategic decision making by assigning weights to each and every factor and comparing to one and other.

Is it confidential?

I believe there are no known risks associated with this research study; however, as with any online related activity the risk of a breach is always possible. To the best of our ability your answers in this study will remain confidential. I will minimize any risks by **storing completed survey offline and delete it after my analysis; keeping the data aggregated, and your answers anonymized.** Please bear in mind that your participation in this study is entirely voluntary. Also, you are free to omit any question.

If you have any questions regarding the research topic or the survey, please contact me.

Thank you again and I am looking forward to your reply.

Kind regards,

Ogan Bekar

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E-mail: o.bekar@student.tudelft.nl
LinkedIn

Jaffalaan 5, 2628 BX Delft

TUDelft

accenture

Start the survey

▽

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Figure B.1. BWM expert survey template page one.

Question 1. Determine the most and least influential factors

Considering the goal – assigning weights on the factors that influence strategic decision-making rationale when pursuing innovation ecosystem strategies, which of the two below factors, in your opinion, are the MOST and LEAST INFLUENTIAL?

**If you need further explanation about the factors, please see Appendix

	The MOST	The LEAST
Push for sectoral reconfiguration	☐	☐
Push for strategic renewal	☐	☐
Firm's strategic posture	☐	☐
Ecosystem related uncertainties	☐	☐
Access to capital	☐	☐
Legislative impositions	☐	☐
Innovation culture	☐	☐
Availability of a new market opportunity	☐	☐

Question 2. Please assign a number from 1 to 9, to show the preference of the MOST influential factor you selected over the LEAST influential factor.

Consider the grading scale below.

Intermediate values: 2, 4, 6, 8

1	3	5	7	9
Equally influential	Moderately more influential	Strongly more influential	Very strongly more influential	Extremely more influential

Click to select

Question 3. Please assign a number from 1 to 9, to show the preference of the MOST influential factor you selected above, over all the other factors.

Consider the same grading scale from the previous question.

Push for sectoral reconfiguration	Click to select
Push for strategic renewal	Click to select
Firm's strategic posture	Click to select
Ecosystem related uncertainties	Click to select
Access to capital	Click to select
Legislative impositions	Click to select
Innovation culture	Click to select
Availability of a new market opportunity	Click to select

Page 2 | 4

Figure B.2. BWM expert survey template page two.

Question 5. Please assign a number from 1 to 9, to show the preference of all the other factors, over the LEAST important factor you selected above.

Consider the same grading scale from the 3rd question.

Push for sectoral reconfiguration	Click to select
Push for strategic renewal	Click to select
Firm's strategic posture	Click to select
Ecosystem related uncertainties	Click to select
Access to capital	Click to select
Legislative impositions	Click to select
Innovation culture	Click to select
Availability of a new market opportunity	Click to select

How to submit?

This is the end of the survey. Thank you for participating. You can e-mail the filled document to below address

o.bekar@student.tudelft.nl.

APPENDIX

FACTORS	**DEFINITIONS** according to expert interviews; innovation management & network economics literature.
Push for sectoral reconfiguration	Increasing collaboration in an ecosystem can provide the early signals of significant technological and industrial convergence. Here, reconfiguration stands for the re-positioning of a firm through inter-industry knowledge. This may reveal itself in practice through either new innovations or major improvements of the existing ones combining learnings from several sectors.
Push for strategic renewal	Ecosystem dynamics tend to change, disrupt, and replace existing systems, creating opportunities for new actors, technologies, and institutions to emerge. Thus, strategic renewal in the form of new business models and value propositions must be dynamic and evolve as business networks and ecosystems evolve.
Focal firm's strategic posture	As the products and services offered by companies continue to converge, communication through images, conceptions, stories and experiences rises. In this way, the image of an organization can positively or negatively affect its identity. The ways and which of participating within innovation ecosystems may create a positive public image for the focal organization's technological initiatives and business models.
Ecosystem related uncertainties	Ecosystem related uncertainties represent both technological, behavioral, and environmental uncertainties. When firms establish ecosystem strategies and together strive for shared business objectives, the inter-dependencies between them start to become more visible and the understanding of the cross product architectures that can create value for the end-customer increases. Therefore, while embracing uncertainty can allow managers more room to experiment, firms that are tend to favour established practices for research and development may collaborate with others mainly to reduce risks. In both circumstances the perception of uncertainty influence one's ecosystem strategy.
Access to capital	It is argued that value co-creation is influenced from financial resources of the focal firm. Depending on the volume of the innovation budget one's intentions and ways to join forces with others may vary. This factors may change depending on the capital intensity of the sector. Throughout this research project, some practitioners acknowledged the importance of the innovation budget that my grant managers the freedom to experiment with new contractual agreements or collaborative research and development projects.
Legislative impositions	Regulations and institutions play an important role in innovations, and so in innovation ecosystems. By definition, a regulatory and institutional environment for innovation consists of laws and regulations that have been developed in order to constrain and enable innovative activities. Thus, certain legislative impositions on the ecosystem or firm may alter the strategic decisions of firms and/or kill it all together. Also, the regulator can prescribe certain technologies, which are supported by certain ecosystems. At the same time impositions of the regulator does not necessarily carry negative outcomes, but they may also flourish new partnerships, and network ties.
Innovation culture	Within both sectoral and individual levels, collaboration mainly occurs among individuals. Decisions are made and actions are taken in the context of existing network ties, and cultural fit. Thus, an innovation culture that values and rewards innovative experiments may approve actions favouring innovation ecosystems. Here, culture comprises the behaviour to spark new insights and ideas; welcome transformation.
Availability of a new market opportunity	Inter-dependence and inter-connectedness between firms is a well-known phenomenon which is believed to be some of the key characteristics of innovation ecosystems. Nevertheless, considering firms' innovation strategies neither of them are new to the academic literature or the praxis. What is new through innovation ecosystems, however, is that firms with diverse

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Figure B.3. BWM expert survey template page three.

Appendix C

Push for strategic renewal coding network C.1

List of codes C.2

C.1

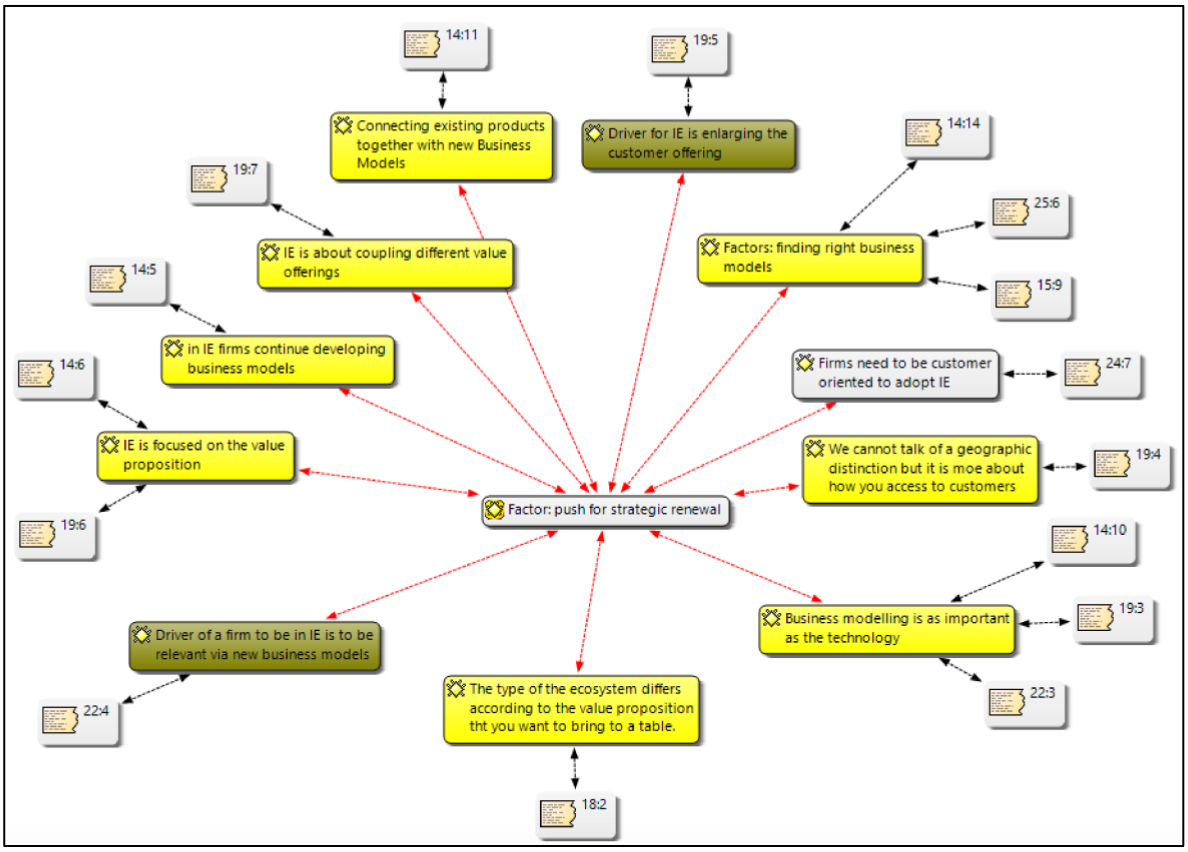

Figure C.1. Coding network of factor push for strategic renewal

C.2

Table C.2

List of codes

Code Families	Codes	Number of Quotes #
Push for sectoral reconfiguration	IE driver is the available market	2
	Go beyond the current customer	1
	Repositioning for the end customer	2
	Repositioning in the sector	4
	Market orientation	1
	Customer Experience in the market	1
Push for strategic renewal	Need for strategic renewal	3
	Firms need to be customer oriented	1
	Factors: finding right business models	1
	IE is about coupling different value offerings	3
	IE is focused on the value proposition	2
	Developing business models	1
	Value proposition	1
	How you access customers	2
	Relevancy via new business models	1
	Customer experience	2
	Complementarities	1
	Business modelling	1
	New business models	1
Availability of a new market opportunity	Market availability	5
	Market intersections	1
	Tailoring the ecosystem to a market	1
	Market push	2
	IE is market driven	1
Firm’s posture	Brand image	2
	Company posture	1
	Reputation and peer pressure	2
	Customer experience is a reason to be in IE	1

Table C.2 List of codes, Continued

List of codes

Code Families	Codes	Number of Quotes #
Legislative impositions	Legislation hinders innovation	1
	Legislation prevents globalization	4
Access to capital	Stay within the budget	1
	Abundance of capital	1
	Access to capital	2
	Feasibility over technology	1
Innovation culture	Risk taking	1
	Energy companies are more global	1
	Innovation culture	6
Ecosystem related uncertainties	Driver for IE is risk mitigation	1
	Risk allocation	1
	Uncertainty is inherently in creating value	3
	Partners together diminish the uncertainty	2