Innovation activities and their influence on the innovation capabilities of knowledge-intensive entrepreneurship firms within North Brabant

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Abstract

The present study examines how innovation activities impact the innovation capabilities of knowledge-intensive entrepreneurship firms by analyzing their networking and absorptive capabilities. The research begins by conceptualizing variables such as knowledge-intensive entrepreneurship firms, dynamic capabilities, and innovation activities. Subsequently, a model is drawn based on the aforementioned theoretical framework and it will serve as a prototype for the qualitative analysis. The method of this study is abductive, allowing for the discovery of new themes whilst focusing on specific theories. Two models emerged from seven interviews, five with knowledge-intensive entrepreneurship firms and two with organizations that facilitate innovation practices. The results show that the innovation practices affiliated with incubators directly impact the formation of weak ties and potential absorptive capacity, whilst the innovation practices of TTOs affect the development of weak ties, strong ties, and realized absorptive capacity. The paper follows with a detailed discussion that includes theoretical and practical implications. In the end, limitations and future research recommendations are given.

Keywords: innovation practices, networking capabilities, absorptive capabilities, tie strength, knowledge-intensive entrepreneurship, North Brabant.

Contents

1 Introduction

This research analyzes the indirect impact of innovation activities on the innovation capabilities of knowledge-intensive entrepreneurial (KIE) firms and the mediating effect of dynamic capabilities such as networking and absorptive. The study is a part of greater research performed by two universities: the University of Twente (the Netherlands) and the State University of Ceará (Brazil). Various regions in the Netherlands are going to be documented, such that data can be combined to observe patterns and then compare those to the data gathered by the researchers in Brazil. The scope is to uncover the differences between the activities and capabilities of a developed country in contrast to that of a developing country. Within the Netherlands, there are several regions hosting industry clusters that include KIE firms. Hence, this study focuses on the region of North Brabant.

Innovation activities affect various organizations and their capacity to innovate. KIE firms are a great example due to their knowledge-intensive profile that focuses on the capability to quickly assimilate and commercialize new knowledge (Groen, 2005; Malerba and McKelvey, 2020; Figueiredo and Piana, 2018). Current studies surrounding these firms often address the dynamics between the new firms and public or private institutions. The survival of KIE firms is strongly dependent on collaborations with other entities as they lack the necessary resources to become successful on their own. Etzkowitz and Leydesdorff (1995) defined the triple helix as the academic-industry-government relations. The framework considers that cooperation between the three entities is essential in spreading new knowledge that can support KIE firms. The assistance provided by institutions is influenced by KIE firms' networking and absorptive capabilities (Patanakul and Pinto, 2014; Groen, 2005). The networking capability is necessary to create and maintain contacts with other organizations and actors that can aid the new firm by providing resources and knowledge (Zaheer et al., 2010; Protogerou et al., 2017; Polzin et al., 2018), whilst the absorptive capability is vital for the proper comprehension and utilization of resources and knowledge (Protogerou et al., 2017; Choi et al., 2021; Lee and Kang, 2015; Audretsch, 2014).

Collaborations between KIE firms and other entities can be supported or hindered by innovation activities designed by the government. Researchers use the framework of innovation systems (IS) to understand what type of policies need to be created to tackle current faults in the system (Boekholt, 2010). Hekkert et al. (2007) defined a framework with seven functions that describe the key activities within IS entrepreneurial activities, knowledge development, knowledge diffusion through networks, the guidance of the search, market formation, resources mobilization, and creation of legitimacy. This framework allows its user to follow the activities that lead to successful technological development and diffusion within society. Hence, the Dutch government (Government of the Netherlands, 2021) appears to have a deep understanding of these functions and supports the IS within the Netherlands by guiding through policies, boosting the demand side, and financing various kinds of research.

It is also important to note that the majority of these policies are reflected in the capabilities of KIE firms through the practices and activities offered by incubators, accelerators, and technology transfer offices (TTO). Even with the current strategies of the government, there is still a struggle to tackle various challenges such as funding KIE firms, developing the necessary capabilities of firms, strengthening knowledge transfer, etc. It is

to the advantage of the Dutch government to solve as many challenges as possible since KIE firms can attract large investments that benefit the country's economy (NLTimes, 2022). To do so, the government incentivizes the creation and existence of innovation programs that offer tailored services aimed at improving the capabilities necessary to innovate of KIE firms. The incubator and accelerator aid KIE firms in their early stage such that a scalable business model can be created and the first round of capital can be raised. On the other hand, the TTOs can support those firms in their late stage which are primarily concerned with the commercialization and advancements of their products. Hence, innovation policies and the goals of the Dutch government are expected to reflect on the capabilities of KIE firms through the practices of organizations such as incubators, accelerators, and TTOs.

The current study is now introduced and that is to investigate how innovation activities reflect on the capabilities of KIE firms, and more specifically, the capability to innovate. The research is focused solely on the impacts produced by the innovation activities on the capabilities of KIE firms to further understand how young companies operate given the support found within the region. Thus, the following research question is developed:

How do the innovation activities of incubators and TTOs affect the innovation capability of KIE firms through networking and absorptive capabilities?

There is a gap in research when it comes to innovation activities and the capabilities of KIE firms. In literature, a multitude of papers is found to discuss the collaboration between educational institutions, industry organizations, and new firms toward innovation (Fischer et al., 2018). This type of networking is deemed essential for innovation and information flow (Stam, 2015). Huynh et al. (2017) emphasized the need for the integration of the triple helix through networking to increase the capability to innovate of companies. Aside from that, some researchers accentuate the need for capabilities-building support by the government such that firms can survive and innovate (Choi et al., 2021; Figueiredo and Piana, 2018). In the end, there are only a few studies that relate how innovation activities and capabilities such as networking and absorptive interact with each other towards innovation (Lynskey, 2004; Protogerou et al., 2017).

Other literature only focuses on the effect of dynamic capabilities on the capability to innovate of firms, completely disregarding the concept of innovation activities. There is a limited amount of papers that discuss how the networking and absorptive capabilities influence each other and the capacity to innovate (Peng, 2022; Liu et al., 2017; Schoenmakers and Duysters, 2006; Zhou, 2022). All studies seem to agree that there is an interaction between networking and absorptive capabilities and that together they improve the capability to innovate of companies. Peng (2022) found that the networking capability affects the capacity to absorb which determines how innovative the firm can be. The study even differentiates between two types of networking and absorptive capabilities respectively.

The research design used in this paper enables the researcher to optimally address these gaps in the literature. The study starts off with an assumed model based on extant theory which can then be altered based on the actual findings for a more accurate portrayal of the current situation in North Brabant. Therefore, this paper is considered exploratory research based on qualitative data.

From an academic point of view, the research can shed new light on the way innovation activities affect the innovation of KIE firms from a region of a developed country such

as the Netherlands. Not only does the study go in-depth and discerns between different sorts of networking and absorptive capabilities, but it also creates a dynamic model with links affirmed by the results. Other researchers can use the system to observe how the operations of the firm, and the capability to innovate, are affected given the form of innovation policy pushed by the government and their reflection on innovation activities. Furthermore, the dynamic model resulting from this study can also be used to compare different regions of the Netherlands or to contrast the past with the future by using this research as a former study. When comparing different regions, this study can aid in constructing a model that fits the whole country. Thus, this offers a new perspective on the impact of innovation activities on capability to innovate, whilst allowing academia to build on it in various manners.

From a practical standpoint, the study can serve as a tool for the Ministry of Economic Affairs, responsible for innovation policies, and the KIE firms located in the region of North Brabant. Firstly, the Dutch government can use the research to observe where the discord is between the innovation activities and the innovation capabilities of firms. Based on the final model of the system, the government can have a proper view of what firm capabilities they are currently indirectly influencing using innovation policies. Thereby, they can determine which underdeveloped capability is impeding the creation and commercialization of new products and services in the region of North Brabant. Secondly, KIE firms can use the research to observe how existing innovation activities influence their capabilities. A clearly detailed picture of how activities are linked to capability to innovate can help KIE firms determine which business strategies can sustain their survival the best. Additionally, the founders may also use the research to decide how their capabilities could be further developed given the current governmental regulations. Therefore, a system that properly links the relationships between innovation activities, dynamic capabilities, and firm innovation is beneficial for both the government and executives of KIE firms.

2 Theoretical Framework

To understand how innovation activities play a role in the development of certain KIE firm capabilities, it is important to create an understanding of the concepts surrounding this topic. Innovation policies, which influence the variety of innovation activities, are often developed based on research done by specialists. The goal of the researchers is to create a comprehensive image of the current situation and point out the challenges new firms are facing due to their lack of experience, support, or resources. Subsequently, the role of the innovation activities is to fill in the gap and aid KIE firms in developing capabilities that enable the firm to gain more experience, knowledge, and resources. In this study, a comprehensive perspective of Dutch innovation policies active in the region of North Brabant is provided to understand how it influences the assortment of innovation activities offered by the incubators, accelerators, and TTOs of North Brabant.

Before going in-depth with the explanation of such concepts, the reader may wonder: “What are KIE firms exactly? What are the capabilities of such enterprises? How can innovation activities support the growth of these firms?”. To answer all these questions, the theoretical framework is split into two parts: conceptualization and the design of a system that links innovation activities and capabilities of KIE firms. The conceptualization covers various notions such as KIE firms, capabilities, and innovation activities. The section starts by defining and explaining what a KIE firm entails. Following that, dynamic

capabilities are described by placing emphasis on networking, absorptive, and innovation capabilities. Furthermore, innovation policies are outlined alongside the current situation of North Brabant to better comprehend the available innovation activities. In the end, a system is constructed that links the main variables discussed in conceptualization.

2.1 Conceptualization

2.1.1 KIE Firms

According to the Web of Science, the earliest study available on KIE dates back to 1992 when the concept became emergent. It can be found that most of the research regarding KIE is done in the areas of management, business, and economics. Malerba and McKelvey (2020, p. 508) proposed an empirical definition for KIE firms:

> "Knowledge-intensive innovative entrepreneurial firms are new learning organizations that use and transform existing knowledge and generate new knowledge in order to innovate within the innovation systems."

Conceptualizing KIE allows for easier recognition and differentiation between new firms and their potential. In accordance with the definition, there are four key elements that describe the qualities of a KIE firm:

1. New and independent;
2. Innovative;
3. Knowledge-intensive;
4. Prepared to exploit innovative opportunities.

The first key element suggests that the firm should be new and independent. The classification of new implies the company started its operations only in recent years which means it is still in its start-up phase. Moreover, being independent refers that the firm cannot be a division of another organization. Malerba and McKelvey (2020) noted that the origins of a new independent firm can be found in educational organizations, incumbent firms, universities, public sectors, and NGOs. Figueiredo and Piana (2018) agreed with this classification and noted that most KIE firms are the product of an entrepreneur, university spin-off, or corporate spin-off. In accordance with the previous statements, van Looy et al. (2011) found that universities with a technology transfer office produce around 26.88 spin-off companies in total on average. This indicates that universities and other institutions can be considered the origins of most KIE firms. Furthermore, the innovative aspect of a firm, as described by Malerba and McKelvey (2020), suggests that the company introduced new or made a significant improvement to its services and goods in the past three years. This is easily identifiable by searching within the history of the company and checking whether this is true or not. On the other hand, innovative companies often catch the interest of investors which results in capital injection. For example, Dutta et al. (2022) observed that the National Science Foundation of the USA prioritizes innovative, and risky technology

ventures within their funding applicant pool. This insinuates that some of the companies which had recently acquired funding might be more innovative than others.

The third key element marks the knowledge-intensive character the KIE firm needs to have. To fit in this category, Malerba and McKelvey (2020) suggested that the founder must have at least a bachelor's degree and whether the main areas of expertise of the founder are engineering or product design. A number of studies corroborate the fact that educated founders display better results by supporting R&D intensity (Belso-Martinez et al., 2013; Protogerou et al., 2017). Another study suggested that these types of founders mainly originate from non-commercial environments such as universities and other educational institutions (Huynh et al., 2017). Hence, investigating the educational background of the founder can be used to confirm this key element.

The last element is the firm's ability to be prepared to exploit innovative opportunities. To be ready to exploit an opportunity at any time assumes there are enough capabilities in the company to discover an innovative idea, comprehend it at a firm level, and then commercialize it. To put it simply, the firm must have the capacity to change given an opportunity. Patanakul and Pinto (2014) confirmed this capacity is dependent on technical knowledge and skills within the firm. Lynskey (2004) further solidified this theory by finding that technological capability determines the innovative activities of a KIE firm. A deeper discussion in regard to the capabilities of KIE firms will follow in the next section. For now, it is important to note that KIE firms have a strong capacity to change based on the opportunities available in the market.

To summarize, KIE firms are new and highly innovative companies that constantly introduce novel technologies to the market. This type of company is focused on R&D activities that allow them to exploit the opportunities by recognizing, integrating them, and then commercializing. To undergo research operations, KIE firms have an array of capabilities that allow them to change and reconstruct themselves given any innovation available.

2.1.2 Capabilities of KIE Firms

The main advantage of KIE firms is their inherent capabilities which allow the organization to change given the opportunities in the market. Schoemaker et al. (2018) placed strong importance on the differentiation of ordinary capabilities and dynamic capabilities. The authors further noted the distinction between the two by implying: one identifies process innovations (ordinary capabilities), whilst the other identifies new products and services that could open new markets (dynamic capabilities). Teece et al. (1997, p. 516) took it one step further and defined the dynamic capabilities as follows:

> "We define dynamic capabilities as the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments."

Teece (2007) conceptualized three distinct clusters for the dynamic capability: sensing, seizing, and reconfiguration. Firstly, sensing opportunities implies the firm has the necessary capabilities to recognize innovative ideas and assess whether they can be successful. Furthermore, seizing involves the process of idea materialization where new products,

processes, and services are expected. Lastly, reconfiguration presumes self-innovation such that the company does not remain path-dependent (Teece, 2007). Thus, a firm with dynamic capabilities is expected to produce radical innovation through products and services while keeping its processes innovative so it can hold its competitive position in the market.

The KIE firm is in its early phases of development hence the study focuses on the capabilities which involve sensing and seizing. Starting with sensing, there are multiple interrelated factors within the phase of idea recognition such as prior knowledge, social capital, cognition, environmental conditions, entrepreneurial alertness, and systematic search (George et al., 2016). These factors are a combination of environment and firm-specific capabilities. For instance, environmental conditions such as political climate, demographic conditions, or social mores (Schoemaker et al., 2018) are out of the control of firms. On the other hand, there is social capital which can be directly linked to the networking capabilities (Malerba and McKelvey, 2020; Groen et al., 2008) while prior knowledge, cognition, entrepreneurial alertness, and systematic search appropriate absorptive capabilities (Patanakul and Pinto, 2014). Furthermore, seizing is the phase that involves development and commercialization (Teece, 2007). To acquire resources and knowledge essential for manufacturing products or services, the firm must again rely on its networking and absorptive capabilities.

Hence, for this study, the main capabilities of a KIE firm are assumed to be networking and absorptive. These capabilities are presumed to support the KIE firm to achieve its main goals: to be innovative and to exploit innovative opportunities (Malerba and McKelvey, 2020). Although the technological capability (Lynskey, 2004) was mentioned in the section *KIE Firms*, it is not taken into consideration as it is encompassed within the absorptive capability. Yam et al. (2011) noted that the technological innovation capability compromises of the skills to generate, diffuse and utilize innovations. As a result, the networking and absorptive capabilities in regard to KIE firms are discussed in the next paragraphs.

Networking Capabilities. Networks are vital for KIE firms as they open the possibility to acquire new knowledge in regard to technology or commercialization. Walter et al. (2006, p. 546) defined networking capability as the ability to *"initiate, maintain, and utilize relationships with various external partners"*. Most founders of KIE firms have a non-commercial background (Huynh et al., 2017), so the firms have to seek guidance from actors or organizations that can provide them with information necessary to improve the capabilities they lack (Protogerou et al., 2017; van Looy et al., 2003; Cho et al., 2019; Groen, 2005). The government and other corporations have already started the initiative to aid these new firms by providing them with incumbents, science parks, or inter-organizational collaborations (Protogerou et al., 2017; Groen, 2005). On top of that, Polzin et al. (2018) advised entrepreneurs to invest in their networking activities as they are highly perceived by potential investors.

KIE firms are strongly dependent on the ties they build since their newness on the market hints at the lack of other types of capital when compared to an established company. Perry-Smith and Mannucci (2017) divided the strength of ties within a network into weak and strong. The research found that weak ties facilitate the phase of idea generation which includes recognizing opportunities, whilst strong ties aid in the process of elaboration where an idea is brought within the company to be assessed and developed. Moreover, in a study

by Capaldo (2007), an R&D director noted while strong ties are valuable, weak ties allow the firm to be flexible so they can adopt emergent technologies. Thus, KIE firms should not narrow the number of their ties and strengthen them but instead, they should seek other actors who might aid them with new outlooks and technologies.

The networks of KIE firms change throughout the lifetime of the organization. Stam (2015) highlighted the importance of founders' networks to allow information flow within their firms as well as diffusion of labor and capital. In the beginning, the KIE firm's network might be dominated by weak ties which are built in incumbents, science parks, or TTOs (Huynh et al., 2017). Mort and Weerawardena (2006) observed that founders start with a useful set of networks and work hard to reconfigure them whilst also creating new networks. As mentioned earlier, for a young organization such as a KIE firm, it is important to gather numerous contacts and focus on quantity rather than the strength of the ties. Walsh (2019) confirmed that a large network allows for more resilience in case of obstructions. As time passes and the KIE firm takes more steps towards entering the market, the company needs to be supported by industrial networks that can reduce the environmental uncertainty and provide new inputs for the use of the KIE firm's technology (Dianez-Gonzalez and Camelo-Ordaz, 2019). Hence, with time, the KIE firm should continue expanding its network while simultaneously building stronger ties within the industry such that it can efficiently develop its innovative services and products.

Absorptive Capabilities. KIE firms must develop their absorptive capabilities to assimilate and use knowledge efficiently. Cohen and Levinthal (1990) defined absorptive capability as the ability of a firm to recognize, integrate, and exploit external knowledge. In addition, the firm must have internal actors who specialize in certain technologies or sciences and understand the firm's goal to be able to integrate certain information. In the advantage of KIE firms, the founders already have scientific backgrounds (Malerba and McKelvey, 2020) thus the firm is born with an above-average absorptive capacity which fastens the ability to accumulate new knowledge in the next periods of time (Cohen and Levinthal, 1990). Another definition of absorptive capacity (ACAP) is given by Zahra and George (2002, p. 186): *"[...] we define ACAP as a set of organizational routines and processes by which firms acquire, assimilate, transform, and exploit knowledge to produce a dynamic organizational capability."*. In contrast to Cohen and Levinthal (1990), Zahra and George (2002) divided ACAP into four dimensions: acquisition, assimilation, transformation, and exploitation. These dimensions were then separated into potential and realized ACAP. The potential absorptive capacity (PACAP) includes acquisition and assimilation, whilst the realized absorptive capacity (RACAP) constitutes transformation and exploitation. PACAP focuses on the absorptive capabilities that determine whether the firm can recognize and properly evaluate an innovative opportunity. On the other hand, RACAP establishes whether the firm is able to leverage the knowledge and gain a competitive advantage. In this study, the definition and implications of Zahra and George (2002) are considered suitable in describing the absorptive capability of KIE firms.

KIE firms must be able to use both their PACAP and RACAP at an equal rate for maximum efficiency. According to Malerba and McKelvey (2020), two of the four key elements of a KIE firm are innovation and readiness to exploit innovative opportunities. For a company to be constantly innovating, there needs to be a constant flow of new information going through the organization (Stam, 2015; Liao et al., 2006), which means that PACAP

is necessary. Zahra and George (2002) suggested that PACAP can support the firm's effort to notice changes in the industry and react quickly to them. Dianez-Gonzalez and Camelo-Ordaz (2019) noted that the ability to detect changes is tied to the capacity to network within the industry. According to Cohen and Levinthal (1990), ACAP is strongly related to the ties the actors within the company have with the external industry. Having numerous ties allows for an increased volume of knowledge sharing with outside organizations which can further develop the absorptive capability of firms which results in greater innovation (Liao et al., 2006). As mentioned earlier, to have a grasp of the knowledge flow, the founders of the company need to possess scientific knowledge (Malerba and McKelvey, 2020). Thus, PACAP of KIE firms is dependent on the ties the founders build with the external organizations as well as their prior knowledge to recognize opportunities they found through ties.

Following the recognition and assimilation of new market opportunities, the KIE firm must be capable to transform and exploit them. Zahra and George (2002) noted that PACAP does not determine RACAP. If PACAP was defined by external ties for information flow and prior knowledge of the founder, RACAP is described by the ability to sustain product and service processes to maintain a competitive advantage. In accordance with Malerba and McKelvey (2020), the RACAP of a KIE firm defines the readiness to exploit innovative opportunities. In contrast with established companies, KIE firms do not have access to all of their needed assets, and hence the firms are dependent on other organizations to provide them with the resources necessary to transform their innovative idea and commercialize it (Groen, 2005). Aside from resource networks, the founding team of the KIE firm must have the necessary technological capacity to develop its products or services. As Yam et al. (2011) indicated, technological capacity contains the ability to diffuse and utilize knowledge. For instance, Choi et al. (2021) mentioned that firms with a great number of patents have a developed ACAP and know how to utilize knowledge. Hence, RACAP assumes there is a need for strong ties to facilitate resource transfer to the KIE firm, not only that, but the firm also needs to have a developed technological capability to utilize information.

Innovation Capability. By combining networking and absorptive capabilities, firms construct their capacity to innovate. Aas and Breunig (2006) defined innovation capability as the ability to recognize novel ideas and commercialize them by means of goods, services, or processes. There is a strong resemblance between the definition of dynamic capabilities by Teece et al. (1997) and the one proposed by Aas and Breunig (2006) which might suggest that the capability to innovate is determined by other, more specific, capabilities. In this study, it is presumed that the innovation capability is the result of a balanced utilization of PACAP and RACAP. KIE firms are assumed to develop weak and strong ties with the purpose of facilitating PACAP and respectively RACAP. Sensing an opportunity is strongly tied to the number of weak ties, simultaneously, these weak ties boost the PACAP. On the other hand, seizing involves the use of strong ties to access resources, this is where RACAP is involved. These connections point to an interrelation between the types of networking ties and the ACAP in use.

There are only a few papers that discuss the relationships between tie strength and absorptive capability. Although, in most of them, the differentiation between PACAP and RACAP is indiscernible (Liu et al., 2017; Zhou, 2022; Schoenmakers and Duysters, 2006). Liu et al. (2017) and Peng (2022) found that tie strength indirectly affects inno-

vation through ACAP. What distinguishes the two pieces of research is that Peng (2022) differentiated between the types of ACAP, and found that weak ties affect PACAP, whilst strong ties affect RACAP. This is in line with the assumptions made in a paragraph earlier. Furthermore, Schoenmakers and Duysters (2006) found that learning through weak ties results in more innovative knowledge flow within the company when compared to the effect of strong ties. It makes total sense since PACAP needs new and diverse information, while RACAP requires established knowledge in regard to resource acquisition and commercialization. The remaining literature on this subject does not necessarily include tie strength or the distinction between the types of ACAP. Zhou (2022) discovered that structural holes can enhance the ACAP's positive impact on innovation. Despite the fact that this study is not concerned with structural holes, it is intriguing to observe the direct benefits of networking on ACAP. Hence, the majority of the literature on this subject agrees on the links between tie strength and the ACAP category.

To summarize, in this study it is assumed that weak ties influence PACAP, whilst strong ties affect RACAP. This concept is used throughout the paper and especially in the design of the model that is meant to answer the main research question.

2.1.3 Innovation Activities

To support the creation of suitable capabilities for KIE firms, the government needs to be attentive and implement appropriate policies for the support innovation. Boekholt (2010, p. 334) defined the innovation policies as:

> "[...] innovation policy refers to policies stimulating the translation of knowledge into new commercial applications."

The author further pointed out that the innovation policy is closely tied to three other types of policies: science, research, and technology. While there are no clear boundaries between these sorts of policies, each one of them serves a slightly different purpose. For instance, the science-policy concerns funding for educational institutions or intellectual property rights, while technology policy deals with the support of technological improvements excluding profit and commercialization (Boekholt, 2010). In contrast, Kuhlmann (2001, p. 954) defined the innovation policies as:

> "[...] as the integral of all state initiatives regarding science, education, research, technology policy, and industrial modernization, overlapping also with industrial, environmental, labor, and social policies."

This definition captures all policies and goals, mentioned by Boekholt (2010) under one definition. Kuhlmann (2001, p. 954) also mentioned: *"Public innovation policy aims to strengthen the competitiveness of an economy or of selected sectors, in order to increase societal welfare through economic success."*. In contrast to the previous definition, this one also stresses the sector applicability of innovation policies. This insinuates that every sector of the market can behave differently, hence the approach to innovation policies should be tailored in consideration to each sector.

The literature on innovation policy dates back to 1962 according to the Web of Science. This implies that the research must have experienced multiple reforms according

to the rate of technological advances of each time period. One of the most important findings which were taken into consideration by the government regards technological transfer measures, the support of ACAP, diffusion of policies, and finances for innovation (Boekholt, 2010). This governmental regulatory support came as a response to the disaster of 2008 which sparked a financial crisis globally (Pfotenhauer and Juhl, 2017). The authorities observed that leaving free reign to innovation can bring a country to collapse and thus regulations are needed to prevent that. Throughout time, the situation stabilized with the introduction of innovation policies. However, the current conditions are far from ideal. Pfotenhauer and Juhl (2017) noted that extant research often fails to include the political aspect surrounding innovation policies. Their literature review on the matter allowed them to observe that innovation is not only a "techno-economic development", but also a governing method. Therefore, it is important to remember that innovation policies are not only influencing the economy and technological advances of a country but they also have a political quality.

To construct innovation policies in accordance with market needs, researchers working for the government utilize the IS approach. Using this method, an extensive understanding of the market can be built by following seven functions (Hekkert et al., 2007):

1. Entrepreneurial activities;
2. Knowledge development;
3. Knowledge diffusion through networks;
4. Guidance of the search;
5. Market formation;
6. Resources mobilization;
7. Creation of legitimacy.

These functions are employed to examine how the Dutch government ensures smooth operations within their national innovation systems (NIS). Multiple documents issued by the Dutch government are going to be analyzed to verify whether the support for the abovementioned functions is fulfilled.

The Netherlands appears to be aware of its market needs and the government responds accordingly. In 1932 the TNO (Netherlands Organisation for Applied Scientific Research) was founded to aid governmental and non-governmental organizations with innovative knowledge (TNO, 2022b). The scope of the TNO is to link important actors and encourage knowledge transfer to facilitate innovation (TNO, 2022a). Every four years the organization renews its strategy so it can fit the current market needs. TNO noted that for 2022-2025, their focus is to tackle four societal challenges: safety and security, health, sustainability, and digitization (TNO, 2022a). Given the information available, it appears that the TNO focuses its efforts on the country level rather than the regional level. Thus, the TNO is expected to have an indirect influence on the innovation policies that concern certain regions of the Netherlands.

Since the current research is focused on the North Brabant region, and in particular Eindhoven, it is also interesting to explore regional development agencies (ROMs) instead of the TNO. According to Netherlands Chamber of Commerce, KVK (2022), ROMs are meant to stimulate the economy of their belonging region by promoting innovation, investments, and globalization. ROMs also aid entrepreneurs and organizations in finding suitable contacts that can enhance their innovation processes. Furthermore, Netherlands Chamber of Commerce, KVK (2022) mentioned that ROMs receive an annual budget from the government, which they can use to invest in innovative local businesses as venture capital. Most of the time, this venture capital is given in exchange for equity. Moreover, ROMs also decide on the development and adjustment of industrial buildings, and business parks. In North Brabant, the company that seeks to aid companies with innovation is BOM (The Brabant Development Agency).

BOM has the funds and connections which could aid KIE firms in taking off. According to their website (BOM, 2022a), BOM's main focus is to bridge the gap between entrepreneurs, knowledge institutes, and authorities. Etzkowitz and Leydesdorff (1995) mentioned that the triple helix, the collaboration between the three entities stated previously, is essential for innovation on a larger scale. BOM facilitates the engagement of the triple helix through venture-building programs which specifically focus on start-ups (BOM, 2022b). Firstly, BOM analyzes the firm to confirm what stage of the company life-cycle they are in, and then they provide the firm with connections to the best partners that can help with scaling up the business. It is important to note that BOM carefully selects companies they want to invest in based on requirements such as sustainability, health, climate neutrality, and promising technologies. BOM (2022b) highlighted that joining this program aids new firms to gain insight into their position on the market, but also helps the firms put all their efforts in the right direction. Hence, BOM acts like an incubator for new firms that they consider high-tech (KIE firms) or sustainable.

The region of North Brabant is a prime example of a well-developed region that can host KIE firms by continuously supporting them through various means. Hagens et al. (2020) mentioned that the south of the Netherlands already has developed an entrepreneurial mindset by hosting multiple established companies and emerging ones. In addition, North Brabant is the host of leading-edge universities such as the Eindhoven University of Technology. Adler and Florida (2021) observed that the presence of such academic institutions leads to an increase in high-tech spin-off formations. Many of these high-tech companies in North Brabant operate in the domains of digital technologies, photonics, advanced materials, life science & biotech, chemical technology, and nanotechnology (Hagens et al., 2020). Furthermore, the infrastructure built in this region promotes cooperation and networking by supporting specialized campuses and other organizations of the triple helix. Nonetheless, the region is still facing some challenges in regard to the commercialization of innovative products and services. Although most of the functions proposed by Hekkert et al. (2007) are supported by the Dutch government in the region of North Brabant, the market formation and creation of legitimacy still remain an issue. For instance, Hagens et al. (2020) observed that technological knowledge exists in abundance. However, there might be no market established for these technological advances which impedes their potential to innovate in society. Thus, the Dutch government aims to solve this issue in North Brabant by implementing appropriate innovation policies that can enable the new technologies to

take off on the market.

To fill the gap between technological knowledge and its commercialization and promote regional innovation, the Dutch government proposed several focus points for the years 2021-2027. The aim of these items is to increase innovation and the creation of sustainable solutions in the region of North Brabant. By implementing these strategies, the government can tackle regional challenges that regard energy, raw materials, climate, agriculture and food, and health. The world has become increasingly aware of the dangers concerning climate change and its impacts on health (World Health Organization, 2021). Hence, the North Brabant government takes into consideration public opinion and chooses to focus on creating solutions for the transition towards greener energy which can offset the pollution produced by raw materials, as well as agriculture and food.

To encourage developments towards renewable energy, the regional innovation system (RIS) framework is employed by the local administration. The scope of RIS is to provide the domestic ecosystem with information that can reduce uncertainty, promote collaboration, and boost innovation (Asheim et al., 2019). Moreover, RIS can enact itself through various institutions such as incubators, universities, research laboratories, and other similar entities. Isaksen et al. (2018a) classified the type of policies affiliated with such institutions to be within the entrepreneurial regional innovation system (ERIS). Through ERIS, the Dutch government can focus on stimulating businesses that display high R&D efforts and scalable potential, hence, KIE firms. In addition, the ERIS policies aim to develop the innovation capabilities of young companies within its designated region by building on the absorptive and networking capacities (Isaksen et al., 2018b, Isaksen et al., 2018c). A large network would allow entrepreneurs to capitalize on new knowledge, whilst the absorptive capacity enables them to efficiently assimilate the information within their own KIE firm. Thus, in the following paragraphs, the way in which the Dutch government uses the RIS framework is explained.

Firstly, the Dutch government wants to introduce new forms of collaboration in the region of North Brabant. For instance, KIE firms have become the largest interest for Regional Innovation Strategy for Smart Specialisation (RIS3) since they can bring technology locally and adapt it to a national level and ultimately to international (Hagens et al., 2020). Since established companies choose to collaborate with firms that can bring them an advantage (Oukes et al., 2019), KIE firms can fit this role given their innovative products and services which may aid the operations of extant large corporations. To facilitate this sort of cooperation, the government wants to ease the regulatory environment and reduce the administrative burden making it easier for a young company to collaborate with potential partners. In addition, ROMs should be further promoted and new firms need to be encouraged to collaborate with such intermediaries so that they can gain access to essential networks. Hence, networking is considered a key element for the foundation of KIE firms in North Brabant.

Secondly, innovative products and services should go through vigorous market validation before their launch. Hagens et al. (2020) noted it is important for the new firm as well as the investors to comprehend the readiness of the society in regards to their technology. Current organizations must have the necessary means to accommodate the new technology easily without causing any additional environmental damage. Taking into consideration Tesla, the company was and still remains a key innovative player in the electric

car industry. However, the production of vehicle batteries proves to be a challenge as the current process of lithium mining is highly polluting (Putzer, 2022). Furthermore, people must be open to embracing this innovative product and service, and thus, they need to be made aware of the scope of the new technology. Although the manufacturing of electric car batteries is more polluting than combustion engines, using electric cars instead of traditional gas cars creates less air pollution which makes them more sustainable in the long term (Tonachel, 2015).

Thirdly, the KIE firm has to take into consideration how their unique knowledge can be translated to new employees as their company takes off. Training new employees on specific new technologies usually requires an effort from the company that now has to allocate a certain amount of money towards education. Hagens et al. (2020) suggested that KIE firms could collaborate with educational institutions such that the skills they are seeking in an employee can be taught early on without the need for additional investment from the KIE firm. Another solution provided by the document is to create learning workplaces inside the company which could alternatively be supported through EU funds. There are two other actions that the government can take to bridge the aforementioned gap. Hagens et al. (2020) also suggested cooperation with parties at home and abroad to improve resilience. Not only that, but the government also wants to monitor and document the societal impacts of innovations to improve their reaction to the market needs.

To summarize, the Dutch government appears to be greatly aware of the issues within its NIS and more specifically its regional IS, and hence appropriate solutions are formed and applied through various projects and innovation policies. To be exact, the Dutch government focuses on facilitating networking between all sorts of organizations by easing bureaucracy and providing companies with incentives and knowledge to do so. The goal is to provide young businesses, such as KIE firms, with the means to validate their innovative idea and bring it to commercialization. In addition, considering the current concerns with climate change and its impact on people's health, the RIS3 framework also aims to support sustainable technologies which have a limited impact on the environment. According to governmental research, this can be achieved through collaborations with ROMs and other knowledge institutes, where the KIE firm can learn how to grow its business and remain sustainable. Hence, rather than looking at regional innovation policies, it would be more relevant to see how the innovation activities of institutions meant to aid KIE firms impact the capabilities of the young start-ups.

In the next section, the conceptualized elements are linked together to form an emergent model which is taken into consideration when performing interviews and after that, when coding them.

2.2 The Effect of Innovation activities on KIE Firm Capabilities

So far, the study elaborated on different concepts such as KIE firms, dynamic capabilities, and innovation activities, not only that, but it also specified the current challenges of innovations in the Dutch market and how the government aims to regulate these conditions. To understand how the three conceptualized variables are linked, Figure 1 displays a model which presents the assumed indirect effect of innovation activities on the innovation capabilities of KIE firms using different types of networking and ACAP as mediating variables.

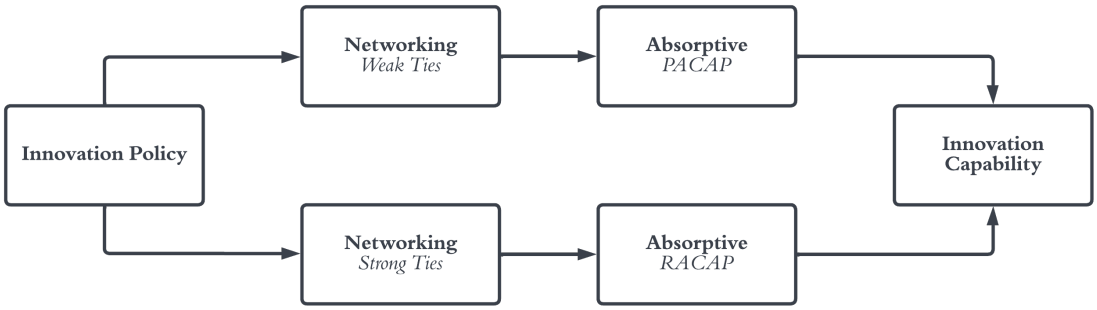

Figure 1

The influence of innovation activities on the dynamic capabilities of KIE firms which includes ACAP concepts defined by Zahra and George (2002).

This scheme is abstract and only covers a few assumptions generalized in Section 2. For this reason, there are no further details for each respective box, nor are there any specifications of the actions which define the relationships between the variables (Figure 1). However, as the research advances into results, the dynamic links separating the variables are expected to be solidified using the findings of the gathered empirical data. The 'unclad' scheme allows the study to be exploratory and search beyond confirmation of facts. This approach enables a more realistic view of the current situation regarding innovation activities and innovation as output by allowing the researcher to change, add or remove links or even variables.

The following paragraphs are used to explain how the system in Figure 1 is constructed. Innovation policies in North Brabant are assumed to indirectly impact networking capabilities through the activities of incubators, accelerators, and TTOs based on ERIS. The existing activities and programs focus on enabling the KIE firm to collaborate with various institutions on the market such that the KIE firms can receive essential knowledge for the commercialization of innovations (Hagens et al., 2020). This means that the Dutch government is focused on providing the necessary help to teach KIE firms to form long-lasting relationships. Not only does the regional Dutch government focus on improving strong ties, but they also want to maintain their support towards weak ties through, for instance, business parks (Netherlands Chamber of Commerce, KVK, 2022). Therefore, it is assumed that innovation activities can directly affect the tie strengths of the networking capability through the activities offered by the incubator or TTO.

Moving on, the networking capability is assumed to have a direct effect on the absorptive capability of a KIE firm. Cohen and Levinthal (1990) emphasized the interrelation of these two capabilities by specifying that the ACAP of a company depends on the ties it has with outside organizations. This view is shared by Vrontis et al. (2017) who mentioned that investing in external knowledge improves the means of exploring and exploiting, in this situation, sensing and seizing. Moreover, depending on the type of networking ties, a different dimension of ACAP is concerned. For example, PACAP is mostly influenced by weak ties since, through vague and various kinds of information, the organization is able to learn to identify innovative opportunities. On the other hand, RACAP is determined by

strong ties, in this case, ties fostered by KIE firms with educational institutions or other partners from numerous industries. In contrast to weak ties, strong ties provide knowledge that can be absorbed with more ease by KIE firms. Not only that, but strong ties supply the KIE firm with resources necessary for commercialization (Groen, 2005).

Finally, the innovation capability is assumed to rely on the KIE firms' PACAP to sense an opportunity, and the RACAP to seize and commercialize it. It is important to note that while PACAP does not determine RACAP (Zahra and George, 2002), they weigh into *"Innovation Capability"* around 50% each. This implies that the capability to innovate can be considered fully developed only when both types of ACAP are present. A fact aligned with the definition stated by Aas and Breunig (2006) which remarked that a novel idea does not become an innovation on the market unless it is also successfully commercialized by the specific KIE firm. Thus, recognizing and transforming an opportunity, also known as sensing and seizing, are assumed to constitute the KIE firm's innovation capability.

To conclude, the dynamic model found in Figure 1 is only an assumption based on information from the theoretical framework, and additional relationships or variables are expected to emerge as the research goes on.

3 Method

The Method Section focuses on the methods used to collect and analyze data. The study utilizes a qualitative approach to answer the main research question and to uncover if the model in Figure 1 provides an accurate view of the current situation of innovation in North Brabant. Various sub-sections are used to explain in detail how the data gathering proceeds and what it entails. For starters, the qualitative approach is justified and a setting is given explaining how the interviews will proceed. Afterward, the study elaborates on what kinds of institutions and organizations are needed for data collection. Once the potential interviewees are identified, a short discussion explaining how the actors are approached and asked to join the research is provided. Following that, an interview protocol is displayed in detail clarifying the questions used during the interview and data collection, confidentiality, usage, and storage. Lastly, the approach chosen for analyzing the transcripts of the interviews is described in-depth.

3.1 Research Method & Setting

This study follows a qualitative approach to investigate the influence of innovation policies on the innovating capabilities of KIE firms. Due to the openness of the main research question, it is interesting to go beyond the verification of hypotheses and instead explore possible underlying relationships between the variables given in the assumed model (Figure 1). According to Bansal and Corley (2012), a qualitative study is focused on embracing various narratives, allowing the researchers to discover the exact relationships between the variables as the research occurs rather than a simple confirmation of whether the link assumed between variables is correct or not. Since there are no specifications on how innovation policies interact with dynamic capabilities that promote innovation within Figure 1, the proposed approach is suitable for this study.

The large majority of data collection is expected to be online. The platform proposed for this study is Microsoft Teams which allows for confidentiality and video recording. While

both are important aspects of an interview, the latter is essential to assure that the data is interpreted correctly by the researcher. A video recording is necessary to create a transcript of the interview for data analysis. Furthermore, at the time the online interview takes place, the cameras of the interviewer and the interviewee should be on. Since the online medium cuts off a large amount of tacit communication, facial expressions should at least be preserved for the sake of a deeper understanding and interpretation. In this manner, the interview is more personal and the information can be communicated with more ease between the two parties minimizing the risk of confusion.

3.2 Sample

For the online interviews, the study proposes two different sample groups to be interviewed: KIE firms and governmental institutions that are in charge of innovation policies or incentives. The intended number of samples for each organization is depicted in Table 1. More information is needed from KIE firms as they have better input on their learning experiences. Moreover, the study expects that for at least one KIE firm, multiple individuals should be interviewed to solidify the findings regarding the intra-organizational impact of innovation policies through various sources.

Table 1

Number of samples expected from each organization.

KIE Firms	$\approx (3+ \geq 2)$
Governmental Institutions	≈ 2

To begin with, KIE firms are necessary for this research as these organizations are increasingly aware of how the innovation policies impact their dynamic capabilities, in contrast to the knowledge of governmental institutions. To identify this kind of firm, the study uses the findings of multiple papers which are summarized in Section 2.1.1. As stated by Malerba and McKelvey (2020), the KIE firm is defined by four key elements: new and independent, innovative, knowledge-intensive, and prepared to exploit innovative opportunities. For each of these elements, examples were given showing how they might exhibit within a KIE firm. To summarize, a firm is considered a KIE firm if:

1. The firm is not a division of another organization.
2. The firm only began its operations in recent years.
3. The firm commercialized new or innovative improved goods and services.
4. The founder(s) are highly educated (bachelor's degree or engineering background).
5. The firm has displayed its capability to innovate.

Aside from KIE firms, certain governmental institutions should be interviewed. By considering these organizations, it can be better understood whether the majority of the triple helix is aware of the current challenges faced by KIE firms in regard to their capability

to innovate. Moreover, this inclusion aids greatly in the quality of this research by including different points of view. Nonetheless, the governmental institutions considered for this research are ROMs and TTOs. These organizations serve one purpose so there is no need to go in-depth to discover elements that might aid in their recognition. For the region of North Brabant, a known ROMs is BOM as presented in Section 2.1.3, whilst a TTOs to consider is the Research Support Network (RSN) from the Eindhoven University of Technology.

3.3 Recruitment Process

Once all the organizations needed for this research are identified, the researcher can start contacting each one of them individually. The first contact with the organizations involved in this study is via e-mail or LinkedIn message. A standard letter (Appendix 6.2) is designed to be sent as an opening statement to potential research participants. In this e-mail or message, the scope of the research is briefly explained and the potential participant is assured that the data gathered remains confidential within the privately published study. The organizations are given one week to reply and if no response is received, then the researcher proceeds by sending them a reminder through other forms of communication such as e-mail (if first contacted through LinkedIn), LinkedIn (if first contacted through e-mail), or phone.

For each organization, different actors need to be contacted and requested for an interview. For KIE firms, the researcher needs to get in touch with people who are aware of the development of the firm and its capabilities. For this, a person who operates at the core of the organization and possesses an overview of all operations is needed. Since the company is assumed to be new (Malerba and McKelvey, 2020), the person intended for the interview can be the founder or another managerial employee. In the case where more than one sample per company can be gathered, other employees dealing with internal and external affairs are taken into consideration. Again, since the firm is small, it is expected that most employees have a more substantial overview of the current situation when compared to employees of established corporations. As for governmental organizations, people who are in direct contact with KIE firms can be taken into consideration as potential interviewees. These actors are expected to have a more comprehensive impression of how the innovation policies and programs impact the KIE firms. Hence, they are capable of properly answering the questions of the interview.

Once the organization responds positively to the research invitation, the researcher should make sure to connect with the specified actors of each organization such that they can explain more about the study and schedule a date for the interview.

3.4 Interview Protocol

Since this study is a part of the research done on a larger scale, the data gathered needs to answer a standard set of questions such that it can later be used for accurate comparison with other regions of the Netherlands or Brazil. Aside from the standard protocol, an additional set of questions is added to distinguish between weak and strong ties, as well as PACAP and RACAP. Moreover, the study does not focus on the confirmation of the

system from Figure 1 but it aims to explore the possibility of new emergent variables and relationships.

3.4.1 Standard Script

The standard interview scripts for institutions and KIE firms are found in Appendix 6.1.1. It is important to note that the standard scripts follow a general model (Figure 2) linking three different variables: innovation policy, dynamic capabilities [1], and innovation policies.

Figure 2

The basic model concerning the influence of innovation policies on the dynamic capabilities of KIE firms.

The first script in Appendix 6.1.1 displays the questions used to gather data from institutions such as incubators, governmental initiatives, or TTOs. The script is divided into three parts, namely: innovation policy, dynamic capabilities, and innovation capability. Moving on, the second script in Appendix 6.1.1 presents the set of questions addressed to KIE firms. In this case, the script is separated into five sections: innovation policy, dynamic capabilities, absorptive capability, networking capability, and innovation capability. The script for KIE firms differentiates between absorptive and networking capabilities. This is due to the fact that KIE firms are expected to have more awareness of their capabilities and thus more information can be extracted from their experiences with innovation policies.

It is important to note that while the standard script down not discern between different types of networking and ACAP, the script does offer important input regarding the knowledge processes of KIE firms. The manner in which KIE firms learn based on innovation policies is evaluated from both the institution's and the KIE firm's point of view. These questions are addressed in the *"Innovation Capability"* rubrics of each script and are kept also in the final script.

3.4.2 Final Script

As remarked earlier, the standard script follows a simpler design that does not discern between strong and weak ties, nor between PACAP and RACAP. Although some of the questions in the scripts from Appendix 6.1.1 could be used to discern between the two dimensions of ACAP, additional questions are needed for further clarification and to ensure refinement from supplementary speculation.

New questions are added to the dynamic capabilities section in the script for institutions (Appendix 6.1.2) and for KIE firms, they are included in the sections: absorptive capability and networking capability (Appendix 6.1.2). The new elements of the scripts are

[1] The basic models assumes that dynamic capabilities contain the absorptive and networking capabilities.

in strict accordance with the conceptualization of dynamic capabilities discussed in Section 2.1.2. Firstly, following the theory of networking capabilities, the subsequent questions were generated for the institutions' script (Appendix 6.1.2) whilst taking into consideration the research conducted by Perry-Smith and Mannucci (2017):

***Weak ties**: "Does your institution aid companies to come into contact with actors from different industries? (How does it work?)"*
***Strong ties**: "Does your institution help and teach companies to efficiently collaborate with organizations that provide access to important resources? (How does this happen?)"*

For the KIE firms the questions added to Appendix 6.1.2 concerning the networking capability are modified in such way:

***Weak ties**: "How many new contacts from various industries have you gained during the innovation program? (Can you elaborate?)"*
***Strong ties**: "Have you been taught how to maintain efficient communication with organizations that provide access to important resources? (How did it work?)"*

Secondly, the absorptive capabilities questions on the standard script are discussed to assess whether there is indeed a need for any additional set of questions that should differentiate between PACAP and RACAP (Zahra and George, 2002). From the institution's standard script (Appendix 6.1.1). The following questions could be used to differentiate between the two dimensions of ACAP:

***PACAP**: "Do you support the process of acquiring new technology knowledge for your clients? (Can you elaborate on how this happens?)"*
***RACAPa**: "And about the development of the technology/product? Does your institution help the companies to improve it?"*
***RACAPb**: "Does your institution support the companies in the commercial process?"*

The question for RACAP is divided into two sub-questions. This is due to the fact that the first one did not cover all the implications of RACAP described by Zahra and George (2002). Favorably, the second question fills this gap and thus RACAP can be considered fully addressed.

Thirdly, there are already two questions from the standard KIE firm script that accommodate the distinction between PACAP and RACAP:

***PACAP**: "Do you think your company assimilates other actors' knowledge to build new products and/or services during the program?"*
***RACAP**: "Do you design alternative prototypes for your company's products and/or services? Does the program influence it? "*

Lastly, another interesting element worth inquiring about during the interview is the division between PACAP and RACAP and the implicitly weak and strong ties a KIE firm utilizes to commercialize innovation. These new sets of questions are only addressed to the KIE firms as they have a better overview of their own operations. Thereafter, these questions need to be answered by actors of KIE firms:

Between weak ties/PACAP and strong ties/RACAP, what would you consider to be the percentages your company operates on? (How did you decide on these numbers?)
Between weak ties/PACAP and strong ties/RACAP, which combination of capabilities is more difficult to achieve by your company? (Why is that so?)
What could enable your company to balance these capabilities more efficiently?

The first question observes how these capabilities co-exist within the innovation process of a KIE firm. From the second question, the study can uncover the current challenge the companies face. This can also point out to what kind of network contacts the companies have access to and how it affects their commercialization process. Finally, an open question is designed to allow the interviewee to share their opinion on the necessary support that should be given to the KIE firm such that they can balance weak ties/PACAP and strong ties/RACAP. All of these are added to the final script of KIE firms in Appendix 6.1.2.

The language used in the last set of three questions is scientific and might confuse interviewees into giving an answer unrelated to the actual topic. Hence, wording easily understood by any employee should be used when addressing these questions in an interview. For this, the following questions are re-written:

Do you consider your company more innovative when it operates more with close connections in comparison to distant contacts? (How so?)
Do you think it is more difficult to make brand new contacts in comparison to growing a closer relationship with a contact you have already made? (Why is that so?)
What could enable your company to gather new contacts and also focus on growing closer relationships at the same time? (Can you elaborate?)

To summarize, the study assumes the final set of scripts in Appendix 6.1.2 to be sufficient in identifying the existent and possible links between the variables in Figure 1. These questions offer differentiation between various categories of variables and enable the interviewee to add insights not yet touched on by extant research.

3.4.3 Consent for Recording & Confidentiality

To carefully extract data from the interviews, the researcher asks for permission to record. By doing so, the researcher is able to transcribe the interviews before starting the data analysis process. Before recording, the participant is asked to sign a consent form. In this form (Appendix 6.3), the participant is able to confirm whether they agree to conditions regarding the fashion in which the interview is conducted. Moreover, the interviewee is ensured that whenever they deem fit, they are allowed to conclude the interview and leave the research.

The consent form also assures the participant that their firm's identity, as well as their personal details, can be kept completely confidential when they find it necessary. This means any information which might direct the data to the participant is kept secret throughout the whole study. This includes meetings with the supervisors of the research where the data results are discussed.

3.4.4 Data Collection & Usage

The data for this research is collected via interview once the consent form is signed and the meeting can take place. The interview is recorded via the Microsoft Teams in-built function and the recording file is saved within the chat between the interviewer and the interviewee. The gathered data is then available to use by the researcher when the recording is transcribed and the analysis is completed. For transcription, the live Microsoft Teams transcription tool can be used. As for analysis, this is done manually by the researcher, more about this is discussed in Section 3.5.

The results of the data collection are used to assess and transformed the assumed dynamic system from Figure 1. Whilst writing the Results Section, the researcher is going to quote the interviews in accordance with the specifications on the consent form (Appendix 6.3). Hence, in case of anonymity, the researcher does not add any names or other details that might hint towards a certain company or institution. Instead, the researcher uses numbers and letters to note the responses of different organizations when communicating with other supervisors or writing within the Results Section. Thus, the data is used towards answering the main research question without revealing any confidential information to any other actors.

3.4.5 Data Storing

The interviews are recorded and the resulting file is available on Microsoft Teams for both the interviewer and the interviewee. According to Microsoft, the person who started the recording is the owner of the file and thus they have full control of it. [2] In this case, the owner of the file is the researcher since they need the file for data analysis and the participant consents to it. Furthermore, the researcher is able to view the recording via Microsoft Teams which means there is no need to download the file.

Following the interview, the dialogue between the interviewer and the interviewee has been transcribed from which a transcription file results. This document is stored on google drive by the researcher. [3] The same is entailed for the files used to code each transcript. Thus, for every interview done, there are two files on google drive, one for transcription and another for analysis.

3.5 Data Analysis

To analyze collected data, the interviews need to be transcribed and analyzed. Firstly, the interviews are transcribed individually using the live Microsoft Teams transcription tool which distinguishes between the interviewer and the interviewee. Following that, the interview can be analyzed and a scientific tool is used to increase efficiency. The tool is called ATLAS.ti and it helps categorize codes and apply them throughout various transcripts so it is easier to maintain a high level of consistency when performing the analysis of each script.

For this research, a mix of deductive and inductive analyses is chosen. Timmermans and Tavory (2012) proposed such a mix to be referred to as abductive analysis which aims

[2] Delete a meeting recording in teams. Last accessed on October 17, 2022. url: https://support.microsoft.com/en-us/office/delete-a-meeting-recording-in-teams-b1ff8102-72da-4a6c-9979-d03a55d9b65d

[3] The e-mail used to open the google drive operates under the facilities of the University of Twente.

to create new theoretical insights. This type of analysis enables its user to go beyond the shortcomings of the deductive approach where there is an increased risk of bias due to predefined codes that would limit the researcher's capability of recognizing emerging themes other than the ones listed. The abductive approach does not restrict the researcher's use of theoretical themes but instead encourages the researcher not to limit themselves and consider all known themes when performing the analysis. Discovering emerging themes is a quality of the inductive approach which, in this case, is used in the abductive analysis to compensate for the weakness of the deductive approach. Hence, the abductive analysis is a mix of inductive and deductive approaches, where the user should be mindful of all relevant existing theories but also be open to potential multiple interpretations of the interview.

3.5.1 Inductive Approach

As a part of the abductive analysis, the inductive approach is used first for analyzing the gathered data. As mentioned above, the research needs to incorporate new themes alongside predefined ones. The open coding analysis is used before the deductive approach to reduce, as much as possible, the probability of biases within the final set of codes. By starting with this kind of analysis, the researcher is less restricted in the discovery of emergent themes which do not belong to the predefined codes. To use the inductive analysis, a specific set of steps need to be pursued. To create codes from transcripts, the research follows six basic steps:

1. "Draw on concrete data
2. Draw on the literature
3. Discuss the relationships among data, labels, and ideas
4. Refine prior made codes
5. Assess made codes for fit
6. Use decision rules" (Locke et al., 2020, p. 273)

Thus, when analyzing, the process begins by reading through the transcript and labeling specific quotes and ideas. These vaguely worded codes are then added together into an Excel file along with keywords of the quote they originated from. Afterward, the codes are filtered and refined such that there is no repetition or similar ideas. Finally, the most recent version of the code structure is assessed and the analysis concludes.

Although the steps proposed by Locke et al. (2020) are complete, they only vaguely cover the analysis process giving no concrete instructions on the final structure of the data. In contrast, the Gioia methodology proposed a five-step data analysis method that allows its user to build a clean data structure with codes spanning over three orders. Gioia et al. (2013) created this methodology which is a process that covers the research design, data collection, data analysis, and grounded theory articulation. For this section, it is important to discuss the data analysis method. To begin with, the data analysis follows a five-step procedure to produce a data structure:

1. "Perform initial data coding, maintaining the integrity of 1st-order (informant-centric) terms
2. Develop a comprehensive compendium of 1st-order terms

3. Organize 1st-order codes into 2nd-order (theory-centric) themes
4. Distill 2nd-order themes into overarching theoretical dimensions (if appropriate)
5. Assemble terms, themes, and dimensions into a "data structure"" (Gioia et al., 2013, p. 26)

When compared to the steps of Locke et al. (2020), this approach is direct, and the steps can be easily replicated for each transcript. Firstly, the researcher labels 1st-order concepts straight from the transcript. From there, the similar 1st-order concepts are placed in one category under a 2nd-order theme which acts as an umbrella term. Lastly, the Gioia methodology assumes that various 2nd-order themes sum up to one aggregate dimension. Thus, the Gioia methodology data analysis method is the procedure used for inductive analysis.

3.5.2 Deductive Approach

In the case of the deductive approach, it is important to create a set of predefined codes based on the literature from Section 2. Since the codes for the inductive and deductive approaches need to be combined, it is also necessary to structure the predefined codes in a similar way to the one proposed by the Gioia methodology (Gioia et al., 2013). So, the deductive approach predefines the themes and dimensions before the actual analysis starts. The 1st-order terms are left out due to the fact that they cannot be identified without reading a transcript of the interview. These terms are filled into the data structure during the Results Section of this paper. Nonetheless, it is irrelevant which of the two orders of codes are defined first as both themes and dimensions are constructed on previous research so the result is expected to be the same.

Aggregate dimensions are defined based on the theoretical framework (Section 2). The final list of aggregate dimensions is displayed below by taking into consideration the variables presented in Figure 1:

1. Innovation Policy
2. Networking Capability
3. Absorptive Capability
4. Innovation Capability

Thus innovation policy, networking capability, absorptive capability, and innovation capability are the aggregate dimensions of this study. This adds up since the research seeks a superior comprehension of how each one of the variables influences the other.

Moving on, themes for each of these dimensions are designed accordingly. In this case, it is more important to focus on the conceptualization of each variable to ensure that every element is taken into account during analysis. Starting with the innovation policy, this dimension is conceptualized in detail in Section 2.1.3. For this, the seven functions by Hekkert et al. (2007) are proposed as themes for innovation policy. Even though the 5th function does not necessarily fit in the scheme of Figure 1, the study is still going to include it to observe if any results are related to it. Furthermore, the networking and absorptive capabilities are defined within dynamic capabilities (Section 2.1.2). The themes

of the networking capability are constructed on the two types of ties: weak and strong (Perry-Smith and Mannucci, 2017). On the other hand, the themes of absorptive capability are based upon PACAP and RACAP (Zahra and George, 2002). At last, the innovation capability is the output of this system and it is materialized as new products and services, or by tremendous improvements in products and services (Aas and Breunig, 2006). To summarize, Table 2 contains all the predefined codes including the aggregate dimensions and the 2nd-order themes.

Table 2

Predefined codes for the deductive approach including 2nd-order themes for innovation policy from Susur and Engwall (2022).

2nd-order Themes	**Aggregate Dimensions**
Entrepreneurial activities	Innovation Policy
Knowledge development	
Network knowledge diffusion	
Search guidance	
Market formation	
Resource mobilization	
Legitimacy creation	
Weak ties	Network Capability
Strong ties	
PACAP	Absorptive Capability
RACAP	
New product/service	Innovation Capability
Radical improvements product/service	

Since the deductive approach is used subsequently to the open coding analysis, the predefined codes serve more as a confirmation template for Figure 1. By observing which specific 2nd-order themes are found to be present in the transcripts, the study can challenge or corroborate the findings of the extant literature and the assumptions made by the researcher in the aforementioned figure.

3.5.3 Final Code

In the end, the codes resulting from both analyses are added together so relationships can be made based on the 2nd-order themes from the data structure. Until this stage, the data gathered from the deductive and inductive approaches is considered static. This means that while there is information, nothing links the concepts to each other. Gioia et al. (2013) proposed a last phase of the Gioia methodology, and that is the grounding theory articulation. This stage operates based on three main actions:

1. "Formulate dynamic relationships among the 2nd-order concepts in data

structure

2. Transform static data structure into dynamic grounded theory model

3. Conduct additional consultations with the literature to refine articulation of emergent concepts and relationships" (Gioia et al., 2013, p. 26)

The outcome of this phase is expected to resemble the dynamic model assumed in Figure 1. However, the research is open to new interpretations which are expected to alter the relationships assumed in the aforementioned scheme. Following the conclusion of the analysis process, the results are presented and discussed.

4 Results

4.1 Overview

The study followed the guidelines written in Section 3 and a total of seven interviews were concluded: one incubator, one TTO, three founders, and two R&D managers. According to Section 3.2, it is one less interview than originally proposed. To be specific, an additional two employees from the same KIE firm should have been interviewed to observe the impact of innovation policies at different levels of the company. An extra interview could have shed light on the information symmetry within the KIE firm but it could not be completed due to time restraints and the size of the interviewed KIE firm. In this case, only one additional interview was secured and the data resulting from it significantly impacted the outcome of this study by understanding the different impacts of innovation activities on the founder versus R&D manager level.

The following step was to confirm that the identity of the organizations where the seven interviews originate match the profile of this research (Section 3.2). In this case, the TTO and BOM are confirmed to correspond to the research profile by default due to their affiliation with the University and the ROM respectively. As for the four interviewed KIE firms, the screening resulted in seven viable interviews which can be considered for this research.

It is also important to note that during the analysis of the interviews, other dimensions, excluding the ones from Figure 1, were found and included in Table 4 within Appendix 6.4. Table 4 adds to the final model of this research by incorporating new variables such as:

- Culture, history, and situation of the Dutch region,
- Entering the innovation program, and
- Review of innovation program.

The new findings increase the quality and consistency of this research. Firstly, the situation, culture, and history of North Brabant are described by the actors currently operating in the environment. Secondly, information on the reasoning behind the participation of KIE firms in innovation programs can be used to verify if the outcome of the program matched their initial expectations. Lastly, a new variable is created to take note of the opinions of KIE firms that completed the innovation program and its respective practices.

4.2 The General Setting in North Brabant

In this section, the general setting in North Brabant is explained to provide the research with background information regarding North Brabant. During the analysis, it was noted that the innovation practices offered by the incubator or TTO are influenced by the cultural identity, history, and the present situation in North Brabant. Starting with culture, research results have displayed a common negative sentiment about greediness within the Dutch culture. The BOM interview has confirmed that avaricious behavior is seen unfavorably in Dutch society:

> "[...] has to do with the Dutch culture, right. So keep your head down and just work and don't just scream too hard that you want to be a millionaire or something like that."

This statement assumes that the discouragement of greed compels people to seek more comfort in their current work instead of striving for improved prospects. The interviewee critiques the Dutch culture and blames it for allegedly supporting humble entrepreneurship characterized by a lack of ambition. The BOM participant uses this argument to explain the scarcity of scale-ups in the region of North Brabant, but also in the Netherlands:

> "In the Netherlands, in general, there is quite a lack of ambition [...]."
> "So the number of start-up companies per capita is on par, I think, with the rest of the world, maybe a little bit lower. But the scale-up side, we are lagging behind."

Hence, it makes sense why the feedback provided by BOM is remarkably critical and their investment requirements are rigorous, that is to pressure entrepreneurs out of their comfort zone and into a mindset that allows them to build the foundations of a scalable business.

Moving on, it is worth exploring the historical context of North Brabant and the circumstances that led to the establishment of the university and its role in the region. The TTO interviewee relates that the university was founded 100 years ago by a large corporation within the region, namely Philips. The objective was to advance knowledge in the area and provide access to a pool of highly skilled workforce. This goal was achieved, as North Brabant emerged as a leader in technological advancements in the Netherlands, and the majority of university graduates were engineers with guaranteed employment at the aforementioned major corporation. Currently, the university offers three distinct products: talent, research, and valorization. Talent refers to the graduates which serve as a workforce for local businesses, their role is to use the academic knowledge, gained throughout their study, in practice. Research concerns all the projects conducted by the university with the objective of making new discoveries. Lastly, valorization relates to the capability of the university to transform academic knowledge into practice to be used by businesses, or even the government:

> "[...] the three products that the university has is talent, research, and valorization. "

Not only is the university rich in state-of-the-art knowledge and also capable of sharing it efficiently with other institutions or companies, but it also hosts the future entrepreneurs of the region. The TTO interview confirmed that due to valorization activities,

various new businesses were created on the university campus. This proves that the university aids society on different levels, be it by directly sharing and integrating knowledge through projects with the TTO or through creating new start-ups meant to fill the technological gaps in the market:

> "I see the university as a supporting and serving organization for all the technological economic activity of the region."

Thus, the history and the current situation of North Brabant corroborate that the scope of the university, and implicitly the TTO, is to promote innovation activities that can help enrich the regional techno-economic situation.

In summary, the current setting of North Brabant can help enrich the visualization of how innovation policies impact the capabilities to innovate of KIE firms through the activities offered by the TTO and the incubator.

4.3 Differences between Innovation Programs

In this section, a detailed explanation of the variance between the scopes of the innovation programs' activities is provided to obtain a comprehensive understanding of the available assistance for KIE firms. To accomplish this, every organization mentioned during the interviews will be researched, and a brief summary of their offerings will be compiled in the corresponding section. Based on the data gathered, three specific organizations that offer innovation programs were identified: an incubator/accelerator, TTO, and a hybrid. The latter is an interesting inclusion as it has functions associated with both the incubator and the TTO.

4.3.1 Incubator & Accelerator

The reason for combining the incubator and accelerator programs is that the support for both is usually provided by the same organization. Additionally, it is common for companies to participate in the incubator program before joining the accelerator program. The difference between the two programs is that one of them, the incubator, focuses on innovation by creating a solid business plan and performing market validation for high-potential business ideas, whilst, the accelerator, is concerned with scaling existing businesses to extend the KIE firm's market share. During the interviews, two distinct organizations offering incubator/accelerator programs were mentioned, one of which had already been interviewed as part of the study. To gain a better understanding of the support offered by each organization, research was conducted using the websites of the incubators/accelerators. The two organizations presented in this research are BOM and High Tech XL.

Starting with BOM, the organization offers three official products: developing, investing, and internationalization (BOM, 2023b). First, during their developing program (BOM, 2023a), the organization claims to work in close collaboration with knowledge and public institutions, as well as other businesses to facilitate entrepreneurs in setting the foundations of their future enterprises. The specific products of this service are funding aid, customer identification, sustainability, and energy transition support. During this stage, the KIE firm is expected to develop a robust business model, complete market validation, and value proposition, learn about IP protection, and team development. Furthermore,

financial assistance is provided to support the early-stage funding of KIE firms, enabling them to initiate operations and establish viable businesses. There are various investment sources made available, aside from the incubator/accelerator, which is advantageous for KIE firms that need to raise a large amount of capital for their R&D. The goal of the developing program is to provide the participants with specific knowledge and tools which can enable the young firms to create an economic and societal impact.

Second, the investing program (BOM, 2023d) is meant to financially aid KIE firms with the ambition and potential to scale up. Within the service, BOM offers its own funds as an investment source and, as a result, becomes a shareholder within the firm in which it invested. To attract this type of investment, a KIE firm must demonstrate a great probability of scaling up and achieving significant growth. This requires a well-balanced team with the necessary expertise to develop and commercialize innovations. The firm's value proposition must be persuasive, such that the vision of the firm can be effectively communicated to potential investors. In addition, a scalable business plan must be configured that outlines its strategy for achieving growth, as well as proof of market validation. Aside from these requirements, BOM also invests in popular technologies such as sustainable power, heating, and cooling. It is usually the Dutch government that decides what BOM should focus investing into. Hence, the goal of the investing program is to support firms to create an impact and, when the time comes, allow the incubator/accelerator to exit at great profit.

Lastly, the internationalization incentive (BOM, 2023c) provides newcomers and large foreign corporations an opportunity to take advantage of the region's opportunities and establish their presence in the area and vice versa in regard to moving regional businesses to other prosperous areas of Europe or the rest of the world. For this service, BOM provides local companies with an export accelerator program that would enable businesses to acquire funds needed to locate abroad, country information, market information, and export plans, as well as access to a European network compromised of various businesses. For foreign companies, BOM assists them with the guidance of the local markets. This service is uncommon within the scope of typical incubator/accelerator offerings and thus falls outside the norm for such organizations within the context of this research.

Moving on to High Tech XL, the organization is better known to aid high- and deep-tech companies as it is located within the campus of a technological-focused university. Unlike BOM, High Tech XL does not appear to have a highly structured support offering for KIE firms on its website (High Tech XL, 2023c). However, an online page relates that the organization's motto is to build the region's "fastest-growing companies". To create such an impact, High Tech XL considers a diverse and open team to be key to becoming a market leader. This insinuates that the incubator/accelerator does not only work with already existing companies, such as BOM, but they promote the launching of start-ups by assembling balanced teams ready to take on market issues. This is corroborated on their website where they offer talented entrepreneurs a chance to be co-founders of deep-tech companies who already entered the High Tech XL program (High Tech XL, 2023b). Hence, High Tech XL not only serves as a source of human capital for individuals who possess business ideas but have not yet established a well-rounded team, but it also provides team support for those who already have an existing team.

Upon further review of High Tech XL's website, there appears to be a lack of clarity regarding their accelerator component, as there is no discernible information available on

this particular subject. However, through the process of conducting interviews, it was discovered that the organization provided financial assistance to one of the founders who were already part of the program. Although not present on the website, it is now apparent that High Tech XL provides high-potential KIE firms with funds and hence becomes a shareholder of the business. This finding is of significant importance because the provision of financial support suggests that the organization not only functions as an incubator that helps launch start-ups but also as an accelerator that is prepared to assist companies with substantial growth potential.

Furthermore, High Tech XL's aid includes a vast network of entrepreneurs, as well as experts that could create start-up teams or help balance existing ones. The goal of the organization, similar to that of BOM, is to create a grand societal impact by supplying the region with sustainable and innovative solutions to existing problems but also to enrich the local community by adding new jobs. What stands out when compared to BOM, is that High Tech XL is in close collaboration with an international partner. High Tech XL benefits from its affiliation with a famous foreign technological hub (High Tech XL, 2023a), which enables it to establish connections with valuable partners. By leveraging these resources, KIE firms can allegedly expand their market reach, secure new technologies, and establish partnerships with international companies or investors. Ultimately, this can accelerate the commercialization process and increase the firm's chances of scaling up. The affiliation with the technological hub hints towards the fact that the incubator can possibly directly impact RACAP by providing support to the supply chain. An allegation that can be potentially confirmed by the presence of a supply chain specialist in High Tech XL's employee list. However, this is just an assumption as nothing concrete is written about the matter on the website, instead, it is just a short paragraph that confirms the collaboration between High Tech XL and the foreign institution. In addition, no data was gained through the interviews which could hint towards the benefits of such a partnership.

To summarize, it is now clear that BOM and High Tech XL serve as incubators/accelerators with similar functions. Both entities strive to impact PACAP and weak ties. The main differences between the two organizations are:

- BOM only collaborates with extant businesses, High Tech XL also helps launch businesses.
- BOM provides support to businesses wishing to leave or enter the region.
- High Tech XL supposedly has an extremely valuable partner and supply chain specialists which strengthens the link between innovation activities and the capability to transform and commercialize knowledge.
- High Tech XL assembles teams of start-ups but also helps improve existing ones. BOM only does the latter.

Hence, BOM is more focused on enhancing existing businesses that could improve the level of innovation in the region of North Brabant. The employees strive to provide KIE firms with the business knowledge and funds to create a scalable business that would enrich regional welfare. High Tech XL is also focused on providing start-ups with the necessary information to grow their enterprises and successfully innovate. However, the incubator

appears to be more concerned with high- and deep-tech businesses. In contrast with BOM, High Tech XL's goals are less focused on creating a regional impact, they rather would prefer to make a worldwide impact. To do so, the incubator collaborates with a valuable tech hub overseas.

Due to the fact that the incubator and accelerator programs are affiliated with the same organization, the sections encompassing results and conclusions will continue to refer to both programs as incubators.

4.3.2 TTO

The role of the TTO is to transfer knowledge the university has gained through research to other businesses and governmental institutions. As per the website of the interviewed TTO, the office extends its support to KIE firms by means of joint projects, or by legal, finance, and IP support. In order to pursue technological advancements, a KIE firm may initiate a project where they commission the services of a PhD or other experts affiliated with a university to conduct an investigation on a specific topic and generate solutions. To facilitate such projects, the TTO provides financial backing by proactively strategizing and mitigating potential risks. On top of that, the office promises to enable the use of subsidies to alleviate the cost of R&D and optimally use firm finances. Despite that, it should be noted that certain KIE firms may lack the financial resources necessary to undertake expensive research at the university. As a result, their last resort may be to participate in projects that are funded by regional, national, or European entities.

Legal support is touched upon as well by the TTO and it concerns the drafting of contracts affiliated with collaborative projects. Also on the legal side, the office provides IP support for the firms that choose to work together with the university. This involves experts in compliance that monitor processes and deadlines to ensure the research is being protected thoroughly. In summary, the description offered on the website in regard to the support given by the TTO fits with the results compiled by the data analysis of this study. The main role of the TTO is to enhance RACAP, as well as develop weak ties and strong ties through projects.

4.3.3 Ecosystem Builder

The last organization to be recurrent in one of the interviews with an R&D manager is identified as an ecosystem builder. Although not anticipated in this research, it is interesting to discuss the main characteristics of such an entity. The scope of this type of organization is to establish an ecosystem and facilitate communication between different players working within the same industry. Similarly to an incubator (or accelerator), the ecosystem builder is concerned with promoting firms that could create a societal and economic impact. In addition, the organization is willing to provide funding for those companies showing growth potential. They do so by the means of co-investing alongside a third party or identifying the best possible financing solutions, which may entail securing funding from entities such as the European Union. Thus, based on the description received from interviews, the ecosystem builder is an organization that focuses on bringing together companies from the same industry and supporting them in their commercial and technological advancements similar to an incubator or TTO.

Aside from monetary support, the ecosystem builder also aims to develop the R&D and supply chain of KIE firms within their region. The companies affiliated with the organization are provided access to multiple sources of academic knowledge such as research institutes and universities. It can be understood that the organization acts as a mediator between KIE firms willing to advance their technology and academic institutions. Moreover, as revealed during the interview with the R&D manager, the market segment in which their KIE firm operates is characterized by its lack of maturity. Consequently, enterprises operating within this market must possess the capability to efficiently absorb new research discoveries. Not only that but the emerging knowledge must be integrated by the firms into their value proposition. This is where the ecosystem builder offers strategizing tools and supply chain support to KIE firms. As noted during the interview, roadmapping allows companies to structure a development plan for the future of their technology. This includes changes in partnerships, human capital, resources, and finances. To support the future direction of KIE firms, the ecosystem organization introduces the company to potential customers and their needs. In this way, the organization acts more as a TTO rather than an incubator by providing knowledge and supplying the KIE firms with tools to integrate it in order to commercialize products.

To summarize, the ecosystem builder is an interesting organization that has the potential to address the limitations inherent in both incubators and TTOs. For example, the ecosystem builder:

- easily connects KIE firms with suitable partners in the same industry,
- brings potential customers to KIE firms,
- searches for the future needs of clients.

Although the ecosystem builder is introduced in this section, the results do not offer a dynamic model explaining how the activities of such an innovation program impact the capabilities of KIE firms. The reason is that this type of organization was not covered and, hence, considered during the theoretical framework of this research. Thus, it remains a limitation of this study and it is further discussed in the conclusions section.

4.4 Model A: The Innovation Practices of the Incubator

4.4.1 Entering the Incubator Program

The first model of this study is depicted in Figure 3, which includes the effect of incubator activities on the capabilities of KIE firms. As mentioned in the theoretical framework from Section 2, innovation policies influence the capabilities of KIE firms through the practices and activities offered by incubators and TTOs. Hence, the results of this research will only address these practices and their impact on KIE firms without referring to specific regional policies.

The dynamic model portrayed in Figure 3 reveals the impact of the activities followed by the KIE firm prior to, during, and post the participation in the incubator's innovation program. Starting with the period prior to joining the incubator, this variable was added to the model to create a better understanding of the intentions behind KIE firms' participation in innovation programs. For instance, early-stage companies often need to

perform market validation under expert guidance in order to build a solid foundation for their future business. For those entrepreneurs seeking aid with their business model, the most suitable program appears to be the incubator which offers skilled knowledge in regard to early-stage company support. In contrast, the aid offered by the TTO is distinguished by its potential to facilitate the advancement and transformation of knowledge into a physical product or service, rendering it better suited for late-stage companies.

Other founders related that their initial intentions were to collaborate with a large corporation or obtain money in order to scale their business. In the first instance, the founder acknowledge that whilst their focus was on creating a partnership with a large enterprise, they also needed extensive support with their business endeavors due to the team being mainly technical. The incubator ended up facilitating both of the founder's wishes which allowed their business to take off. In the second case, the entrepreneur already established a flourishing business but greater market impact was desired by the team and, thus, they sought to procure additional funds through the accelerator (incubator). In this situation, the incubator decided that the company was not yet viable for scaling due to challenges in its business model. After completing classes recommended by BOM, the KIE firm improved its value proposition which resulted in a visible market impact. Hence, the selection of an appropriate program to pursue is not solely dependent on the initial intention of KIE firms; rather, it also involves screening procedures conducted by incubators. These screenings enable entities to gather essential information that is crucial in assessing the current status of the KIE firm, and in offering appropriate solutions that are tailored to the firm's specific stage of development.

The interview with BOM confirms the existence of such screening activities within their organization:

> "We have quite a good idea of what a start-up should do and should be doing or should have done before they are investable. "
> "Those scans that we do help start-ups in identifying where they are and what kind of activities they should be doing. It gives them focus on their daily activities."

The quotes indicate that the employees of BOM who are directly involved with the assessment of the program's newcomers are confident in their skills to identify the current level of KIE firms. Moreover, the screening serves a double purpose, on one hand, BOM is able to provide support according to the current capabilities of the start-up, and on the other hand, the entrepreneur team is provided with valuable feedback on their current skills and prospects. To sum up, upon entering the incubator's innovation program, KIE firms declare their initial intentions and goals while at the same time, the incubator performs its own screening to confirm the actual needs of the company seeking their aid.

4.4.2 Activities during the Incubator Program

Moving on to the period during which KIE firms actively participate in the innovation program offered by the incubator. As shown in Figure 3, there are several arrows pointing from innovation practices to the capabilities of KIE firms. The red arrows indicate that the incubator's activities have a direct impact on certain capabilities of KIE firms, whilst the orange interrupted arrows point to an indirect impact. The latter describes the

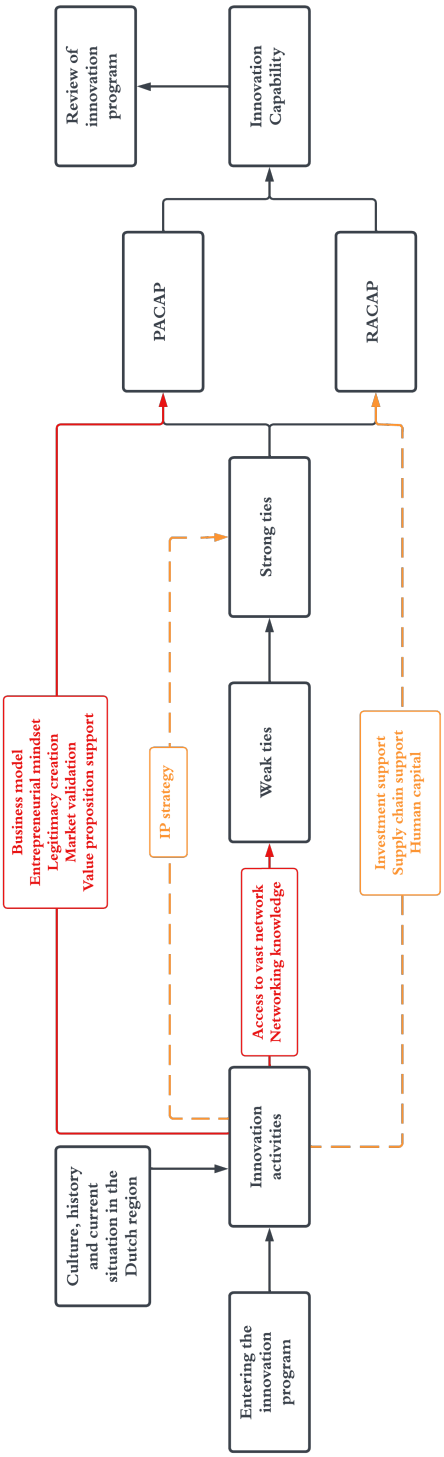

Figure 3

Model A investigates the impact of incubator activities.

practices given by the incubator on a consultancy level or just as a stimulant rather than guided support.

PACAP. The incubator can directly intervene in the KIE firm's capability to develop knowledge and discover innovative opportunities. This is possible by performing detailed analyses of the business model, market validation, and value proposition alongside experts. All of these are essential business aspects that allow the entrepreneur to confirm the feasibility of their business idea, as well as build a strong foundation for the commercialization of innovative products:

> "And so in the program, they forced us to identify potential customers that would actually pay money for our machines, and use those machines, and to try and figure out the business model of our customers. So that's something that we definitely learned through the program."

The input from the incubator not only helps the entrepreneur and the firm develop their business skills but also aids in the formation of an entrepreneurial mindset. For example, three out of the three founders confirmed that the incubator program challenged them to become more open-minded, some even confess that the critical attitude of the incubator pushed them towards seeking more innovative solutions to the issues they were facing at that time.

> "And then they are extremely critical like "we don't understand it, and who is your customer, and you need to think better, etc., etc.". Down to the point that you make this extremely sharp."
> "[...] but we really love the way they provide feedback [...] critically, so they didn't pamper us."

At last, enabling KIE firms to create legitimacy is necessary for the smooth operation of the business. Incubators can facilitate legitimacy by investing through different forms in the KIE firm which demonstrates to other stakeholders that the company has surpassed program expectations with its innovative capabilities. This, in turn, can facilitate KIE firms' ability to attract potential investors, partners, customers, and employees with greater ease.

Weak Ties. Apart from the direct impact on business knowledge development, the incubator also influences the ability of KIE firms to acquire new connections through their networking capabilities. Firms that participate in the innovation program are provided with access to an extensive network owned by the incubator. This includes connections to business experts, peers of the program, corporations, legal actors, and other such entities. Additionally, the incubator also supports the development of necessary skills for the KIE firm alone to successfully create connections with diverse actors. This often happens through events where the firm is allowed the opportunity to present itself to others but also let others present themselves to the firm. The difference between access to a vast network and gaining connections through events lies in the fact that the latter empowers KIE firms with the autonomy to determine their public image and learn through experience:

> "But there's more like a big event where they try to force you to connect with other entrepreneurs in the field and they have speakers like the CEO of [big corporations] and stuff like that. So that really helps to expand your network."

Gaining new connections and learning how to expand networks is essential for the KIE firm's capability to innovate. As depicted in Figure 3, weak ties remain the foundation of most capabilities which enable companies to effectively develop their innovation capability.

RACAP. The incubator also indirectly impacts the formation of capabilities needed to transform knowledge in order to commercialize products or services. This is possible through investment opportunities, aid in regard to the supply chain, or support with the acquisition of necessary human capital. Starting with investment support, this form of assistance is typically targeted towards companies that exhibit significant potential and require funding for the advancement of their internal R&D. The BOM interviewee also shared their viewpoint on the matter:

> "But it could be that a startup is, for example, a deep-tech start-up and has to do research for another five years before they hit the market. [...] so we could fund research, but then within the company and not within the other institutions. So not to say that we invest in start-ups and they give that money to the [university] or something else. That's not what we want. The money we give should be used within the company itself."

Although financial resources are directly allocated towards conducting R&D, there is no provision of technical expertise to assist KIE firms in this area. Rather, the aid serves to support the hiring of experts or the maintenance of operations. According to one of the founders who received financial support from the incubator, the impact was indirectly felt in their capacity to innovate. By combining the investment and their newly enhanced business model, the KIE firm was able to successfully introduce a new product considered a game-changer:

> "But thanks to the [incubator] program, we added this product or service of providing [name] to our local distribution partners [...].

Moving on, the incubator's supply chain support is provided at a consultancy level. This suggests that the staff at the incubator offer ideas and opinions upon request, yet the incubator employee stated that supply chain support is not an official service provided by the incubator:

> "[...] if someone's working on the new process we have somebody with experience in the process [...] and they will maybe help a little bit, but we're not helping with actively sourcing or something, no."
> "And if you need help from the innovation program, you can ask for that help. But it's not that everything happens through the program. They are more in the background supporting you. "

Another form of support that is provided at a consultancy level pertains to human capital. The incubator can provide recommendations of actors from their own network who are deemed suitable to enhance the team's capability balance. However, it is up to the KIE firm to make such decisions and advance with the suggestion of the incubator. This is corroborated by the BOM interview:

> "We sometimes look for a CEO, somebody that we want to put in the company from a network. But that is up to the companies themselves [to hire]."

Strong Ties. The last indirect link concerns the support given by incubators on the facilitation of strong ties. For an early-stage KIE firm, it is crucial to have knowledge of the strategies that can be employed to prevent technological theft. By minimizing the threat of IP theft, firms are enabled to communicate with their partners more freely which, in turn, allows them to innovate at a faster rate compared to when a large share of information is withheld. The incubator plays a vital role in aiding early-stage KIE firms to prevent technological theft by providing support and promoting knowledge about IP protection. Thereby, it indirectly encourages the development of strong ties between KIE firms and potential partners by granting them the necessary knowledge and tools to protect their IP. The incubator and one of the founders stated the following:

> "So if a startup, for example, needs certain knowledge and it needs to bias from a third party [...] then we help them within the negotiations, for example, the IP strategy."
> "So the first thing everyone does is to sign a couple of non-disclosure agreements to be sure that your knowledge is not flowing towards companies you don't want to or to your competitors."

To sum up, the innovation activities that indirectly impact the capabilities of KIE firms also support the development of innovation capabilities. Young companies can create a foundation for their commercial skills by learning from the advice given by the incubator in regard to human capital and supply chain. The KIE firms can also use investments to facilitate internal R&D or fasten their operations. Aside from that, learning about IP strategy can be essential in the formation of business partners with which the firm can communicate efficiently to innovate.

4.4.3 The Review of KIE Firms on Incubator Activities

Post the participation in the innovation program, KIE firms can take a step back and determine the value of the activities they have been offered. In this dimension, several opinions of the founders have been gathered. Overall, the prevailing sentiment is positive, as all founders acknowledge the assistance provided by the program and, upon reflection, recognize its instrumental role in establishing the foundation of their businesses:

> "[...] we came to know a lot of knowledge in the program on different aspects of the business."
> "I think for sure the [incubator] was crucial to creating [KIE firm] and they helped us make the first steps. And so in many aspects, they did help us to, let's say, survive the first one or two years of the company. So I very much liked the program in that sense."
> "[...] it really set the stage for how we still operate and how we manage to double our numbers every year. Thanks to what was said during the [incubator] program."

To summarize, model A depicted in Figure 3 encompasses the multi-level influence of incubator innovation activities on the capabilities of KIE firms. The dynamic model shows a direct impact on PACAP and weak ties, as well as an indirect impact on strong ties and RACAP.

4.5 Model B: The Innovation Practices of the TTO

4.5.1 Entering the TTO Project

The second model defined in this research can be visualized in Figure 4, where the influence of TTO innovation practices on the capabilities of KIE firms can be followed through the red and orange arrows. This section follows a similar format to the previous one (Section 4.4) which included the impact of incubator activities.

As previously explained, the motivation behind KIE firms seeking the assistance of a TTO is driven by their desire to facilitate advancements and transformation in their products or services. In contrast with the incubator's approach to screening, the TTO appears to have designed its evaluation process around the degree of technological advancement demonstrated by the KIE firm. In addition, the TTO's main focus is to support the growth of economically relevant scientific research. Hence, the professionals affiliated with the TTO evaluate whether the technology of the KIE firm is viable for the present or imminent markets:

> "So, I think we should only do economically relevant scientific research."
> "[...] you have to make an assessment or have some gut feeling of what scientific research will become economically relevant."

Hence, the intentions of KIE firms joining the TTO practices are less nuanced when compared to those of the incubator. This makes sense for two reasons. Firstly, the KIE firms which seek the aid of the TTO are more seasoned and, hence, they know more precisely what they need. Secondly, the offerings of incubators are greater and can differ based on the organization as it was mentioned previously. In contrast, the scope of all TTOs is to share state-of-the-art knowledge with institutions and businesses outside their respective university.

4.5.2 Activities during the TTO Project

Similarly to model A from Section 4.4, the influence of TTO innovation activities is distinguished by their direct or indirect impact. In this case, the indirect impact is caused by the exposure of KIE firms to university research by the TTO. The firms could use the new knowledge to inspire themselves and create new products or services or radically improve their current processes. However, this is not the explicit scope of the TTO and hence, this impact is considered indirect.

RACAP. The capability of KIE firms to transform their knowledge and commercialize their products or services efficiently is directly impacted by the TTO's support in human capital, R&D, and supply chain. Although it was mentioned earlier that the purpose of TTOs is to transfer knowledge in regard to research and valorization, it was also found that the university serves an additional function, namely talent provider. The acquisition of a highly skilled workforce can be essential for the survival of KIE firms. Without a strong and developed team, a KIE firm does not have the capabilities to recognize and transform the knowledge necessary to innovate. Moreover, employees acquired through the university have previously collaborated with the KIE firm whilst working or studying at the university which happens through privately or publicly funded projects with the TTO. One founder and another R&D manager confirmed this matter:

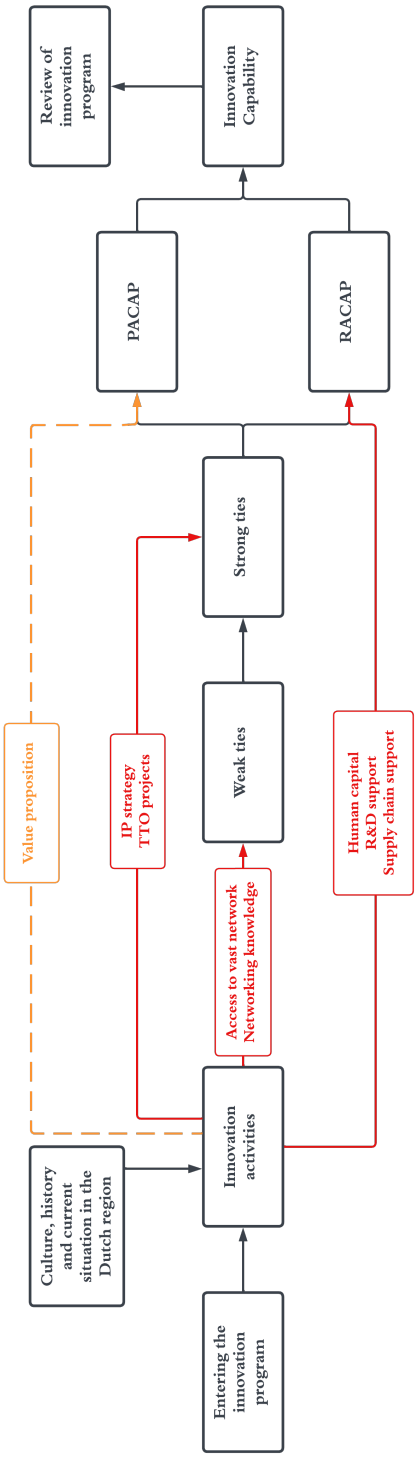

Figure 4

Model A investigates the impact of TTO activities.

> "Our main sourcing of human resources, for example, is by means of our collaboration with universities. We have multiple hires where we start up a collaboration with universities. For example, a PhD person which is working on, let's say, a project that we initiate and that we paid the university for. And then later this PhD starts working for [KIE firm]."
> "And then we have highly qualified, well-trained people, which can immediately work for either R&D, especially PhD people. For master students, that would be more on the operations side where they develop the processing."

As the name suggests, the main function of the TTO is to support the R&D efforts of the companies seeking their aid. The interviews conducted with the R&D managers have consistently indicated that this is indeed the case:

> "They also showed routes which we should definitely not take in our development. And that again saves a lot of time and effort by not exploring these roots."
> "A lot of things that are developed there [...] are transferred to us even better. For example, patents we acquire or together develop patents that we make use of. So there's a constant information stream on the scientific side."
> "And from the [university], we get scientific input from what's possible and what results they have, which might be interesting for us to incorporate into our offering."
> "[...] you can better understand what you have to focus on. And that's what we've done over the years."

The provision of R&D support is considered crucial for KIE firms that are in the advanced stage of their development and whose primary focus is directed towards the commercialization of their products or services. The absence of R&D progress in a KIE firm can lead to a reduction in its competitive advantage, ultimately resulting in a decline in innovation. Furthermore, to successfully support R&D, a resilient supply chain foundation needs to be built. This includes suppliers, distributors, customers, and other potential partners. The incubator aids the KIE firms to form the 'pillars' of this foundation by helping the firm build a strong business model that can narrow the search for supply chain partners and introduce them to a pool of potential partners. In contrast, the TTO is well-equipped to understand the technology used by the KIE firm, and, with their connections, they can get the KIE firm in touch with essential partners. Not only that, but the TTO can also display their judgment in regard to existing partners' viability in consideration of the KIE firm's technological advancements:

> "So they help us also start collaborations with other universities or companies or suppliers."
> "we have a lot of discussions with them where they have meetings where we can talk together about potential topics or about partners or existing partners."
> "[...] so it may be touched upon, purchasing or procurement of key components could be essential."

Weak Ties. The next impacted capability by the TTO is weak ties through the provision of access to a vast network and the possibility of developing essential knowledge

for networking. Starting with the former, the variable influences the weak ties similarly to how the incubator does, by introducing the KIE firm to experts and other researchers who come from the TTO's own network. The knowledge of networking suggests that the TTO facilitates the development of skills for building new connections. In contrast to the incubator's networking events, the TTO brings together multiple companies through collaborative projects, which encourages KIE firms to network with their project peers and get to know each other at a closer level. Projects are not the only facilitator, the TTO also invites companies to take part in European or international events hosted by experts and scientists:

> "So on the scientific part, we have through our projects and also through networking and video networking, we have a lot of contacts with European institutes. So not only in the Netherlands but also around Europe and actually also internationally."

Strong Ties. The last capability to be directly influenced by the TTO innovation activities is the strong ties through IP strategy guidance and access to other firms via collective projects. The latter has been emphasized repeatedly within this section and serves as the fundamental basis for the collaborative partnership between KIE firms and TTOs. The two aforementioned practices relate to each other, as through IP protection, companies are able to closely collaborate with each other and innovate. Many young firms are inexperienced and worried that their innovative technology will be stolen by a more experienced player. Hence, firms opt to maintain a certain degree of distance from the majority of their connections, which constrains their ability to innovate in collaborative projects. The TTO understands the issue and offers IP strategy services meant to dissolve the fear of theft:

> "There are specialists on IP to arrange the necessary contracts [...]."

Furthermore, the TTO fosters strong connections through diverse project initiatives in which it participates. There are two kinds of projects available: privately and publicly funded. The former is a type of project where a company commissions the university to research a specific topic that regards their product or service more in-depth. The TTO and KIE firm closely work together to successfully integrate the findings of the research into their value proposition. As a result, the two entities have established a strong relationship by regularly conducting in-person progress meetings:

> "So some researchers, they do the research they report, let's say every two weeks or every three weeks. It depends a bit. And then we discuss the results and make suggestions for following experiments, or we try to validate some hypotheses we have."
> "So from our team, we assign one as, let's say, the lead, or at least the coordinator who makes sure that they have regular meetings, etc., and keeps track of the process."

The same can be said about publicly funded projects. The only distinction lies in the fact that multiple companies collaborate towards finding solutions for the project's goal. The

TTO arranges the meetings among all firms engaged in the research, thus serving as an integrating entity. Hence, during these projects, the KIE firm is forced to learn how to create and maintain strong ties with other companies or institutions such that innovation can take place.

PACAP. The results suggest that there is a link between the TTO's value proposition support and the capability of KIE firms to recognize and accumulate new knowledge. Although the incubator is the primary source of support for developing a strong value proposition, the TTO also influences this factor through their comprehensive R&D assistance. When new discoveries are made via the TTO, they are integrated into the product or service offering which, in turn, alters the value proposition of the KIE firm:

> "So we narrowed it down to a little bit less options than we had in the beginning, which is also, I would say, part of being in a start-up."
> "Now that we got a little bit bigger, we generalize our offering so that we make a little bit less specific [products], more general. But then we're also able to produce more because if you sell 200 items, you also have to make those 200 items in the same amount of time. Whereas if you only sell ten items. You can have more attention to those ten items. You can increase the quality [...]. I'm exaggerating a little bit, but that's what we did in the last ten years. So focusing on less, but being able to get better quality and make them faster and also better."

Therefore, the R&D support provided by the TTO translates into the product or service development of the KIE firm, which impacts its value proposition and, in turn, its innovation capability.

4.5.3 The Review of KIE Firms on TTO Activities

The interviewed R&D managers from model B also assessed the assistance provided by the TTO to their respective firms. While the incubator reviews focus on how the knowledge gained during the innovation program set the foundation for the business's future, the TTO reviews highlight the significant technological support provided, which enabled the KIE firms to enhance their products more easily and continue their commercialization efforts:

> "For several cases, we made some big steps in the performance of our material. And that was I think a large part of that was based on the knowledge we got from these collaborations [with TTOs]."
> "So and it helps us a lot in making important choices in regard of also machine design, etc., because there are some points, of course, in the development that are almost like a sort of lock-in and then it's difficult to divert from the route you've chosen. So I think they helped there in that case for sure."

Therefore, the assistance provided by the TTO is considered essential for the commercialization of products among the deep-tech KIE firms surveyed in this study.

In summary, model B (Figure 4 incorporates the multi-level impact of TTO innovation activities on the capabilities of KIE firms. The dynamic model shows a direct impact on RACAP, strong ties, and weak ties, as well as an indirect impact on PACAP.

4.6 Combined Effect of the Activities of Incubator & TTO

By taking out the influence of innovation activities, a general model can be deducted using three of the seven aggregate dimensions in Figure 5 [4]. In the original scheme portrayed in Figure 1, the formation of new connections was assumed to influence the ability of KIE firms to recognize and assimilate new knowledge, whilst the deeper connections allegedly impacted only the capability to transform the knowledge and commercialize products. This is important to take into consideration, as the formation of strong ties means that KIE firms have access to business partners which can help them identify customer needs, develop new technologies, or commercialize their products. In contrast with the literature, the findings show that it is actually the strong ties acting as a mediator between weak ties and the capabilities to absorb and transform knowledge. The majority of interviewed people expressed that almost no innovation takes place between their firm and more distant connections due to increased concern about IP theft:

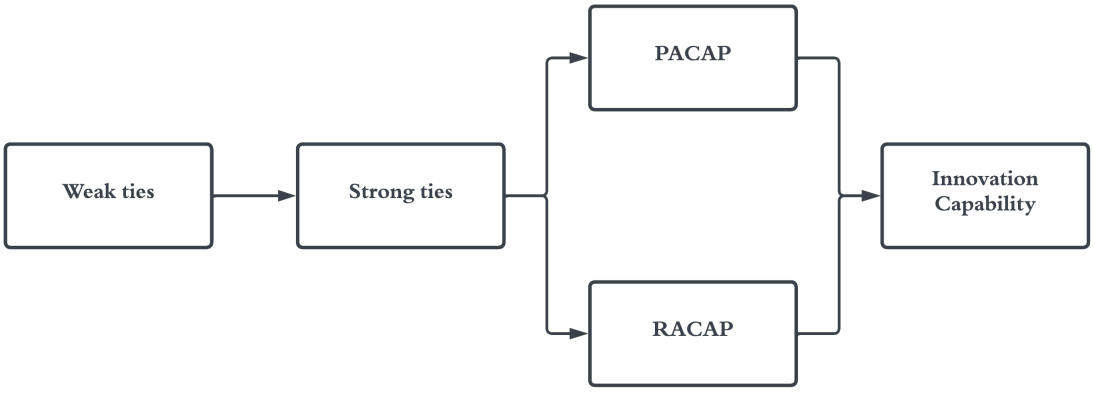

Figure 5

A general model using three aggregate dimensions.

> "You are really scared, this is probably someone who can take over our technology [...] that's not a good basis of co-creation and innovation."

The threat of IP theft, however, is not the only factor impeding the potential of weak ties to facilitate the absorption of new knowledge. Participants have also explained that there are several elements that would ease communication and promote knowledge flow such as common goals, proximity, and similar cultures. In reality, not all weak ties can fit all of the aforementioned requirements so little information transfer is expected in such circumstances. Hence, it is considered that the function of weak ties lies in their capacity to serve as a foundation for the formation of strong ties, or alternatively, to facilitate the creation of new connections with which strong ties may be established.

[4] The networking and absorptive capabilities are split into their respective 2nd-order themes for the ease of reading and understanding the model. This remains consistent throughout the results section.

The results also show that the innovation capability is directly impacted only by the capability to absorb and transform information. All entities present in this research have confirmed that the two absorptive capabilities to recognize and transform knowledge are needed to successfully innovate, the other variables within the model are, hence, considered mediators between the innovation policies and the innovation capability. Some quotes are provided as examples highlighting the need for the capabilities to absorb and transform knowledge for the development of the innovation capability:

> "[...] if you don't have a customer, of course, you can't sell your product, so you don't have to have a product." - market validation (PACAP)
> "But our business model operates in a whole chain supply chain and in a whole ecosystem, that started during the investment readiness program." - business model improvement (PACAP)
> "On the other hand, they also showed routes which we should definitely not take in our development. And that saves a lot of time and effort by not exploring these routes." - R&D support (RACAP)
> "So we have to build a roadmap and for that we need our academic partners to see, okay, what is possible and also to bridge the gap from new ideas to actual products." - roadmap support (RACAP)

Figure 6 within Appendix 6.4 was compiled using all the information gathered so far on the influence of innovation activities on the dynamic capabilities of KIE firms (model A & B). The visualization encompasses the impacts of the incubator and the TTO. It is visible that seeking assistance from both the incubator and TTO would address all branches of networking and absorptive capabilities within the KIE firm. Although ideal in theory, it is hard to pursue the support of the two entities at the same time due to the phases a young firm experiences. In the early stage, the main focus of the start-up is to build a viable and robust foundation for their businesses through market validation and the composition of a persuasive value proposition to attract partners and investors. After securing the first round of capital, the KIE firm could be in a position to recruit experts or collaborate with academic institutions, namely the TTO, to advance their technological findings and commercialize their products.

In essence, early-stage KIE firms should seek the support of an incubator to set the basis of their business by improving their capability to absorb new knowledge and build new connections. Afterward, in a later stage, the company can pursue a project with the TTO to develop its ability to commercialize its products and build a reliable network of business partners. Hence, engaging the programs in this order ensures that every capability is supported towards building the capacity to innovate for KIE firms.

5 Discussion & Conclusion

The aim of this research was to investigate how innovation activities influence the innovation capabilities of KIE firms through networking and absorptive capabilities. The results showed that depending on the innovation program, incubator, or TTO, there are various activities through which the innovation policies affect different branches of networking and absorptive capabilities. While both programs impact the formation of weak ties within KIE firms, the incubator also directly impacts PACAP, and indirectly, strong ties

and RACAP (Figure 3). On the other hand, the TTO directly supports strong ties and RACAP, and indirectly, PACAP (Figure 4). Hence, pursuing both programs (Figure 6) provides KIE firms with direct support to all capabilities that indirectly and directly influence the capability to innovate.

The findings differ from the original assumptions developed in the theoretical framework from Section 2. Based on the knowledge from Hagens et al. (2020) and Netherlands Chamber of Commerce, KVK (2022), it was alleged that the innovation activities only directly impact the networking capabilities of KIE firms through weak and strong ties (Figure 1). This contrasts with the current findings. While it is indeed the case that most innovation activities affect weak ties, it is only certain functions offered by the TTO that also directly impact strong ties, namely collaborative projects involving the TTO and supply chain support. Hence, it becomes apparent that innovation activities are not only reserved for developing the networking capability in KIE firms. Instead, the activities also aim to improve the absorptive capabilities of businesses. For instance, incubators are focused on teaching firms how to construct a solid business model and value proposition. These elements directly influence PACAP since companies are using the theoretical knowledge provided by the incubator to build on the potential of their innovative idea. Furthermore, TTOs are centered around R&D and commercialization support. This insinuates that the TTOs directly impact RACAP through their effort to transfer state-of-the-art knowledge to KIE firms but also facilitate commercialization by presenting the firm with access to key resources.

The following assumption from Figure 1 was that networking capability is a mediating variable between the innovation activities and the absorptive capability. The results corroborate the theory brought by Cohen and Levinthal (1990) since ACAP has been proven to be directly influenced by the capability to create and maintain strong ties. In contrast, the gathered data disapproves of the statements made by Vrontis et al. (2017) regarding the fact that weak ties impact PACAP, whilst strong ties affect RACAP. During the interviews, it was discovered that most KIE firms choose to not divulge sensitive information to distant connections due to the threat of IP theft. This limits the chances of a creative discussion taking place between the firm and weak ties where innovative ideas could be disclosed. The difference between the conclusions of Vrontis et al. (2017) and this study might be explained by several factors. In contrast to the quantitative approach used by Vrontis et al. (2017), this research uses qualitative data to investigate potential links between innovation activities, tie strengths, and the capability to recognize and transform information. Quantitative research is known to be confirmatory which implies that other relationships aside from the ones stated by the hypotheses of the study might be overlooked. In addition, Vrontis et al. (2017) never distinguishes between strong and weak ties but it does refer to what kind of networks are needed to recognize and transform knowledge. This could mean that weak ties and strong ties could both exist within the same network which confirms the theory of this research and Vrontis et al. (2017). To sum up, this research considers that weak ties act as a foundation for strong ties, and they also facilitate the identification of other actors who could potentially become stronger ties.

The final theory proposed in Figure 1 was that PACAP and RACAP need to be employed uniformly in order for the KIE firm to be considered entirely capable of innovation. The knowledge presented by Zahra and George (2002) and Aas and Breunig (2006)

is corroborated within this research, the interviewed entities emphasized the essential combination of PACAP and RACAP as a means of maintaining and enhancing the innovation capability of KIE firms. It is a comprehensible fact that a firm cannot effectively bring products to market without a feasible business model, or alternatively, commercialization is unfeasible in the absence of a well-defined business structure. Thus, the model from Figure 6 is in line with previous literature which stated that the capabilities to recognize and transform knowledge result in the uniform development of the ability of KIE firms to innovate.

During the research, new variables were found that describe the setting of North Brabant, the reasoning behind the participation in innovation programs by KIE firms, and the reviews of incubators and TTOs. Firstly, important insights were drawn from the interviewees in regard to the culture and history of North Brabant. The opinions on culture were delegated by the BOM participant who focused on the negative attitude of Dutch people towards greediness. The interviewee critiqued the Dutch perspective and attributed it to the low number of scale-ups compared to that of start-ups not only within the assigned region but also throughout the Netherlands. This outlook on the national culture prompted a more critical attitude towards the incubator's newcomers who were pressured from the very beginning to keep being ambitious and build toward a scalable business model. Furthermore, the history of North Brabant was also briefly discussed given the input received from the TTO interview. The region bloomed due to the investments of Philips and the government. What started as a company seeking accessible and educated human capital snowballed into an ecosystem hosting some of today's most innovative companies. Thereby, the scope of the university is to sustain the region in terms of techno-economic efforts through valorization activities. The interviews with the R&D managers corroborated the importance of the TTO and stated that their companies increased their innovation capabilities due to the knowledge and talents provided to them by the university. Hence, it is interesting to include the setting of North Brabant to have a better comprehension of the reasoning behind the activities provided to KIE firms by either the TTO or the incubator.

Moving on, the initial intentions of KIE firms were analyzed to understand the reasoning behind the choice of their support. It was found that early-stage firms seek the incubator's aid in order to learn more business skills, get in contact with large corporations, or finance their operations. By accessing these services, the KIE firm is required to take development courses with which the team can improve its business model, complete market validation, and improve its value proposition for future investors and clients. In one instance where the founder directly sought funds from the incubator, it was fascinating to notice that although the employee did not provide them with the investment, the expert instead suggested that the company partake in their courses to improve their business model. Once that was done, the firm developed a new product that significantly improved its potential to scale up and triggered the incubator's decision to become its investor. This was made possible through the screening of the incubator that observed the firm's current capabilities and decided to aid towards their improvement. As for the TTO, the intentions of firms joining TTO projects are straightforward, as is the assessment of the organization in regard to the company's technological advancements. Thus, the new variable describing the time prior to joining the innovation program is an insightful addition and it helps explain the reason KIE firms choose to approach these support organizations.

The variable named review encompasses all the opinions and sentiments expressed by the KIE firms post the participation in the innovation programs offered by the incubator or TTO. All of the participants shared a positive sentiment in regard to the aid provided by either of the two organizations. The founders stated that their business skills have advanced due to the courses and expertise granted by the incubator, whilst the R&D managers acknowledged the benefits of the TTO in their technological development. This proves that the incubator is more focused on developing the early-stage companies in recognizing and absorbing the necessary knowledge to successfully develop their business idea, meanwhile, the TTO is concerned with the transformation of knowledge into a product fit for commercialization. In the end, both the incubator and the TTO are ideal support organizations that can sustain the two branches of the absorptive capability that can assist the ability to innovate of KIE firms.

5.1 Theoretical Implications

Previously, it was noted that there exist a few gaps in the literature regarding the extent to which innovation policies impact the dynamic capabilities of KIE firms, specifically in a developed country such as the Netherlands. There is a lack of papers that focus on the effect of innovation policies and the capabilities of firms, more specifically, networking, absorptive, and innovation. A part of the literature explains the interaction of networking and absorptive capabilities towards building innovation capability but fails to include the effect of innovation policies or activities. Other papers which include all of the aforementioned variables do not concentrate on KIE firms as their sample data. Thus, this research contributes to academia by bridging the aforementioned gaps through the development of two dynamic models that illustrate the aforementioned relationship. Both models (Figure 3 & 4, combined in Figure 6) build upon the findings of Lynskey (2004), Peng (2022), and Protogerou et al. (2017) which explained how innovation activities and capabilities such as networking and absorptive interact with each other. Within this paper, it was declared that the innovation policies reflect on the capabilities of KIE firms through the practices and activities offered by the incubators or TTOs. The novel aspect of this research is that within the dynamic models, there is a distinguishment between the activities affiliated with an incubator and those associated with the TTO. This distinctive attribute has the potential to enhance comprehension regarding the direct provider of support for KIE firms and the specific attributes of the organization that influence the capabilities of participating firms.

Scholars can build upon this research by conducting comparative analyses of the impact of incubator innovation activities in other regions of the Netherlands. The outcomes of such research could reveal disparities in the ecosystems of KIE firms based on their geographical origins. Such knowledge could facilitate the understanding of the industries that are more likely to prosper in specific regions. Moreover, expanding upon comparative research could enable scholars to establish a nationwide pattern that is observable across Dutch incubators. Other academics could use this knowledge to compare the situation of incubators in an advanced country, to that of emerging economies such as Brazil. Hence, using this study to compare the incubators of several regions of the Netherlands could be valuable for future research.

It is also interesting to consider that this study contributes to the literature on the longitudinal development of regional innovation policies. In the theoretical framework from

Section 2, the research briefly elaborated on the history of innovation policies and what caused their change. The results presented in this paper could enhance understanding of the factors that prompt future transformations of innovation policies by observing how, in the past, innovation policies influenced indirectly the formation of KIE firms' innovation capability through innovation activities of incubators and TTOs. On top of that, elements such as culture, history, and the current situation of North Brabant are also touched upon within this research and associated with the innovation programs' scope and operations. Hence, these are the additional factors that could help explain future alternations of innovation policies.

Scholars could also use the research to further build upon the indirect impact of innovation activities on the capabilities of KIE firms. Future research can employ models A (Figure 3) and B (Figure 4) to quantify the relationships between each of the variables included in the model. For instance, academics can measure the weight of each innovation activity on weak ties, strong ties, PACAP, and RACAP. Conducting a follow-up quantitative study that weighs and validates the relationships between the variables of Figure 6, could provide a stronger foundation for the theoretical implications mentioned earlier. In summary, scholars can expand upon this research in numerous ways to improve their comprehension of how regional innovation activities influence the innovation capability of KIE firms. This can include comparative analyses of activities across different regions or organizations, longitudinal studies of activity development over a period of time, and investigations into the causes of activity alterations in the future.

5.2 Practical Implications

The findings of this study have not only theoretical implications but also practical implications for businesses and the institutions that support them. In models A (Figure 3) and B (Figure 4) managers can easily identify the impact of innovation activities on the capabilities of their firms and strategize accordingly. To begin with, entrepreneurs should increase their awareness of the varying impact that different organizations can have on their operations. For instance, incubators aim to support the early stages of a start-up by building a viable business model and persuasive value proposition. Not only that, but the organizations also aid them by providing access to various forms of financing enabling firms to raise their first rounds of capital and establish their operations. In contrast, the TTO is better equipped to support those companies that have already launched the internal research of their technology and prototyping of products. When compared to the incubator, the TTO typically requires funding to initiate projects or requires the presence of internal research so that the company can participate in national or EU-funded projects. Hence, it is harder for early-stage firms to join this type of program immediately. Instead, KIE firms should seek the aid of incubators to improve their PACAP through a robust business model and then seek collaboration with a TTO to develop their RACAP towards commercialization. In this way, the KIE firm can cultivate its networking and absorptive capabilities to comprehensively support its innovation capability.

It is also important to note that the offerings of various incubators may vary based on their unique goals while the TTOs remain similar. In this study, High Tech XL and BOM were mentioned numerous times, and it was discovered that their support slightly varies from one another. BOM only works with extant companies so entrepreneurs who

have an undeveloped business idea cannot join the program, alternatively, they could join High Tech XL which promotes itself as a key creator of the start-ups in North Brabant. Another difference between the two entities is in their approach to supply chain support, BOM has explained that their aid is on a consultancy level, in contrast, High Tech XL could potentially provide direct access to suppliers and mediating services to facilitate the relationship between the KIE firm and their new partners. Hence, businessmen can take such factors into consideration and join the incubator most suitable for their needs.

The study does not only provide practical implications for entrepreneurs but also for the regional government. The RIS framework implemented in North Brabant stated that the Dutch government is trying to facilitate increased ease of collaboration, market validation, employee training within KIE firms, international networking, and monitoring of societal impacts. The first two elements have been addressed by the interviewees and are confirmed to be the focus activities of innovation programs within this research. The TTO is a key mediator in the formation of business partners. They guide companies through projects and encourage them to collaborate with each other to achieve technological advances. Moreover, the incubator considers market validation a significant step in building the foundations of a scalable business as the BOM and three founders related in their interviews. However, during the research, none of the interviews affirmed that any activities provided by the TTO or incubator aided them in training new employees. The two R&D managers stated that if their firms need highly educated employees, they can be acquired through the university. Nonetheless, they failed to mention any sort of trainings or subsidies given through EU funds for trainings. Hence, the regional government can use this research to find better ways in which they can reach KIE firms and provide them with the needed support for trainings. On the other hand, it is possible that KIE firms do not require this type of aid since their enterprises are still small and the knowledge flows smoothly. In this case, the government can decide to stop offering this type of assistance and switch its focus to something else. As for the rest of the RIS framework goals, the Dutch government succeeded in facilitating international networking and observation of innovations in society.

A final aspect that was constantly stressed by all interviewees is the necessity of a well-balanced team. An element of such great significance that BOM has even released a team product aimed to improve and develop the capabilities of start-up teams such that the operations of the business can run smoothly. Furthermore, High Tech XL has also taken the matter seriously as on their webpage (High Tech XL, 2023b), the incubator offers talented entrepreneurs a chance to become co-founders of certain start-ups within their program. This proves that before laying the foundations of the business model, a competent team is needed to visualize the market potential and strategize accordingly. In addition, the importance of team composition will continue to prevail throughout the lifetime of the KIE firm. Without capable managers at the top of the operations, a company cannot reach the full potential of its PACAP and RACAP as was displayed during the interviews. Thus, entrepreneurs should spend time and effort analyzing the current capabilities of their team and what steps can be taken to improve its composition.

To summarize, there are three main takeaways for practical implications which involve the mindfulness of entrepreneurs towards the stage their firm is in, the kind of incubator aid needed, and their team composition. In addition, a fourth takeaway concerns the Dutch government and it recommends that the regional administrators revise the need for

trainings support offered to KIE firms.

5.3 Limitations & Future Research

Although the research provides valuable theoretical and practical implications, there are a few limitations that should be addressed. Firstly, this study's pool of participants is limited. In the beginning, more than eight interviewees were expected to join the research with the requirement that three of them are affiliated with the same KIE firm (further details in Section 3.2). However, this goal was not achieved, which may have affected the quality of the results by reducing their accuracy. A decreased number of participants may increase the likelihood of overlooking various novel perspectives. Hence, for future research, it would be interesting to have a pool of at least ten participants, three of which originate from the same KIE firm, affiliated with different industries to see if there are any changes in the dynamic model or if new variables arise.

Secondly, the study failed to account for ecosystem builders, such as the one referenced in an interview. As mentioned in the results of Section 4, an ecosystem builder could be considered a hybrid between incubators and TTOs due to its quality to finance firms but at the same time provide them with R&D efforts. This type of organization was not taken into consideration when creating models A (Figure 3) and B (Figure 4). For future research, it would be recommended to take into consideration the addition of model C which visualizes how the innovation activities affiliated with the ecosystem builders affect the dynamic capabilities of KIE firms.

Lastly, the study lacks a specific industry focus when prospecting KIE firms. Dividing results by industry could clearly indicate if the innovation activities are biased toward certain markets. The present study does not differentiate this fact, and thus, no conclusions can be inferred regarding industry-specific factors that influence innovation activities. Therefore, future research could be valuable in dividing KIE firms by industry and comparing whether the incubator has consistent effects across industries.

The current research proved to be insightful as both theoretical and practical implications were found. To conclude, the research findings revealed that innovation policies associated with the activities of innovation programs have a direct impact on all aspects of networking and absorptive capabilities, thereby indirectly influencing the innovation capability of KIE firms.

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6 Appendix

6.1 Interview Scripts

6.1.1 Standard Scripts

The standard script used in the overarching research is displayed below. The set of questions is divided into two categories where one is addressed to institutions such as incubators or TTOs (Appendix 6.1.1), whilst the other concerns KIE firms (Appendix 6.1.1).

Script for Institutions. Innovation Policy

1. Please, talk more about how it works your institution's programs that stimulate the creation and development of KIE / startups / firms?
2. What is the profile of a company that your institution works with? Is it early-stage startups (modeling the business model, for example)? Or firms in a more mature level of development (already established the core business, operations, and commercialization)?
3. What do you think the firms expect to achieve after your program's participation?
4. Could you mention the benefits your program offers for the firms that participate?
5. Which areas (commercial, technology, operations, or financial) do you think are most impacted in the companies that participate in your program?
6. Does your institution supports or stimulate the companies' investments in scientific research and technology change?
7. And about the training of employees or hiring of new ones?
8. Which are the mechanisms your institution uses to follow up on the companies' participation during your program? And after the finalization of it?

Dynamic Capabilities

1. Do you support the process of acquiring new technology knowledge for your clients?
2. Does your institution help the companies to develop their business model? In which way?
3. And about the development of the technology/product? Does your institution help the companies to improve it?
4. Does your institution support the companies in the commercial process?
5. Does your program supports or stimulate the companies to interact with other participants or externals to exchange knowledge?

6. Does your institution help the firms with the purchasing process and the relationship with suppliers?

Innovation Capability

1. How do you consider that your institution helped the companies to change and develop their innovation capabilities?
2. Do you perceive a big difference between the product/technology of the companies at the end of the program comparing when they started?
3. In this sense, how does your institution measure the results (in terms of innovation outputs for the companies) at the end of the program?
4. Could you mention some success stories of companies that passed through your program? And about the companies that could not succeed, what reasons do you think led to this?

Script for KIE Firms. Innovation Policy

1. How is your participation in the innovation/entrepreneurship incentive program?
2. What was your initial intention to join the program?
3. Which areas of your company are impacted by participation in this program?
4. Did this program allow you to contact and develop relationships with new partners (customers, suppliers, etc)?
5. Does the program/institution support the process of R&D in your company?
6. How has your company improved in aspects such as technological learning of the employees (absorbing new information, knowledge) or hiring new ones?

Dynamic Capabilities

1. Could you talk about how the program influences the development of the capabilities of your company?
2. How does participation in the program affect your product/technology? And the business model?

Absorptive Capability

1. What do you think about the learning process of your organization? How the participation in the innovation program impact this?
2. Do you think your company assimilates other actors' knowledge to build new products and/or services during the program?
3. Do you design alternative prototypes for your company's products and/or services? Does the program influence it?

Networking Capability

1. Who are your main partners today? How did you build a relationship with them?
2. Do you think strategically about which partners you want to prospect? Do your experience in the innovation program help in any way with this selection of partners?
3. How does the innovation program impact your current partners (trading partner, supplier, or learning partner)?
4. How do you collaborate with other institutions/companies during the program?

Innovation Capability

1. The program/institution supports or stimulates your R&D process?
2. Do you think the program/institution helps your company improve its product/technology or create new ones?
3. Could you talk about how the program influences the development of the innovation capabilities of your company?
4. What are the problems and expectations of the customers that your innovations/products aim to solve? The program/institution helps you improve the value offered for your customers?
5. What is the impact of these innovations on your segment? How could you improve it during your participation in the program/institution?

6.1.2 Final Scripts

The make it easier to observe, the questions that are added to the standard script are written in bold font below.

Script for Institutions. Innovation Policy

1. Please, talk more about how it works your institution's programs that stimulate the creation and development of KIE / startups / firms?
2. What is the profile of a company that your institution works with? Is it early-stage startups (modeling the business model, for example)? Or firms in a more mature level of development (already established the core business, operations, and commercialization)?
3. What do you think the firms expect to achieve after your program's participation?
4. Could you mention the benefits your program offers for the firms that participate?
5. Which areas (commercial, technology, operations, or financial) do you think are most impacted in the companies that participate in your program?
6. Does your institution supports or stimulate the companies' investments in scientific research and technology change?
7. And about the training of employees or hiring of new ones?
8. Which are the mechanisms your institution uses to follow up on the companies' participation during your program? And after the finalization of it?

Dynamic Capabilities

1. Do you support the process of acquiring new technology knowledge for your clients?
2. Does your institution help the companies to develop their business model? In which way?
3. And about the development of the technology/product? Does your institution help the companies to improve it?
4. Does your institution support the companies in the commercial process?
5. Does your program supports or stimulate the companies to interact with other participants or externals to exchange knowledge?
6. **Does your institution aid companies to come into contact with actors from different industries?**

7. **Does your institution help and teach companies to efficiently collaborate with organizations that provide access to important resources?**
8. Does your institution help the firms with the purchasing process and the relationship with suppliers?

Innovation Capability

1. How do you consider that your institution helped the companies to change and develop their innovation capabilities?
2. Do you perceive a big difference between the product/technology of the companies at the end of the program comparing when they started?
3. In this sense, how does your institution measure the results (in terms of innovation outputs for the companies) at the end of the program?
4. Could you mention some success stories of companies that passed through your program? And about the companies that could not succeed, what reasons do you think led to this?

Script for KIE Firms. Innovation Policy

1. How is your participation in the innovation/entrepreneurship incentive program?
2. What was your initial intention to join the program?
3. Which areas of your company are impacted by the participation in this program?
4. Did this program allow you to contact and develop relationships with new partners (customers, suppliers, etc)?
5. Does the program/institution support the process of R&D in your company?
6. How has your company improved in aspects such as technological learning of the employees (absorbing new information, knowledge) or hiring new ones?

Dynamic Capabilities

1. Could you talk about how the program influences the development of the capabilities of your company?
2. How does the participation in the program affect your product/technology? And the business model?

Absorptive Capability

1. What do you think about the learning process of your organization? How the participation in the innovation program impact this?
2. Do you think your company assimilates other actors' knowledge to build new products and/or services during the program?
3. Do you design alternative prototypes for your company's products and/or services? Does the program influence it?

Networking Capability

1. **How many new contacts from various industries have you gained during the innovation program?**
2. Who are your main partners today? How did you build a relationship with them?
3. Do you think strategically about which partners you want to prospect? Do your experience in the innovation program help in any way with this selection of partners?
4. How does the innovation program impact your current partners (trading partner, supplier, or learning partner)?
5. How do you collaborate with other institutions/companies during the program?

6. **Have you been taught how to maintain an efficient communication with organizations that provide access to important resources**

Innovation Capability

1. The program/institution supports or stimulates your R&D process?
2. Do you think the program/institution helps your company improve its product/technology or create new ones?
3. Could you talk about how the program influences the development of the innovation capabilities of your company?
4. What are the problems and expectations of the customers that your innovations/products aim to solve? The program/institution helps you improve the value offer for your customers?
5. What is the impact of these innovations on your segment? How could you improve it during your participation in the program/institution?
6. **Do you consider your company more innovative when it operates more with close connections in comparison to distant contacts?**
7. **Do you think it is more difficult to make brand new contacts in comparison to growing a closer relationship with a contact you have already made? Why is that so?**
8. **What could enable your company to gather new contacts and also focus on growing closer relationships at the same time?**

6.2 First Form of Contact with Institutions or KIE Firms

"Hello!

I hereby invite you and your organization to participate in a study called "Innovation policies and their influence on the capabilities of knowledge-intensive firms in the region of North Brabant". The research is part of a larger initiative performed in several regions of the Netherlands and Brazil. My name is Raluca Lăzăreanu and I am assigned to investigate the situation in the region of North Brabant, the Netherlands. I am part of the Faculty of Behavioural, Management, and Social Sciences at the University of Twente.

As the title might reveal, the goal of this study is to examine how innovation policies influence the capabilities of knowledge-intensive firms. Thus, I kindly ask if you can spare some time to conduct a semi-structured interview with me. Please let me know if this is possible by replying to this e-mail/message.

I assure you that your answers in this study will remain confidential. Hence, I consider there are no risks associated with participating in this research.
Best regards,

Raluca Lăzăreanu
[personal e-mail]
[personal phone number]"

6.3 Informed Consent for Interviews

Innovation Policies and Their Influence on the Capabilities of Knowledge-intensive Firms in the Region of North Brabant

Consent for participation in research interview

I agree to participate in a research project directed by Raluca Lăzăreanu from the University of Twente in Enschede, the Netherlands. The purpose of this document is to confirm I was made aware of the terms of my participation in this project by being interviewed.

1. I have been given enough information about this research project. The intention of my participation as an interviewee is well explained to me.
2. My participation in this interview is voluntary. I have not been coerced by anyone explicitly or implicitly to join this research project. Hence, I have the right to stop answering questions and leave at any time I find it necessary.
3. I understand that my interview is video-recorded. I have been made aware that the recording is safely stored by the researcher.
4. I have been guaranteed by the interviewer that, if I wish so, the project will not disclose the identity of my organization or my personal identity. Thus, I hereby choose to keep my personal identity and that of the organization _____ [Choices: confidential OR not confidential].
5. I understand that the information gathered is used towards the master's thesis of Raluca Lăzăreanu. This paper will be anonymously and confidentially published on the University of Twente database.

Signature: _____

[Name Interviewee]
[Date]

Signature: _____

[Name Interviewer]
[Date]

6.4 Data analysis

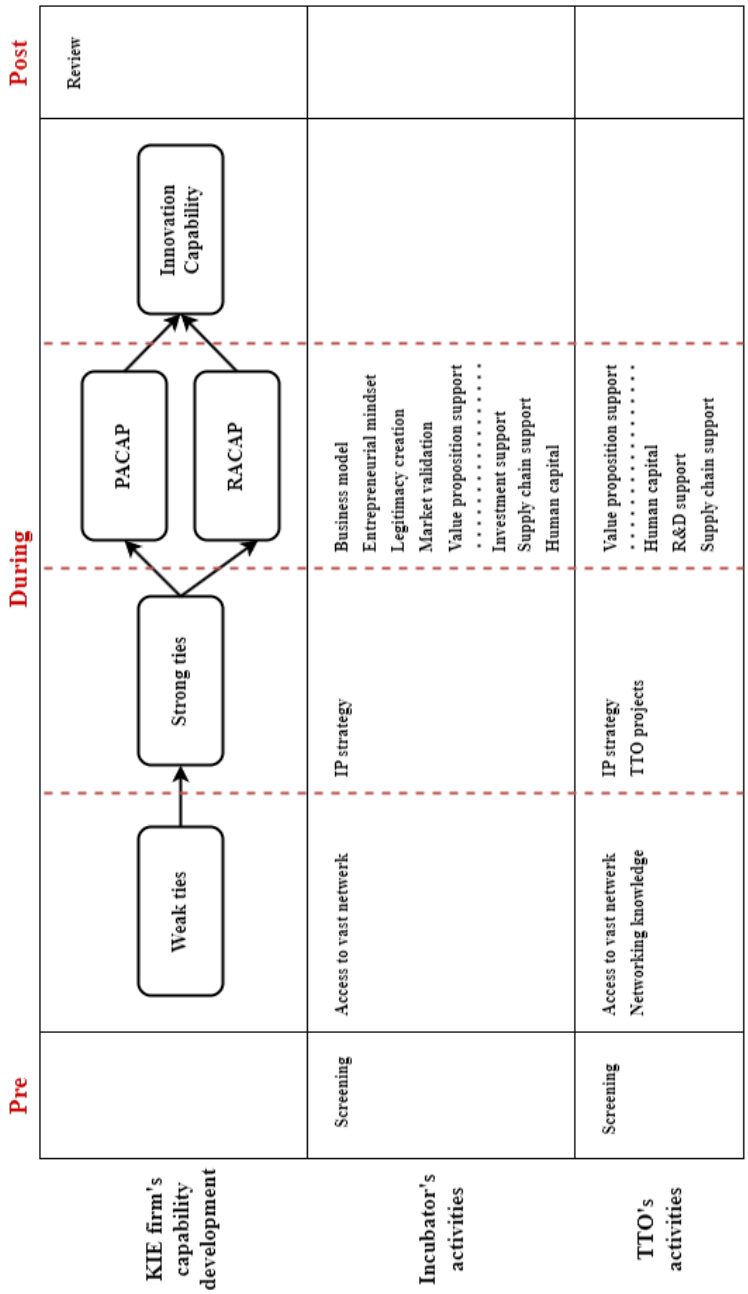

Figure 6

Combined effect of model A & B on innovation capabilities of KIE firms.

Table 3

The hierarchy of codes as a result of the abductive analysis.

Aggregate dimensions	**2nd-order themes**	**1st-order codes**	**Notable Quotes**
Innovation activities	Access to vast network	Innovation program network	"I think at [incubator name] there are people working from all kinds of industries and there's a very broad network."
			"The professor, for example, says "ok, I know this or this person can do these kinds of experiments for you, or they have expertise in that or field A or field B"
		Networking with investors	"So it could be that we help them acquire friends at the [incubator funding program], Rabobank Innovation Loan, or any other available early-stage money."
		Networking with judicial authorities	"On the legal side of things, we have a very good relationship with [legal firm]. I think that came through the innovation program"

		Networking with program peers	"The program tries, of course, to bring different companies in touch with one another so they can learn from one another."
		Searching for new networks	"They help you in [...] how to find people. "
	Networking knowledge	Events	"But there's more like a big event where they try to force you to connect with other entrepreneurs in the field [...]."
			"So with these events that they have with by actively bringing the people together, we have a lot of discussions with them where they, uh, meetings where we can talk together about potential topics or about partners or existing partners or new ways to make the communication. "
	Business model	Business model support	"We help them by providing development programs like [program names] at which we help start-ups define their business case."

			“I think the strength of the program is more in terms of the business model rather than innovation in itself.”
		No business model support	“In general, that’s not so much the subject of research, the business model.”
	Entrepreneurial mindset	Open-minded challenge	“The programs force you to take time to step back and really think about "hey, what’s going on? What am I learning here and how can I apply it in my day-to-day business?".”
			“They didn’t say "ok, good job.". They say "ok, what can we improve?" and that really changed our mindset as well.”
		Entrepreneur self-reflection	“I had this idea, but I had no experience with starting a company around that. [...] and I knew I needed the support.”

			“We were more confident about our own model because we managed to flip it around.”
		Pressure to scale-up	“We’re trying to also challenge the start-ups "you’re thinking about this business model or this business case. Could you maybe scale it up?".”
			“We want to see a scalable business with exit potential [...].”
	Human capital	Support for hiring	“[incubator name] facilitates [hiring] because they organize so-called job days where they invite people that are looking for a job and then there is a kind of job fair where those people can talk with different companies which are a part of the program.”
		Hiring through University	“For example, we had a post-doc working for us at the University. In the end, [KIE firm] decided to hire the post-doc as an employee. So that happened two times.”

		Consultancy on hiring	“We sometimes look for a CEO, somebody that we want to put in the company from a network. But that is up to the companies themselves [to hire].”
		No support for hiring	“The exact process of hiring people in a professional way, I must say that this was never done by the program. It’s something we had to figure out ourselves in the end.”
	Investment support	Investment forms	“So if the company is really interesting, we might also invest in the very early stage, but not through equity, but it will be in a convertible loan.”
		Investment requirements	“You see in the investment world that everything is gearing towards impact.”
			“"Is it unique? Yes, it is unique. We have IP." So they just believe it.”
	IP strategy	IP strategy support	“There are specialists on IP that arrange the necessary contracts.”

	Legitimacy creation	Ecosystem affiliation	"So if [KIE firm] can be part of an ecosystem and show that there are companies in partnership with [KIE firm] and that there is also room for further scale-up in production, then it makes it more attractive for companies to come to [KIE firm]."
		Awards	"We easily find new contacts because of what happened a year ago, we won the [prize] and the [prize] is a worldwide competition for companies developing a machine like what we do. And that created a lot of visibility."
		Investment	"But what helped, especially in the financial aspect, is that [incubator name] invested. So you strengthen your equity position. So that means that these companies are more comfortable in providing their financial instruments."

	Market validation	Market validation support	"Because we challenge them on market validation a lot, mainly so we expect them to do a lot of customer interviews, which is quite challenging for most start-ups."
			"[...] by focusing on market validation is that we see a lot of companies pivoting towards a different business model or different product."
	R&D support	R&D via TTO	"They also showed routes we should definitely not take in our development. That again saves a lot of time and effort by not exploring these routes."
			"So these collaborations, I think, are also very important not only for performing the experiments and the research but also for the scientific discussion and let's say the creative process involved with that. Because then if you put all these great minds together, then you you can get a lot of different ideas."

		R&D consultancy via incubator	"I think the people working at [incubator name] have different backgrounds, so for example, I have an electronics background. So when there's an electronics company or somebody with an electronic product, I get directed to have a quick assessment whether that is working or if they have questions."
		No R&D via incubator	"[...] the R&D aspect is not the main concern of those programs most of the times."
	Supply chain support	Supply chain consultancy via incubator	"So the program invites many consultants, so to speak, to find suppliers and partners with whom you can work together."
			"[incubator name] you see that they are talking to a lot of companies in the [region] and that they are trying to link us to a lot of possible customers, but also to possible suppliers."

		No supply chain via incubator	"In the innovation program, it didn't really let us find new suppliers or new customers in that sense."
		Supply chain via TTO	"So they help us start collaborations with other universities or companies or suppliers."
			"We have a lot of discussions [...] where we can talk together about potential topics or about partners or existing partners."
	TTO projects	Public projects	"Joint participation in European project or joined participation in a national project."
			"Typically you work with them on a funded project basis so that we both can benefit from the work and also from the budget that's being available in the EU funds."
		Private projects	"Direct contract research, where no public funding is involved, but we develop or research a particular area instructed by and paid by the company."

			“We have our own money to fund a PhD research [...].”
	Value proposition support	Value proposition via incubator	“Our value proposition was completely re-designed thanks to the program.”
			“[...] it helped us focus and say "ok, all these nice things to do, let’s stop that for a moment and focus only on a few development projects".”
		Value proposition via TTO	“[...] we are providing new knowledge to a company that would help them to give a better commercial offer.”
			“So focusing on less, but being able to get better quality and make them faster and also better.”
Networking capability	Weak ties	Gaining connections	“Of course, we set up new contacts because as we grow as a company, you need to set up new contacts.”
			“Thanks to these deep contacts and deep relationships with existing partners, it’s easier to get new partnerships, I would say.”

		Distant connections	"You are really scared, this is probably someone who can take over our technology [...] that's not a good basis of co-creation and innovation."
			"If you are talking to a more distant supplier or whatever, then you have to be a bit more careful in the discussion. And then yeah, that can also hinder [...] innovations."
		Access to knowledge	"You know more people, you are entering different networks of different specific topics."
			"I think because of a bigger network, you will get a higher absorption capacity."
	Strong ties	Common goals	"And it's a bit of a win-win because typically these are companies that would like to offer their services to these start-up companies, and the start-up companies are looking for these services."

		Proximity	"So there is simply, let's say, a bigger trust circle with partners that are closer geographically closer than with then with remote, remote partners, let's say. [...] It means you meet one another on a regular basis face to face, and that really helps to strengthen the relationship and the willingness to do the extra thing that is sometimes needed in a partnership and a collaboration."
		Similar culture	"It's also cultural differences, and so that also determines your choice. If you work with Asia, then a long-term relationship is very important. If you work with the US, then you can have short contacts, and then you work together [...]. When we say "we're not interested anymore", they continue something else. So there you constantly have to look for new contacts."

		Ease of communication	"[...] you have more trust in a company, so in that sense then it's closer to you then I think it's more easy to share [information]."
			"I would say with close collaborations because, for example, these two universities, we have really close collaboration with them and we know we can safely share everything."
		Main partners	"Our main partners today are universities across Belgium and the Netherlands."
			"Our main partners, I would say are our local distribution partners [...]."
		Knowledge transfer	"So these collaborations, I think, are also very important not only for performing the experiments and the research but also for the scientific discussion and let's say the creative process involved with that.[...] then you can get a lot of different ideas."

			"So that's also something we do a lot. So we also do a lot of research ourselves and a lot of results, and we share that also with the universities."
		Maintaining close contact	"It will help to have any physical communication because I know what they do and what they can. So if I need something you can easily reach out."
			"It means you meet one another on a regular basis face to face, and that really helps to strengthen the relationship and the willingness to do the extra thing that is sometimes needed in a partnership and a collaboration."
Absorptive capabilities	PACAP	Customer identification	"I think it did affect the business model because thanks to the program, we realized that we should focus on selling it to companies that will use it for [...]. That is something that we learned through the program."

		Customer needs identification	"So by interaction with our companies, external companies and also with networking, we get an idea. We try to understand what the needs are for the coming years."
		Value proposition	"So during that program, we found this financial partner [name] that could help us finance our local distribution partners. So it actually changed almost everything."
			"We made it extremely sharp that our customers are [...] companies that will buy our equipment to make [...]. And I experience up until today that if you tell the story like that, it's much clearer for people from outside to understand what we do and to whom we will sell it. And that's really thanks to the program. "
		Operating segment of the start-up	"You know, our sector. You don't see a lot of innovation. So in that sense, it helps us more internally."

			"the [name] industry is still growing [...]."
		Ecosystem knowledge	"I've been exposed to open innovation. [...] It is impossible for a company to work in isolation. You can only take the right decisions to be actively involved in all kinds of networks which make you understand what to do and also enable you to show the rest of the world what you're doing. "
			"We really help them improve their business and these are all innovations that are a result of us looking at the whole chain, our own business model."
	RACAP	Team composition	"And then we have highly qualified, well-trained people, which can immediately work for either R&D, especially PhD people. For master students, that would be more on the operations side where they develop the processing."

			"Our team is, I think, mainly chemists, but we have physicists and also mechanical engineers, etc. so we have quite a broad range of expertise. And so far, um. We were quite good in absorbing that knowledge."
		Knowledge diffusion	"But I think this exchange, this knowledge is always also shared with the whole team and eventually also with the whole company."
			"[...] realize how important that that to so even people in the technical department have to understand how the financial constructs work to be able to understand how the technical product should work."
		Technology roadmaps	"we have a timeline on how fast we want to develop our [product]."

			"We translate those needs into a roadmap, and the roadmap means we want to do this in two, three, four years' time. That could involve investment and new tools and new people, whatever new processing."
		Product characteristics	"And I think the really nice thing is because they all like the goal on which we are working and reverting climate change. That also helps with your enthusiasm and energy because everybody is inclined to help us. And that's what's really nice."
		Structured partner selection	"OK, let's start with our own requirements, so to say, what does a partner need to bring? When will it work for us? So yes, I think it definitely helped."
			"[...] we strategically pick which collaborations can be can be useful. And that's also for the long term. "

		Unstructured partner selection	“And I think before that we were way more opportunistic. So if we saw some partners "hey, maybe we can work with them. Yeah, let’s do it." Everything for revenue.”
		Monitoring collaborations	“So some researchers, they do the research then there and they report, let’s say every two weeks or every three weeks. It depends a bit. And then we discuss the results and make suggestions for, for following experiments, or we try to validate some hypotheses we have. And we also add our insights of what we think, what is going on in the system we’re investigating.”
			“So from our team, we assign one as, let’s say, the lead, or at least the coordinator who makes sure that they have regular meetings, etc., and keeps track of the process. ”

Innovation capability	New product	Adding a product	"But thanks to the [innovation program], we added this product or service of providing [...] to our local distribution partners."
	Radical product improvement	Product improvement	"For several cases, we made some big steps in the performance of our material. And I think a large part of that was based on the knowledge we got from these collaborations. "
	Scale-up success	Scale-up	"So it really set the stage for how we still operate and how we manage to double our numbers every year. Thanks to what we set up during the [innovation program]."

Table 4

The hierarchy of additional codes as a result of the abductive analysis.

Aggregate dimensions	**1st-order code**	
Culture, history, and situation of the Dutch region	Culture	"[...] has to do with the Dutch culture, right. So keep your head down and just work and don't just scream too hard that you wanna be a millionaire or something like that."
	History	"It all started by [corporation], who came to this region over 100 years ago. But it was also [corporation] who launched this university because they needed the knowledge and in the late 50s."
	Origin start-ups	"And there are lots of start-ups that have been created as a result of the [university] valorization activities."
	Conditions of start-ups & scale-ups	"So the number of start-up companies per capita it's on par, I think, with the rest of the world, maybe a little bit lower, but on the scale-up side, we are lagging behind. "
	Academia	"I see the university as a supporting and serving organization for all the technological economic activity of the region."
	Governmental focus	"[...] the Dutch Government set out a few sectors that they want to stimulate like Med-tech and deep-tech and AI."

Entering the innovation program	Assessment of start-ups	“We have quite a good idea on what a start-up should do and should be doing or should have the one before they are investable. ”
	Initial intentions of start-ups	“To be honest, we hoped to get money. ”
		“We wanted to learn, of course. ”
		“My initial intention was actually to set up a collaboration with [corporation].”
	Support according to start-up phase	“Those scans that we do help startups in identifying where they are and what kind of activities they should be doing. It gives them focus on their daily activities. ”
		“we help them by providing programs development programs like our [program names] at which we help startups to define their business case and do market validation. ”
		“[...] but we are providing new knowledge to a company that would help them to give a better commercial offer. ”
Review of innovation programs	Incubator	“[...] we came to know a lot of knowledge in the program on different aspects of the of the business.”
	TTO	“For several cases, we made some big steps in the performance of our material.”