

MASTER

Improving performance of R&D outsourcing the effects of proximity and absorptive capacity

Dorhout, D.

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Improving performance of R&D outsourcing: the effects of Proximity and Absorptive Capacity

By Doeke Dorhout BSc.

Student identity number: 0785676

MASTER THESIS

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University supervisors:

Dr. A.A. Alblas, Eindhoven University of Technology

Dr. M.M.A.H. Cloudt, Eindhoven University of Technology

Third assessor:

Dr. A. Markus, Eindhoven University of Technology

Company supervisor:

Drs. D. Verheijden

Abstract

Open Innovation is becoming an increasingly popular phenomenon. However, companies remain with the question how to successfully arrange R&D collaborations with external parties. The purpose of this study is to deliver more insight in how companies make better use of external partners in innovation processes to improve collaboration performance. This thesis builds on a dyad analysis, by describing cross-case patterns for 16 R&D collaborations. This led to the acquisition of data from 32 semi-structured interviews and surveys. Three dimensions of proximity were taken into account, relevant in interorganizational collaboration (Knoben & Oerlemans, 2006). These are respectively geographical, organizational and technological proximity.

For geographical proximity, results show a U-shaped relationship with collaboration performance. Regarding technological and organizational proximity, the company tends to look for lower levels of partner proximity in collaboration partners, when innovation is intended. This is done as a means to increase knowledge heterogeneity. Nevertheless, higher levels of technological and organizational proximity results in the highest collaboration performance.

This thesis contributes by the empirical demonstration of previous research that suggested that partner proximities have a rather dynamic character rather than static (Balland, Boschma, & Frenken, 2014). Subsequently, collaboration performance increased when parties became more proximate. Four mechanisms were found in favor of proximity growth. First, the relocation of employees increased geographical proximity. Secondly, Absorptive Capacity enables absorption of market and technical knowledge, resulting in an increase of technological proximity. The same accounts for the absorption of norms, routines and processes which increase organizational proximity. Another mechanism in favor organizational proximity growth is the connection of stakeholders between collaborating parties. The increased proximity was found to negatively affect innovativeness in a collaboration.

Practically, this research suggest to connect with new collaboration parties when innovation is intended. As proximity growth positively influences collaboration performance, a firm would benefit from formulating long-term oriented partnerships. Nonetheless, companies need to be aware of the risks of a competency trap, as innovativeness reduces when collaborating for longer periods.

Key words: Proximity, Absorptive Capacity, Open Innovation

**“RUIJITE SCHEIDT
DE LICHAMEN,
NIET DE
GEESTEN”**

ERASMUS

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1. Problem description: from 'Closed' to 'Open Innovation'

Firms are confronted with increasing needs to engage external expertise in their innovation processes to remain competitive. Research reported that only being dependent on internal innovation sources could result into a diminishing competitive advantage (Chesbrough, 2003; Chesbrough, Vanhaverbeke, & West, 2006). In this thesis, an assessment on the incorporation of external expertise is done for a firm called Focallogistics. Focallogistics is a global company which is specialized in material handling and logistical automation. Their products could be identified as Complex Product Systems (CoPS), which is characterized by "*high-technology and high-value capital goods*" (Davies & Brady, 2000, p. 931).

For Focallogistics, as a consequence of increasing growth rates of both the firm as well as its market, the desire arose to incorporate external expertise in innovation. Eight explorative interviews were conducted to identify the rationales for R&D outsourcing (Appendix A). Two risks were identified to be most striking for remaining dependent on only internal development capacity. These are respectively; *work overload of internal R&D employees* (R&D 2,3,6)¹ and *increased R&D development time* (R&D1). First, R&D employees have been involved in numerous innovation projects, resulting in a large workload. This number of innovation projects may increase even more, because of intended further growth. Therefore, the company needs additional R&D capacity. Until recently, this was addressed by additional hires within the R&D department. Nonetheless, newly hired employees needed to be coordinated and onboarded, which resulted in extra workload for senior R&D employees. Secondly, an increase in innovation pace in the environment is noticed. This makes time-to-market reductions of developments more urgent. When R&D capacity could not be extended internally, Focallogistics is at risk of falling behind competition. As goals have been set for further growth in the future (11% by 2025), these problems are assumed to become critical to its business operations. Consequently, the company differed its strategy; remaining the same amount of FTE within the R&D department, while increasing budgets by incorporating external expertise.

However, no clear insight exists in the circumstances that lead to successful incorporation of external expertise. While *increasing numbers of external R&D activities exist within the firm, outcomes differed* (SC1&2). Some collaborations were successful, whereas some were killed over time. Interestingly, *many projects had a desirable outcome, while the development process was considered as objectionable* (R&D3). For example, the R&D director complained on *the afterwork that was needed for the integration of external technology* (R&D1). Managers accounted these issues to misunderstandings between Focallogistics and the external party. One R&D manager theorized that *market related knowledge differed a lot between Focallogistics and the external party. Some assumptions which seem evident in one firm, were not that evident for the partner. This led to misunderstandings within the collaboration* (R&D2). Consequently, *this resulted in afterwork or even killing of the project, accompanied by costs and delays in the developments* (R&D3). Taking everything together, this leads to the following problem statement:

¹ These reflects the interviewee during the explorative interviews. Characteristics of the interviewee can be found in Appendix A.

The internal R&D department encounters capacity limits. Collaborating with external parties seems to be most practical to overcome this issue. However, R&D collaborations required a lot of afterwork as a consequence of misunderstandings between the focal firm and collaborating parties. This results in a risk of falling behind innovation pace of the environment and competitive advantage could be at risk.

Academic literature also concerns the incorporation of external expertise. Over the last decades, collaborative developments were shown to become increasingly common (Hagedoorn, 2002). In literature, incorporating external expertise is also referred to as the '*Open Innovation*' (OI) model (Chesbrough, 2003, 2012; Chesbrough et al., 2006). Until recently, companies had an innovation model in which no external sources were incorporated, corresponding to the "*Closed Innovation*" model (Chesbrough et al., 2006). Also in literature was showed that Open Innovation collaborations result in failure often (Lauritzen & Karafyllia, 2019). Unclearly remains why certain collaborations provide more value than others (West & Bogers, 2014).

One concept that is closely related to OI is Absorptive Capacity (ACAP). It might be one of the mechanisms that helps in explaining differences in collaboration outcomes, as they both focus on the sourcing of external knowledge (Vanhaverbeke, Van de Vrande, & Cloudt, 2007). Frequently, research used the concept to analyze a firms' structured interactions with external contributors (Cohen & Levinthal, 1990; Dyer & Singh, 1998; Lane & Lubatkin, 1998; Lauritzen & Karafyllia, 2019; Laursen & Salter, 2014; Todorova & Durisin, 2007; Vanhaverbeke et al., 2007; West & Bogers, 2014; Zahra & George, 2002). *Absorptive Capacity* refers to the acquisition, assimilation, transformation and exploitation of external knowledge sources (Jansen, Van Den Bosch, & Volberda, 2005; Yao & Chang, 2017; Zahra & George, 2002). Similarity in both knowledge bases and social structures is claimed to facilitate absorption of external knowledge (Cohen & Levinthal, 1990; Lane & Lubatkin, 1998; Zahra & George, 2002).

Similarity is frequently analyzed by application of the *Proximity* concept (Boschma, 2005; Gattringer, Wiener, & Strehl, 2017; Knobben & Oerlemans, 2006; Laursen & Salter, 2006; West & Bogers, 2014). Similarity between collaborating parties increases understanding and consequently increases collaboration success (Enkel, Groemminger, & Heil, 2018; Lane & Lubatkin, 1998; Zahra & George, 2002). Traditionally, there has been a focus on geographical proximity, referring to the spatial dispersion between collaborating actors (Cramton, 2001). Nevertheless, various dimensions of proximity were shown to be relevant in describing phenomena in interorganizational context (Knobben & Oerlemans, 2006). The complication with proximity is that both high as low levels could be beneficial for a collaboration (Boschma & Frenken, 2010; Broekel & Boschma, 2012). On the one hand, a high degree of proximity may be considered as a prerequisite to make parties connected and exchange knowledge (Boschma & Frenken, 2010; Broekel & Boschma, 2012) while it increases comprehensibility (Nootboom, 2000). On the other hand, innovative potential decreases as a consequence of cognitive lock-in when partners bring similar knowledge and resources to the table (Boschma, 2005; Nootboom, 2000). Hence, when innovation is intended, collaborating under lower levels of proximity would be advantageous, while it harms the understanding of one another (Boschma, 2005; Boschma & Frenken, 2010; Gattringer et al., 2017; Guan & Yan, 2016; Knobben & Oerlemans, 2006; Nootboom, 2000). Thus, in the decision upon a collaboration partner, companies face a "*proximity paradox*", in which proximity enables agents to connect and share knowledge, while too much proximity might harm innovativeness in a collaboration (Boschma & Frenken, 2010; Broekel & Boschma, 2012).

Summing up, companies need to collaborate with external parties to keep competitive advantage. Thus companies need to adopt the OI model. However, the successful absorption of external knowledge remains a problem. When taking into account the previously mentioned proximity paradox, unclarity remains in how to collaborate with external parties. According to company managers, the company wants to “*better assess decisions regarding external R&D and manage the R&D absorptive capacity in a more systematic, validated and well-informed manner*” (Appendix B). Hence, research is needed in order to follow up on these issues. This leads to the formulation of the following research questions:

How should the company make better use of external partners in their innovation process to improve collaboration performance?

To answer the main research question, different sub-questions were formulated:

1. What is proximity and how does it influence collaboration performance?
2. What is absorptive capacity and how does it influence collaboration performance?
3. How does proximity affect absorptive capacity and vice versa?

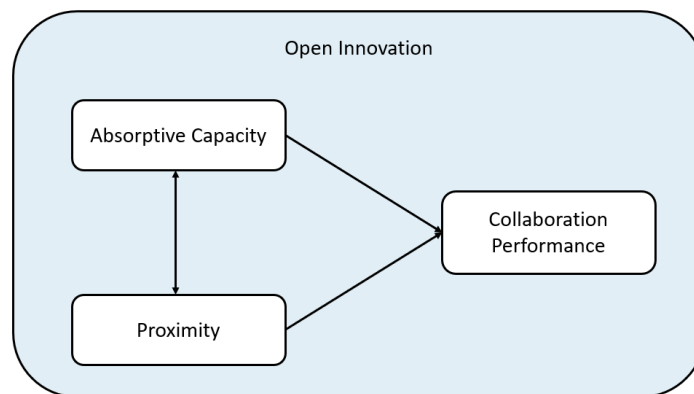


Figure 1: Conceptual framework

In this research, OI collaborations are analyzed by taking into account the interorganizational dimensions of proximity, as formulated by Knobens and Oerlemans (2006). It contributes by making an attempt to enhance the R&D outsourcing effectiveness. This is done by taking into account the concept of ACAP as formulated by Zahra and George (2002) (Figure 1). It builds on previous literature by providing empirical evidence to the dynamic approach to proximity. Hereby is demonstrated that companies would be less affected by the proximity paradox, when adequately designing the R&D outsourcing process to become more proximate. Propositions were developed to give new opportunities of research, enriching the understanding of both ACAP and proximity.

In the remainder of this thesis, first a description literature on the used concept will be delivered. The concepts as mentioned in Figure 1 will be further elaborated upon. Thereafter, an evaluation is given on the research methods that were used to gather and analyze the data. Subsequently, the findings will be presented and propositions are delivered. Lastly, these findings are reflected to the theory and areas for future research are defined.

2. Theoretical framework: Proximity and Absorptive capacity explained

In this section, the concepts of open innovation, absorptive capacity (ACAP) and proximity are further elaborated upon. The concepts have not frequently been studied together (Table 1). A possible explanation for this may be that proximities are frequently used to describe macro-level phenomena (Boschma, 2005; Boschma & Frenken, 2010; Guan & Yan, 2016; Knobens & Oerlemans, 2006). This thesis brings the concepts of proximity to the dyadic level of analysis. First, the selection for the theoretical lens will be described, which forms a foundation to this research. Subsequently, the concept of ACAP is further elaborated upon. Thereafter, theoretical background is delivered on the researched dimensions of proximity. Lastly, an illustration is given on how both ACAP and proximity interrelate.

Table 1: This research in comparison to previous researches' concepts used.

Article	Themes									Counts
	Open Innovation	Absorptive Capacity	Proximity/Distance							
			Geographical	Technological	Cognitive	Organizational	Cultural	Institutional	Social	
Balland (2012)		x	x		x	x		x	x	6
Bell & Zaheer (2007)		x/0	x						0	3
Boschma & Frenken (2010)			x		x	x	x	x	x	6
Boschma (2005)		x	x		x	x	x	x	x	7
Chesbrough (2003)	x									1
Cohen & Levinthal (1990)		x		0	0					3
De Jong & Freel (2010)		x	x		x					3
Diestre & Rajagopalan (2012)		x	x	0						3
Dyer & Singh (1998)		x			0	0			0	4
Emden et al. (2006)	x	x/0		0	0	0	0	0		7
Enkel et al. (2018)		x		x	x					3
Fabrizio 2009	x/0	x							0	3
Gattringer et al. (2017)	x/0		x	x		x				4
Gilsing et al (2008)	x	x		x	x				x	5
Guan & Yan (2016)	0	x	x	x			x			5
Knobens & Oerlemans (2006)		x	x	x	x	x	x	x	x	8
Lane & Lubatkin (1998)		x			0	0				3
Lauritzen Khafilia (2019)	x	x								2
Laursen & Salter (2014)	x	x								2
Nooteboom (2000, 2007)		x		0	x		x/0			4
Rothaermel and Boeker (2008)	0	0	0	0	0	0		0	0	8
Rosenkopf & Almeida (2003)		x/0	x	x						3
Vanhaverbeke et al. (2007)	x	x		x						3
Volberda et al. (2010)	x/0	x		0	0	0				5
West & Bogers (2014)	x	x								2
Zahra & George (2003)		x		0	0					3
This paper	x	x	x	x	x	x	x	x	x	9
Total counts	15	25	14	16	17	12	8	8	11	

0= not mentioned in context, but relatedness exists

x/0=is mentioned as inspiration, but no further details

x= mentioned and incorporated in research

2.1. Innovation: combining internal and external knowledge components.

Different combinations of knowledge are possible that can lead to innovation (Fabrizio, 2009). Knowledge that leads to innovation could be generated either within a firm (internally) or within a firm's environment (externally) (Chesbrough, 2003, 2012; Chesbrough et al., 2006). The internal ability to generate knowledge, is reflected in the Knowledge-Based View (KBV) of the firm as introduced by Kogut and Zander (1992). The KBV refers to the importance of knowledge as one of the main antecedents of competitive advantage, in particular for knowledge-intensive firms. In addition to

knowledge as a source of competitive advantage, the Resource-Based View (RBV) was introduced. The RBV *“refers to the broad definition of resources as all types of assets, organizational processes, knowledge, capabilities and other potential sources of competitive advantage.”* (Lavie, 2006, p. 643). For both KBV and RBV holds that these assign competitive advantage to firms in isolation.

In contrast, in the article of Dyer and Singh (1998) an addition is made to the RBV where competitive advantage could be sustained and developed by collaborating with other parties (Dyer & Singh, 1998; Lavie, 2006). From a RBV perspective, external collaborations are explained by the need to acquire more resources which could not be possessed internally, and therefore overcoming limitations in internal resources (Ireland, Hitt, & Vaidyanath, 2002). Therefore, they introduce the Relational View, which focuses on the dyad as a source of competitive advantage.

Looking from a relational view perspective; when combining internal and external knowledge, knowledge heterogeneity could be increased. Consequently, innovation could be sparked (Nelson & Winter, 1982). Hence, the ability to innovate depends on both internal knowledge development and the utilization and exploitation of external knowledge (Kogut & Zander, 1992). As the firm intends to employ resources both internally as externally to acquire competitive advantage, the relational view seems to be an appropriate theoretical lens for this research. The phenomenon of incorporation of external expertise named OI, will be further described in the section hereafter.

2.2. Open Innovation: incorporation of external knowledge

In the beginning of this century, Chesbrough (2003) introduced the concept of Open Innovation (OI). OI is referred to as the incorporation of external knowledge in innovation processes (Vanhaverbeke et al., 2007; Chesbrough, 2012; Chesbrough et al., 2006; Chesbrough, 2003; Enkel, Gassmann, & Chesbrough, 2009). In business, OI is becoming an increasingly popular phenomenon (Chesbrough, 2012; West & Bogers, 2014). Also for the case of Focallogistics. It contemplates a paradigm which assumes that firms can and should use external ideas as well as internal ideas (Chesbrough et al., 2006, p. 1).

OI consists of two dimensions; outside-in and inside-out (Dahlander & Gann, 2010; Vanhaverbeke et al., 2007; West & Bogers, 2014). Outside-in refers to enriching the company's internal knowledge by integrating external knowledge sources such as suppliers, customers and other external sources. This dimension is assumed to improve innovative capability within the in-sourcing firm. Inside-out refers to the transfer of ideas to the external environment. This refers to selling ideas and intellectual property to the market (Enkel et al., 2009; Gassman, Enkel, & Chesbrough, 2010; Laursen & Salter, 2006). The main reason for companies occupying this strategy is to bring ideas to the market faster than they could have when relying on internal development (Enkel et al., 2009; Gassman et al., 2010). As the company intends to acquire more knowledge externally, this research focuses on the outside-in dimension of OI.

2.2.1. Application of Open Innovation remains a struggle

Even though companies seem to benefit from incorporating external expertise, effective governance of OI remains subject of discussion (e.g. Emden, Calantone, & Droge, 2006; Lauritzen & Karafyllia, 2019; West & Bogers, 2014). In literature, different advantages were mentioned regarding OI. One of the main motivations to conduct OI is to acquire external knowledge (Balland, 2012), leading to heterogenous knowledge inputs of which the advantages have been mentioned previously. Also other advantages have been found: the access to markets that could not have been accessed without collaboration (Chesbrough, 2003; Lauritzen & Karafyllia, 2019), acquisition of external ideas

(Chesbrough, 2003; Laursen & Salter, 2006) and access to additional resources and expertise (Dahlander & Gann, 2010; Lauritzen & Karafyllia, 2019). In relation to innovation, it was shown that the acquisition of external innovation by less innovative firms has a positive effect on innovative performance after acquisition (Ceccagnoli, Graham, Higgins, & Lee, 2010). It is argued that external parties possess critical tacit knowledge that a firm can acquire by collaboration activities, useful for innovation activities.

Still, studies were done which repudiated the effectiveness of incorporating external knowledge in internal processes. In the literature review of West and Bogers (2014), the following were mentioned: OI can lead to information overload, Not-Invented-Here (NIH) syndrome, conflicts of ownership of ideas, and spillover of critical knowledge to competitors. The latter relates to the 'paradox of openness' (Lauritzen & Karafyllia, 2019; Laursen & Salter, 2014). This paradox refers to a trade-off between the need to collaborate with external parties, and on the other hand value capturing, when innovations can be guarded against unintended knowledge spillovers (patenting). In other words, the creation of innovation requires openness, and commercialization requires protection (Laursen & Salter, 2014).

Even when these potential hurdles have been avoided or resolved, the risk of misunderstanding remains (Dahlander & Gann, 2010). As a result an increase in resources needed to manage the external developments (Salge, Farchi, Barrett, & Dopson, 2013). In the research of Salge and colleagues (2013), these are allocated to three types of costs. These are respectively; identification, assimilation and utilization costs. These are all related to the extra resources needed to enable ACAP. As potential parties for collaboration are often not known in the development of a new product, resource intensive searches are required to search for relevant external knowledge (Dahlander & Gann, 2010; Hansen, 1999; Salge et al., 2013). Thereafter, an evaluation must be done on the external party. In some cases, external ideas and information could be biased and misleading, in order to advocate for the interests of the sender, instead of helping the information receiver (Salge et al., 2013). When deciding on collaborating with a particular party, assimilation costs are associated with the transfer and internalization of external knowledge (Salge et al., 2013). Ideas and knowledge need to be fully revealed in order to successfully transfer external knowledge. However, the issue remains whether companies would benefit, taking into account the paradox of openness (Lauritzen & Karafyllia, 2019; Laursen & Salter, 2014). In addition, trust and direct contact are needed to prevent knowledge to remain sticky during a collaboration (Von Hippel, 1994). On top of that, companies need to be willing to internalize external knowledge. The so-called Not-Invented-Here syndrome refers to the rejection of externally developed knowledge (West & Bogers, 2014). Lastly, the utilization costs refer to the integration of different knowledge components. Even though heterogeneity of knowledge is claimed to be advantageous for innovation purposes, excessive heterogeneity could result in integration problems. Additionally, appropriation challenges could arise when collaborating with an external party (Salge et al., 2013).

In conclusion, firms should acquire knowledge externally. Nevertheless, focusing too much on the external knowledge acquisition results in higher costs and inability to gather value from exploitation (Berchicci, 2013; Rothaermel & Alexandre, 2009; Salge et al., 2013; Volberda, Foss, & Lyles, 2010; Zahra & George, 2002). Hence, a company needs to carefully determine and manage the incorporation of external sources of knowledge in innovation practices in order to realize its benefits.

2.3. Absorptive Capacity: the ability to absorb external knowledge

Open Innovation could not exist without the absorption of external knowledge. ACAP appears to be one of the most important determinants for a firm to successfully spot and integrate external information (Daghfous, 2004; Vanhaverbeke et al., 2007). Therefore, ACAP and OI are frequently associated with each other (Table 1) (Vanhaverbeke et al., 2007). ACAP is one of the largest bodies in research regarding the integration of external knowledge (West & Bogers, 2014) and is used in various organizational theories in relation to learning and innovation (Volberda et al., 2010). Over the years, various definitions of ACAP have been mentioned in academical research (e.g. Cohen & Levinthal, 1990; Todorova & Durisin, 2007; Zahra & George, 2002). A brief illustration will be given hereafter, as well as the definition which is adopted in this research.

2.3.1. Absorptive capacity, an evolving concept

In the prelude to the formulation of ACAP, R&D was claimed to be responsible for generating innovation. At the same time, an important by-product is created which incorporated the “*capabilities to assimilate and exploit externally available information*” (Cohen & Levinthal, 1989, p. 593). When publishing the seminal article by Cohen and Levinthal, Absorptive Capacity was defined as ‘*the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends*’ (1990, p. 128). Traditionally, ACAP was seen as a consequence of a large internal knowledge stock (Berchicci, 2013; Cohen & Levinthal, 1989, 1990). Therefore, it was proxied by indirect measures as internal R&D spending or number of scientists working in R&D departments frequently (Cohen & Levinthal, 1990; Vanhaverbeke et al., 2007; Volberda et al., 2010).

Zahra and George (2002), who reconceptualized Absorptive Capacity (ACAP) to a firm’s ability to *acquire, assimilate, transform* and *exploit* external knowledge sources. A differentiation is made between two consecutive absorptive capacity functions; Potential Absorptive Capacity (PACAP) and Realized Absorptive Capacity (RACAP) (Jansen et al., 2005; Yao & Chang, 2017; Zahra & George, 2002). PACAP is defined as the receptiveness to external ideas (Lane & Lubatkin, 1998). It holds for both acquisition and assimilation mechanisms. The importance of PACAP was shown as an antecedent of innovativeness (Fosfuri & Tribó, 2008; Zahra & George, 2002). RACAP reflects the firm’s capacity to leverage and incorporate the knowledge that has been absorbed within the previous stage (PACAP). It includes the development of new perceptions and changes to existing processes (p. 195). There are two mechanisms involved in RACAP; transformation and exploitation (Zahra & George, 2002). Its four dimensions are described hereafter.

Acquisition refers to the organization’s capability to identify and acquire valuable external knowledge. According to Zahra and George (2002), ACAP is affected by three different attributes: intensity, speed and direction. The greater the intensity and speed of the effort of the company, the larger the ACAP outcomes. Direction of knowledge accumulation can influence the paths that firm follows in obtaining external knowledge.

Assimilation refers to the firm routines related to “*analyze, process, interpret and understand*” (Zahra & George, 2002, p. 189) externally acquired knowledge. The assimilation mechanism is closely related to comprehension. When heuristics of the externally acquired knowledge differ from those used in the organization, comprehension issues might arise (Leonard-Barton, 1995).

Transformation refers to the development of routines that facilitate the combination of existing knowledge with newly acquired and assimilated knowledge. The recognition and combination of two apparently incongruent sets of knowledge is an example of the transformation capability. Initially, the concept of transformation was not mentioned in the conceptualization of Cohen and

Levinthal (1990). However, Zahra and George (2002) claim the transformation component to be a mechanism that opens the black box on organizational transformation and strategic change.

Exploitation refers to the organizational routines that grant firms to “refine, extend and leverage existing competences or create new ones by incorporating acquired and transformed knowledge to its operations” (Zahra & George, 2002, p. 190). It also refers to the commercial application of knowledge, as referred to by Cohen & Levinthal (1990). The ability to exploit knowledge can be serendipitous. However, structurally exploiting knowledge, may result in sustaining competitive advantage for longer periods of time (Zahra & George, 2002).

However, debate exists on the composition of the absorptive capacity. For example, Todorova and Durisin (2007), claim that value recognition does not necessarily result in acquisition. Also, they claim that after acquisition, external knowledge is either assimilated or transformed. Nevertheless, the definitions of Zahra and George (2002) were tested and confirmed in an empirical setting (Jansen et al., 2005; Naqshbandi & Tabche, 2018; Yao & Chang, 2017). For this reason we adopt the ACAP model of Zahra and George (2002) in this research (Figure 2).

In this research, the distinction between PACAP and RACAP seems to be necessary in explaining the phenomenon of the proximity paradox. It is claimed that a balance needs to exist in PACAP and RACAP. Firms which are focused on external knowledge acquisition (PACAP) cope with high costs of the assimilation of knowledge, without gaining benefits of exploitation (Volberda et al., 2010; Zahra & George, 2002). On the contrary, firms focusing on RACAP too much, may achieve short-term benefits but fall into a competence trap (Jansen et al., 2005; Volberda et al., 2010). Hence, PACAP seems to be associated with collaborations characterized by lower levels of proximity. It is responsible for the innovativeness of a firm. On the other hand, RACAP seems to be related to higher levels of proximity. It contemplates the exploitation of external knowledge, without acquiring of new knowledge.

Absorptive capacity has been associated with various outcomes such as; competitive advantage (Cohen & Levinthal, 1989, 1990), strategic flexibility (Todorova & Durisin, 2007; Zahra & George, 2002) business performance (Lane, Salk, & Lyles, 2001), financial performance (Rothaermel & Alexandre, 2009), interorganizational learning (Lane, Koka, & Pathak, 2006; Lane et al., 2001; Lane & Lubatkin, 1998), ambidexterity (Rothaermel & Deeds, 2004; Vanhaverbeke et al., 2007), assimilation and commercialization speed of external knowledge (Fabrizio, 2009) and innovative performance (Berchicci, 2013; Chen, Lin, & Chang, 2009; Cohen & Levinthal, 1990; Fosfuri & Tribó, 2008; Rothaermel & Alexandre, 2009). However, as this research adopts the conceptualization of ACAP by Zahra and George (2002), attention is paid to the strategic change and flexibility as a consequence of external knowledge absorption.

Also, different antecedents have been found for ACAP. As this research concerns ACAP in an interorganizational perspective, a focus is made on the interorganizational antecedents of ACAP (cf. Volberda et al., 2010). Among others, similarity and complementarity in knowledge bases (Enkel et al., 2018; Nooteboom, Van Haverbeke, Duysters, Gilsing, & Van den Oord, 2007) and knowledge sharing (Enkel et al., 2018; Volberda et al., 2010). The notion of similarity is inherent in the concept of proximities (Knoben & Oerlemans, 2006), which will be described in the next section. The conceptualization of Zahra and George (2002) is visualized in Figure 2.

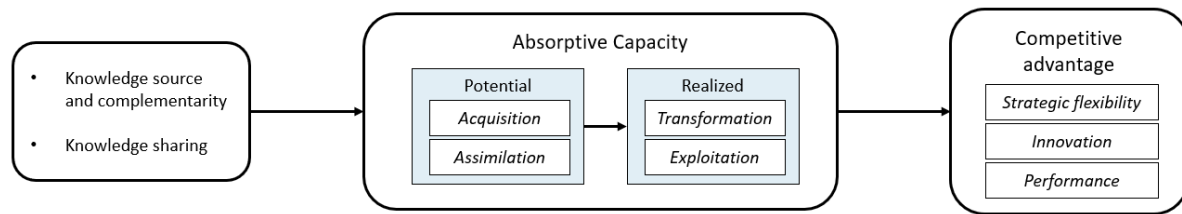


Figure 2: The Absorptive Capacity concept (Adapted from Zahra & George, 2002).

2.4. Proximities; similarities between companies

Proximity, sometimes denoted as “distance” (e.g. Enkel et al., 2018; Nooteboom et al., 2007), is a concept which describes the similarities between companies. As mentioned before, companies face a paradox in whether or not a proximate collaboration partner would be valuable (Boschma & Frenken, 2010; Broekel & Boschma, 2012). Interorganizational collaborations under conditions of low levels of proximity are supposed to create the highest heterogeneity of knowledge (Rosenkopf & Almeida, 2003). Therefore, it is claimed that when knowledge bases differ greatly, this increases the novelty value of the collaboration (Boschma & Frenken, 2010; Cohen & Levinthal, 1990; Nooteboom, 2000). Bertrand and Mol (2013) confirm this argument in more recent research. They show that less proximity in R&D outsourcing delivers more innovation advantages in the long run, as a consequence of difference in perspectives. In contrast, high levels of proximity are supposed to be beneficial as a consequence of increased knowledge transfer, resulting in reduced risks of confusion and misunderstanding seen from a Transaction Costs Economics (TCE) perspective (Boschma, 2005; Williamson, 1979).

When the proximity concept is used, often is referred to geographical proximity (Knoben & Oerlemans, 2006). Nevertheless, multiple dimensions of proximity are distinguished in the literature as for example; geographical (Bell & Zaheer, 2007; Boschma, 2005; Boschma & Frenken, 2010; Cramton, 2001; Guan & Yan, 2016; Knoben & Oerlemans, 2006; Oerlemans & Meeus, 2005; Rosenkopf & Almeida, 2003; Rothaermel & Boeker, 2008; Torre & Rallet, 2005), functional (De Jong & Freel, 2010), cognitive (Boschma & Frenken, 2010; Gilsing, Nooteboom, Vanhaverbeke, Duysters, & Van den Oord, 2008), technological (Boschma & Frenken, 2010; Gilsing et al., 2008; Guan & Yan, 2016; Rosenkopf & Almeida, 2003), virtual (Guan & Yan, 2016), organizational (Balland, 2012; Boschma & Frenken, 2010; Knoben & Oerlemans, 2006; Oerlemans & Meeus, 2005), cultural (Guan & Yan, 2016; Knoben & Oerlemans, 2006), institutional (Balland, 2012; Boschma, 2005; Boschma & Frenken, 2010; Knoben & Oerlemans, 2006; Porter, 1998), and social (Balland, 2012; Boschma, 2005; Boschma & Frenken, 2010; Knoben & Oerlemans, 2006).

The concept of proximities originates from the French regional scientists to understand the coordination of economic activities, over 20 years ago (French School of Proximity, 2018). The concept has been frequently used by describing economic geographical phenomena (e.g. Balland, 2012; Balland, Boschma, & Frenken, 2015). In seminal articles in economic geography, five dimensions of proximities were analyzed frequently. These are respectively cognitive, organizational, social, institutional and geographical proximity (Balland, 2012; Balland et al., 2015; Boschma, 2005; Boschma & Frenken, 2010).

For interorganizational collaboration, three main dimensions have been argued to be relevant: organizational proximity, technological proximity and geographical proximity (Knoben & Oerlemans, 2006). Recent research amplifies the relevance of these three proximity dimensions in collaborative practices (Gattringer et al., 2017; Guan & Yan, 2016). Therefore, these three dimensions

were used as guidance in this research. In the next section, these and related dimensions of proximity will be further explained in their relation to external knowledge absorption. Previous research showed interrelatedness between the concepts already (Figure 3) (Knoben & Oerlemans, 2006). Therefore, ambiguity in dimensions is addressed, as some dimensions seem to be very alike.

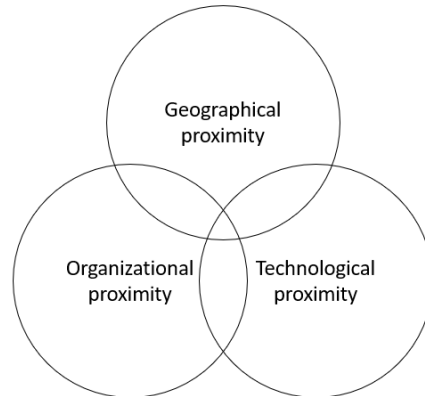


Figure 3: Dimensions of proximities analyzed in this research

2.4.1. Geographical proximity: spatial separation between actors

Geographical proximity refers to the spatial separation between actors (Cramton, 2001). The effect of spatially distributed collaborations has been a frequent subject of discussion (Boschma, 2005; Boschma & Frenken, 2010; Funk, 2014; Morgan, 2004; Rothaermel & Boeker, 2008; Torre & Rallet, 2005) also specific for interorganizational context (Diestre & Rajagopalan, 2012; Gattringer et al., 2017; Knoben & Oerlemans, 2006). This is the most frequently researched dimension of proximity (Knoben & Oerlemans, 2006). The main assumption in favor of geographical proximity is that the difficulty of knowledge transfer decreases with geographic proximity (Allen, 1984). This could be a reason why firms tend to form alliances within their geographical zones, also corresponding cultural and institutional boundaries (Hagedoorn, 2002; Rothaermel & Boeker, 2008). When more coordination is necessary, geographical proximity is particularly important (e.g. early phases of new product development) (Guan & Yan, 2016; Knoben & Oerlemans, 2006). Nonetheless, distant knowledge sourcing is facilitated by the rise of the internet (West & Bogers, 2014).

Different mechanisms are supposed to apply for geographical proximity. First, geographical proximity facilitates face-to-face meetings (Boschma, 2005). Face-to-face interactions favor information richness of interaction, and facilitate the exchange of especially tacit knowledge (Bell & Zaheer, 2007; Knoben & Oerlemans, 2006; Von Hippel, 1994). Transferring tacit knowledge could be difficult for companies in general, as it is highly contextual and uncertain, also referred to as the 'stickiness of knowledge' (Von Hippel, 1994). Second, the likelihood of unintended knowledge transfer is increased when being geographically proximate, as chances of meeting each other are higher (Bell & Zaheer, 2007). Managers need to stay in touch to transfer knowledge effectively. Also, chances are increased for local informal knowledge spillovers. Localized knowledge spillovers are a type of positive externality, being a consequence of their geographical proximity. These are positively associated with innovation (Funk, 2014). Third, face-to-face contact could increase team morale. Van Geenhuizen and Nijkamp (2012) showed that a lack of actual human contact could result in faltering morale, spirit and commitment among collaborating actors. Fourth, geographical proximity forms a basis to create trust from embedded ties (Granovetter, 1985). Individuals in a particular area tend to share common

language, culture, norms and values. These are all associated with trust generation, which fosters open communication. This facilitates knowledge sharing between individuals (Bell & Zaheer, 2007).

Yet, the effect of geographical proximity remains subject of discussion, this makes it an interesting concept to take into account for this research. For example, Weterings and Boschma (2009) show that no direct relation between face-to-face interaction and innovative performance exists, but rather an indirect relation. Besides, recent research by Guan and Yan (2016) hypothesized physical distance to result in actors being less knowledgeable about latest technological developments in particular technological fields. However, no significant evidence for this argument was found. Actually, it was found that more knowledge is shared when collaborating actors are more distant (Bell & Zaheer, 2007).

Still, geographic dispersion in collaborative activities is getting more common as a consequence of internationalization of companies (Johanson & Vahlne, 1977). An increased adoption of virtual teams (VT) is noticed as a consequence of further internationalization within companies (Gilson, Maynard, Jones Young, Vartiainen, & Hakonen, 2015). VT are referred to as teams which are geographically dispersed and which are connected through technology (Gibson & Cohen, 2003). The effectiveness of VT remains subject of discussion (Gilson et al., 2015). The ability to communicate while being geographically dispersed has been improved by technological progression. Still, the relevance of geographic proximity appears to exist in current collaborations, as the need for face-to-face meetings remains (Morgan, 2004; Van Geenhuizen & Nijkamp, 2012).

2.4.2. Organizational proximity: norms, routines and processes

Organizational proximity suffers from conceptual ambiguity. In the article of Knobens and Oerlemans (2006), this conceptual ambiguity is addressed. They make a distinction between the definition on the structural level and the dyadic level. The structural level embraces structural equivalence of actors and whether firms belong to the same network. Here, the characteristics of the network are the unit of analysis. On the other hand, the dyadic level of analysis refers to the specific relationships between the actors. Here, *“the similarity in organizational context in which members of different organizations operate determines the level of organizational proximity”* (Knobens & Oerlemans, 2006, p. 75). Similarity in organizational context could exist on different levels, such as similarity in routines of individuals (Oerlemans & Meeus, 2005) similarity in strategy (Rothaermel & Boeker, 2008), governance structures (Boschma, 2005; Knobens & Oerlemans, 2006) and existing ties (Boschma, 2005).

As current research concerns the description of interorganizational phenomena, the dyadic level of analysis is adopted. Interorganizational collaborations are assumed to be both more efficient and effective when organizational contexts are similar, as it facilitates the creation of mutual understanding. This results in an increased capacity to combine information and knowledge from the collaborating parties and is seen as a prerequisite for learning (Knobens & Oerlemans, 2006). Other research showed that organizational proximity reduces uncertainty and opportunism within a collaboration (Balland, 2012; Boschma, 2005; Boschma & Frenken, 2010). It is claimed that cultural, economic and institutional similarities across countries facilitate in establishing trust (Gilson et al., 2015; Ireland, Hitt, & Vaidyanath, 2002). Thus, trust may be inherent to organizational proximity, resulting in collaboration success (Ireland et al., 2002).

2.4.2.1. Related dimensions: institutional, cultural and social proximity

Organizational proximity embraces three other dimensions of proximity: institutional, cultural and social proximity. These three dimensions also reflect the similarity in organizational context, and thus were unified in organizational proximity in previous research (Knoben & Oerlemans, 2006).

Institutional proximity refers to the degree of presence in common institutions like models, norms, procedures and rules (Balland, 2012; Capello, 1999). These can exist on both micro and macro level of analysis and does not necessarily need to be similar (Knoben & Oerlemans, 2006). It is claimed that organizations have a higher propensity to interact when they have similar institutional forms and thus share institutional proximity (Balland, 2012). Second, cultural proximity is similar to institutional proximity (Knoben & Oerlemans, 2006). Culture is the collection of cognitions, expectations, mindsets, norms and values within an organization (O'Reilly et al., 1991). Culture can be evaluated on bases of nations or regions, and even within a company (e.g. Hofstede, 1980). In relation to the company, culture incorporates the synchronizations of expectations and behaviors. Problems are addressed more easily when cultures are compatible, as compatible cultures have a higher likelihood to understand one another and working toward common goals (Emden et al., 2006). Lastly, social proximity incorporates structural equivalence. Here, friendships between collaborating parties are key, which is associated with an increase in trust (Balland, 2012). As organizational proximity embraces shared relationships (Boschma & Frenken, 2010; Knoben & Oerlemans, 2006), social proximity is categorized under organizational proximity. Previous research showed that social proximity enhances informal knowledge exchange and facilitates collaborations (Boschma & Frenken, 2010).

2.4.3. Technological proximity: knowledge base similarity

Technological proximity is defined as *“the level of overlap of the knowledge bases of two collaborating actors”* (Knoben & Oerlemans, 2006, p. 80). It is claimed that when knowledge bases are similar, easier absorption of external knowledge exists, due to a mutual understanding of a problem (Enkel et al., 2018; Gattringer et al., 2017; Lane & Lubatkin, 1998). Prior knowledge needs to be there in order to create learning, seen from an ACAP perspective (Emden et al., 2006; Enkel et al., 2018). As Cohen & Levinthal (1990, p. 136) claim, *“some fraction [of knowledge] must be fairly diverse to permit the effective utilization of new knowledge”* Hence, it is assumed that high technological proximity decreases innovative capacity. Therefore, knowledge bases must be similar to a certain extend in order to communicate effectively, but different enough to acquire relevant external knowledge (Nooteboom, 2000). When a collaboration is characterized by low technological proximity the knowledge gap may be too large to transform knowledge combinations into innovations (Enkel et al., 2018; Nooteboom et al., 2007). Knowledge sourcing could be restricted by the internal knowledge base as parties need similarity in knowledge bases to see technological opportunities (Guan & Yan, 2016).

2.4.3.1. Related concepts: virtual and cognitive proximity

Often, cognitive and technological proximity are used interchangeably (Knoben & Oerlemans, 2006). Cognitive proximity refers to a firm's cognitive base in order to communicate, understand and process external knowledge successfully (Boschma & Frenken, 2010; Nooteboom, 2000; Nooteboom et al., 2007). Nooteboom (2000), can be seen as the founder of the concept of cognitive proximity. The paper claims that novelty value of interaction increases with lower levels of cognitive proximity. On the other hand, absorptive capacity decreases when cognitive bases become more dissimilar. Thus, a trade-off seems to exist between understandability and novelty value. Therefore, Nooteboom (2000)

proposed an inverted-U shaped relationship with innovative performance (Figure 4). This statement was later confirmed with empirical evidence (Nooteboom et al., 2007). Thus, companies seem to look for less cognitive proximity in collaborations. For example, Rothaermel and Boeker (2008) suggest that should be sought for complementarities in an alliance partner, as there is a higher propensity to collaborate when value chains are complementary.

In relation to technological proximity, both reflect the overlap in knowledge base (Knoben & Oerlemans, 2006). However, the concept of cognitive proximity is a broader concept that does not only cover technological knowledge, but also includes market knowledge (Boschma, 2005; Emden et al., 2006; Jespersen, Rigamonti, Jensen, & Bysted, 2018). Market knowledge incorporates the knowhow on customer and market characteristics preferences and needs (Garcia & Calantone, 2002). Thus, within technological proximity, also the market knowledge overlap should be taken into account. The separation between both technological and market knowledge will be kept during the rest of this research.

Besides, technological proximity is sometimes denoted as virtual proximity (Knoben & Oerlemans, 2006). Virtual proximity specifically refers to the similarity in information and communication technology which is used, based upon common standards (Da Silveira, 2011; Morgan, 2004; Schamp, Rentmeister, & Lo, 2004). The adoption of information and communication technology is getting a more common because of ongoing internationalization of companies (Morgan, 2004).

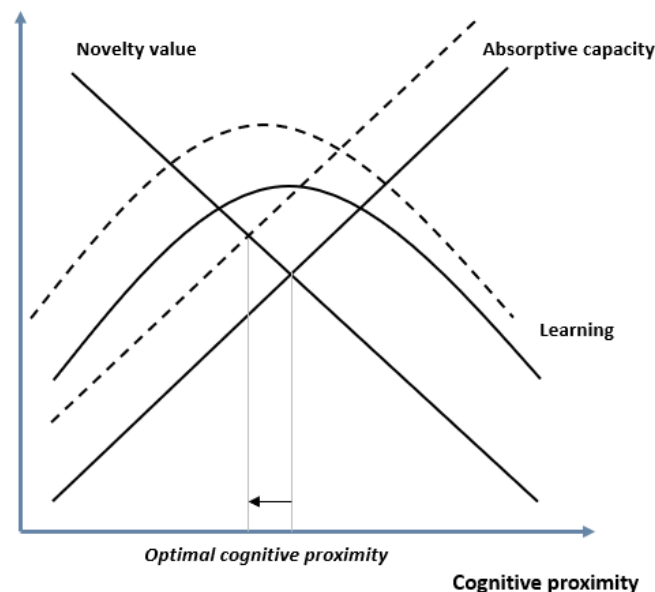


Figure 4: Optimal cognitive proximity (Adopted from Nooteboom et al., 2007).

2.5. The effect of proximity on ACAP

Proximity and ACAP seem to be related to each other. Most often, proximity is mentioned as an antecedent to ACAP. Namely, the degree to which a firm can learn from external knowledge may be largely dependent on the similarity between both the teaching and student firm (Cohen & Levinthal, 1990; Knoben & Oerlemans, 2006; Lane & Lubatkin, 1998). In most research, ACAP is connected with either the technological or the cognitive dimensions of proximity (Boschma & Frenken, 2010; Enkel et al., 2018; Knoben & Oerlemans, 2006). One of the antecedents for ACAP is knowledge base similarity (Cohen & Levinthal, 1990; Volberda et al., 2010), which is inherent to technological or cognitive proximity. Cohen and Levinthal (1990) claimed that prior knowledge of a

firm must be similar to the new knowledge to a certain extent in order to create understanding, as a consequence of path dependency. However, it must be diverse in order to absorb new knowledge. Thus, resembling the proximity paradox, when technological proximity is too high, this results in a cognitive lock-in where both collaborating parties possess equal knowledge (Nooteboom et al., 2007). However, when knowledge bases become more dissimilar, it is suggested that learning potential declines as a consequence of a lack of understanding (Enkel et al., 2018; Gilsing et al., 2008; Lane & Lubatkin, 1998).

On the other hand, research demonstrated that when ACAP is highly developed, this creates the ability to collaborate under conditions of lower levels of technological or cognitive proximity. It enables companies to bridge knowledge differences. Thus, profiting from potentially higher innovative outcomes in collaborations characterized by lower technological or cognitive proximity (Figure 4) (Enkel et al., 2018; Todorova & Durisin, 2007; Zahra & George, 2002).

Also, organizational proximity is assumed to affect ACAP. In the article of Lane and Lubatkin (1998) is demonstrated that *“the ability of a firm to learn from another firm is jointly determined by the relative characteristics of the two firms”* (p. 464). Consequently, they introduce the notion of Relative Absorptive Capacity. They propose that similarity in knowledge processing systems plays a key role in the ability to absorb knowledge. In their article, two proxies were used to identify for knowledge-processing systems; compensation practices and organization structure. As these reflect organizational similarity, the assumption is made that organizational proximity positively affects knowledge absorption.

Lastly, geographical proximity is assumed to benefit ACAP. The facilitation to have face-to-face interactions, creating more information richness in interactions, is positively associated with tacit knowledge sharing (Gattringer et al., 2017). Thus, geographical dispersion is assumed to limit the scope of knowledge that is transferred, limiting ACAP in the collaboration. However, geographical proximity is seen as necessary nor sufficient nowadays, due to the development of communication tools (Boschma & Frenken, 2010; Gilson et al., 2015; Guan & Yan, 2016).

In conclusion, ACAP is positively affected by similarity, thus proximity within a collaboration on all dimensions that were researched. However, higher ACAP also seems to enable collaborations characterized by low technological proximity. The empirical part of this thesis will further analyze the interrelated effects between the two concepts.

3. Methods and research design

This research follows a qualitative research design and is of explanatory intent. Empirical evidence was collected through a mixed method research design (Bryman, 2012), including multiple case studies following semi-structured interviews and a dyadic survey (Yin, 2012). The multiple case study design was chosen for various reasons. First, the multiple case study design was most appropriate to answer the “*how*” form of main research question (Yin, 2018, p. 9). Multiple case study research design allows this study to look for cross-case patterns, also, it could be a means to triangulate data sources increasing the validity of this research (Yin, 2018). It offers the greatest ability to fully understand the mechanisms that are present to in the collaboration, compared to other research designs (Yin, 2012). Therefore, it would be a suitable means to provide freshness in perspective to the topic (Eisenhardt, 1989). Hence, the research follows an abductive research approach, as it constructs the theory from the data, while taking into account existing theory on Proximity and ACAP (Bryman, 2012; Gioia, Corley, & Hamilton, 2012). This research makes an attempt for theory building on the mechanisms and contextual understanding within collaborative R&D activities (Bryman, 2012; Langley, 1999).

A quantitative means was added to the research to indicate the cases on basis of their existing proximity. Here, proximities are valued by using validated questions. This decision was made for three reasons. First, it allows for easy comparison between different cases on basis of proximity and gives insight in the gradualness between cases. Second, an increase of reliability could be realized as this method leaves out the interpretation of the researcher for case comparison. Lastly, it creates the ability to triangulate data. One of the drawbacks is the lack of depth in answers, and the inability to gather insight in causal effects (Bryman, 2012). Here, the case study interviews are used as a means to describe contemporary phenomena and acquire insights in the underlying mechanisms that are present in the collaboration (Yin, 2018).

This research focuses on the dyad unit of analysis for four reasons. First, the relational view of the firm suggests a dyadic relationship as unit of analysis for the creation of competitive advantage (Dyer & Singh, 1998; Lavie, 2006). Secondly, recent research on this topic specifically notes the relevance of incorporating opinions of both parties in a collaboration dyad, to gather a full grasp of mechanisms that exist (Gattringer et al., 2017). Third, the mechanism of learning, inherent to ACAP, typically arises between the unique setting of two parties (Lane & Lubatkin, 1998). Lastly, external parties might nuance negative answers as the interviewer is contracted by their customer. Therefore, a dyad analysis forms a means to triangulate data and increase reliability of the research.

To answer the main question as well as the three sub-questions, both desk research as well as interviews and surveys were conducted. The allocated research question and its method to address so is visualized in Table 2.

Table 2: Research questions and methodology on which these are addressed.

	Question	Research Approach
Main Research Question	How should the company make better use of external partners in their innovation process to improve collaboration performance?	Desk research Empirical research Survey
Sub-question 1	What is proximity and how does it influence collaboration performance?	Desk research Empirical research Survey
Sub-question 2	What is absorptive capacity and how does it influence collaboration performance?	Desk research Empirical research
Sub-question 3	How does proximity affect absorptive capacity and vice versa?	Desk research Empirical research

3.1. Data collection

This research includes both a questionnaire and semi-structured interviews. In total, 32 interviews were conducted, varying from 0:32 to 1:10 hour. As already research has been done on this topic, the interviews were confirmatory, theory driven and of explanatory intend (Langley, 1999; Miles, Huberman, & Saldaña, 2014). Before the interviews, a questionnaire was sent to the interviewee, consisting of validated questions. Hereafter, a the questionnaire is discussed in further detail.

3.1.1. Questionnaire development: Independent variables

The questionnaire was based on validated items used in previous research related to the topic. An overview of the sources of the questions that were posed in the questionnaire, could be found in Appendix D. The questionnaire that was presented to the interviewees can be found in Appendix E.

First, for *geographical proximity*, the absolute amount of kms between the focal firm's R&D and the location of interaction of the external party is assessed (Knoben & Oerlemans, 2006). However, some developments were done in multinational companies. Therefore, respondents needed to fill out the location of their company in which the most developments are done within this particular collaboration. Hereafter, spherical geometry is applied to compute distances on curved surfaces. The geographical proximity between two collaborating entities i and j can be calculated by:

$$GeographicalProximity_{ij} = r\{arccos[\sin(lat_i)\sin(lat_j) + \cos(lat_i)\cos(lat_j)\cos(|long_i - long_j|)]\}$$

Where latitude (lat) and longitude ($long$) are converted into radians r is a constant based on the radius of the earth. In this research $r = 6.371$ km was used. A similar approach was adopted in previous studies (Funk, 2014; Guan & Yan, 2016; Sorenson & Audia, 2000).

Second, for *technological proximity*, the comparability of knowledge bases must be assessed (Knoben & Oerlemans, 2006). As Knoben & Oerlemans state; "*technological proximity refers to the extent to which actors can actually learn from each other*" (p. 78). Usually, patent analyses are conducted to identify the overlap in knowledge (Knoben & Oerlemans, 2006). This measure is criticized in other research (De Jong & Freel, 2010; Volberda et al., 2010). For example, it is claimed that the full knowledge which is present in the company, is not fully addressed by measuring the company's number of patents (Volberda et al., 2010, p. 937). Also, in this research, the focal firm's market is not characterized by patenting, which makes patent analysis unattainable. Therefore, a

measure for knowledge heterogeneity is taken into account as this incorporates both the diversity and redundancy of knowledge (Rodan & Galunic, 2004). As Rodan & Galunic (2004) formulated general questions regarding knowledge heterogeneity, in this research questions are adapted to focus on both market and technological knowledge. In addition, a question were adopted from the original work of Knobens and Oerlemans (2006) regarding technology use. Thus, questions are presented regarding knowledge similarity on both market and technical dimensions, as well as knowledge regarding technology use.

Third, for *organizational proximity*, the similarity in organizational context was assessed. This includes the similarity of routines, culture values and norms (Knoben & Oerlemans, 2006). Therefore, validated questions regarding organizational compatibility were taken into account, as it measures “*the match of goals, philosophies and corporate culture between the exchange partners in the relationship*” (Cheung, Myers, & Mentzer, 2010 p. 478; Sáenz, Revilla, & Knoppen, 2014). To gather the full breadth of similarity in organizational context, two questions were added derived from the work of Knobens and Oerlemans (2006). The questions that were used give insight in both similarity in organization structure and network.

Unfortunately, no validated questionnaire items were found to analyze for *Absorptive Capacity* in a dyadic relationship. Until now, ACAP is proxied by assessing R&D spending most frequently (Cohen & Levinthal, 1990). Regarding questionnaire items, only measures were found that assess the ACAP in general. As this research focuses on the absorption of knowledge from one particular party, these questions were not appropriate (e.g. Jansen et al., 2005; Naqshbandi & Tabche, 2018; Todorova & Durisin, 2007; Yao & Chang, 2017) However, in order to assess ACAP in a dyadic collaboration, questionnaire items were reformulated and presented during the interview. How this is done will be described in Section 3.1.3.

3.1.2. Questionnaire development: Dependent variables

Two dependent variables were taken into account. These were chosen on basis of the rationales of the company to outsource R&D. On the one hand, R&D collaborations were aimed at creating innovation (Section 1). Therefore, *novelty value* is taken into account. It is assumed to be a consequence of low partner proximity (Gilsing et al., 2008; Nooteboom, 2000; Nooteboom et al., 2007). Novelty value is measured by taking into account measures for radicality of the product development (Jap, 2001). As Jap (2001) describes, incremental innovations build on currently existing technologies, whereas radical innovations do not. On the other hand, issues occurred in previous R&D collaborations as a consequence of misunderstandings. Focallogistics was not satisfied with the outcomes of the collaboration. Hence, perceived *overall collaboration performance* is included as a general measure to evaluate the collaboration (Lane & Lubatkin, 1998; Parkhe, 1993).

3.1.3. Interview guide development

The questions are based on the research questions as mentioned in section 1. The questions formulated to identify underlying mechanisms that exist in the collaboration dyad. The questions were formulated in a highly structured fashion, resulting in lower interview variance (Emans, 2002). All the dimensions of ACAP as formulated by Zahra and George (2002) are questioned upon during the interviews. As mentioned before, previous work of quantitative validated items formed an inspiration to formulate questions relating to the dimensions of absorptive capacity (Jansen et al., 2005; Naqshbandi & Tabche, 2018; Todorova & Durisin, 2007; Yao & Chang, 2017). For example, the ‘Acquisition’ dimension of ACAP incorporates the “*intensity and speed of a firm to identify and gather*

knowledge" (Zahra & George, 2002, p. 189). Here, the question is posed; "*How close is the contact between collaborating parties?*". The interview guide was formulated in collaboration with two academical researchers. For practical reasons, the interview guide was created in Dutch, as the focal firm and most collaboration parties are located in the Netherlands. To gather data from international collaborations, interview questions were translated to English afterwards. The questions were back translated by two supply chain managers of the focal firm, in order to guarantee for effective translations.

The interview's effectiveness was tested by conducting 4 meta-interviews (Emans, 2002). For the meta-interview, both two supply chain managers, a senior manager regarding university-industry collaborations and a potential interviewee from the focal firm were asked their opinions regarding the interview guide. The four meta-interviewees were not included in further data collection processes. The interview guide can be found in Appendix F.

3.2. Sample

The research was done on the group level of analysis (organizations) in which both entities in the collaboration dyad were interviewed (Van Aken & Berends, 2018). The sample involves suppliers of a logistics automation company, Focallogistics. Suppliers specialized in both hardware as software engineering were involved in the sample, located in both Europe. The interviews with internal stakeholders were conducted with either project managers or system engineers who were involved in the collaboration between the two parties. On the supplier side, interviews were done with either project managers or other representatives such as account managers who were closely involved in the collaboration. The full list with both case as interviewee characteristics is visible in Appendix C.

To identify the R&D outsourcing partners, snowball sampling was used within the R&D department. Internal stakeholders who are involved in R&D outsourcing were asked on their outsourcing parties. This form of sampling was necessary as information regarding R&D collaborations was not centrally documented. In total 66 R&D outsourcing parties were identified. Note, this could form a bias in the sample, leading to limitations in this research (Bryman, 2012).

Hereafter, selection criteria were formulated to filter for appropriate cases. As first selection criterium, both parties must have agreed upon delegating work packages by formal means, terminated by a monetary reward. When identifying the sample, parties were mentioned that offered demos only in which no further agreements were made. Here, no active participation of the focal firm was required in the collaboration. Therefore, these were excluded from the sample. Second, only on-going collaborations were evaluated. As historical collaborations are not documented, further snowball sampling would be necessary, leading to further bias in the sample (Bryman, 2012). To select for on-going collaborations, only parties were taken into account in which payments were made in the year of 2018. A document was made available in which the top 40 parties of spending by the R&D department. Herewith, the most important parties were identified. Third, no one-person businesses were analyzed. As this analysis is done on the group level of analysis, one-person businesses were excluded.

In addition, theoretical selection criteria were formulated to select useful cases (Eisenhardt, 1989). First, only parties who received inquiries for developments were taken into account. This decision is made by following the definition of R&D outsourcing (Bertrand & Mol, 2013). Therefore, suppliers were excluded which made modifications on own initiative to their catalogue offering to fulfill buyer requirements (e.g. change in color, power plug). Second, as the research incorporates the OI concept, the (Laursen & Salter, 2006) definition of 'innovation-related collaboration partners' was

followed. Therefore, collaborations were incorporated in which the creation of innovation was intended by participation of both parties (Grimpe & Kaiser, 2010).

3.2.1. Sample description

Taken these selection criteria together, delivered 16 cases of analysis. Reviewing the sample on behalf of its variety, shows us that a quarter of the companies are small firms, while 5 large firms are included. Nevertheless, 9 cases concern multinational companies, which have offices in more than one country. In 4 cases, no Dutch contact was available and interviews needed to be conducted in English. A complete overview of the case characteristics and interviewee characteristics could be found in Appendix C.

3.3. Analysis

Interviews were recorded in duplicate to reduce risks of malfunctioning of the recorder, thereafter transcripts were made. As a large number of interview data needed to be analyzed, interview transcripts were indexed and coded by using Computer-Assisted Qualitative Data Analysis Software (CAQDAS). For this analysis, QSR NVIVO 12.0 was used. Through open coding (Corbin & Strauss, 1990), relevant codes were identified reflecting the collaboration practices and its sentiments. Here, text segments are broken down, examined, conceptualized and categorized afterwards (Bryman, 2012). Meanwhile, proximities were used as a theoretical lens, for sensitizing the different concepts (Bowen, 2006). Codes are created by constant comparison, in which synonyms are combined and key themes are distilled. Subsequently, categories were combined to create a manageable number of codes and creating first-order categories (Gioia et al., 2012). Here, different attitudes and mechanisms are combined by analyzing interview data through the theoretical lens. From here, the different dimensions of proximity as well as ACAP could be identified as mentioned in the literature. Node trees were constructed in order to summarize various themes that are inherent to the dimensions of proximity. Hereafter, second order dimensions were constructed. These incorporate the larger narrative (Gioia et al., 2012). For both proximity (Table 3) and absorptive capacity (Table 4), examples are given on how this is done in the two tables underneath.

Hereafter, an analytical framework was created in NVIVO by visualizing the first order dimensions in combination to the case data. Here, all the findings on the different dimensions that were found in the research, were presented per interview. Here, the relations between the concepts were analyzed. Subsequently, a framework matrix was constructed by NVIVO, to create a summarization of each interview by category that was mentioned during the interview. Thereafter, data was reduced to create a comprehensible format. This opened up the possibility to analyze the mentioned topics of the interviews, in cross case comparison. The full framework matrix is visible in Appendix G. By applying this model, key features that were mentioned in the interviews regarding the studied topics could be identified. Under constant comparison and iteration between theory and data, cross case patterns were distilled (Eisenhardt, 1989). These are summarized in a new table (Table 8+9), which forms a basis for the formulation of the findings section. These tables forms a basis for the results section hereafter. After giving a description of the findings, these are taken together by formulating propositions.

Table 3: Coding protocol for Proximity

<i>Second order category</i>	<i>First order category</i>	<i>Segment example</i>
<i>Geographical proximity</i>	Face-to-face contact	Being proximate results in easier face-to-face contact, nice when you need to agree on certain decisions. (B1)
	Longer stay because distance	The geographical location could be seen as a disadvantage. [However] it is reachable in one day. [...] I am there a few days in a row, once every few months. (M1)
	Sending employees	Our consultants that come here can do a much better proposal for a solution, they know exactly what matches the requirements. (D2)
<i>Organizational proximity</i>	Peer connection between companies	Our director knew [the acquired company's] director. This led to the collaboration. (A2) One of our employees started working at Focallogistics. He said to us that we should contact them. (E2)
	Company culture	It is important to understand the culture of the collaborating firm, so we can designate the right people to the assignment. [...], we think that matching cultures could result in synergies. It is therefore important to identify and understand how you can collaborate most successfully. (D2) We are quite similar. The challenge is to imprint our way of working. Otherwise this could lead to quality issues and overwork. (F1)
	Company size	I really value to keep the differences, respect them. Take the power of both. Try to learn from each other, the optimum is in the middle. (E2)
	<i>Technological proximity</i>	Different backgrounds
Distance too large		Technologically we didn't get any advantages. Nothing like, this is what they do well. Maybe regarding technology. Functional things, how to develop the application, that is something we wouldn't do ourselves. There has been some learning in that. (O1)

We deliver our technology out of the box. We help to integrate it in a sort of proof of concept. The reason why we do this is that [the technology] is new for many parties. (H2)

Table 4: Coding protocol for Absorptive Capacity

<i>Second order category</i>	<i>First order category</i>	<i>Segment example</i>
<i>Absorptive capacity</i>	Learning How	<p>To overcome [the differences that were running in to] we learn on the job and give context. (D1)</p> <p>We do not really learn from them [...]. Because they are developing really isolated, nobody is keeping contact with them. That's why we get them over here, to show the application at the customer and to transfer the knowledge that is needed with the application. (K1)</p> <p>Our people are learning on the job. How to work with Assure, Cloud technology, and how to test cases and test ware. [...] At one moment we can do it ourselves. (P1)</p>
	Learning What	<p>The model we use [regarding learning], which we learn from is people process tools. So we learn not only on process level, but also people and technology. Technologically we learn from the case of Focallogistics. (P2)</p> <p>We didn't learn anything from them. The lessons we learnt is how to collaborate in innovation.... We need to be clear beforehand that innovation cannot be done when assigning requirements. (J1)</p>

3.4. Research quality

Three issues were run into during the data collection. One respondent refused audio recording during the interview. Here, question answers were quoted and verified with the respondent. In another case, only half of the interview could be recorded due to a technical issue. In this case, the interview was partly redone by phone. For both cases, this led to a loss in data richness of the interview. It was decided to keep the cases, as valuable data was added in these interviews. In one case, one internal interview was conducted, but the survey was refused. Here, a direct colleague also involved in the collaboration (but from a sourcing perspective) was asked to fill out the survey. Note, this from a bias in the analysis.

As Yin (2017) describes, the quality of the research needs to be tested by four distinct tests. These are respectively *construct validity*, *internal validity*, *external validity* and *reliability* of the research. To guarantee *construct validity*, different sources of information have been used (Yin, 2018). As a multiple case study design was chosen, the different cases create unique data sources and the possibility for data triangulation, strengthening the construct validity. Additionally, after conducting interviews, key informants were asked to review draft reports. In order to create a chain of evidence,

NVIVO was used (Yin, 2018). Here, the interview findings must be compared to the research questions. The validated questions, used for technological proximity and organizational proximity, were adopted from other concepts (respectively knowledge heterogeneity and organizational compatibility). These were not initially used as intended measure for proximity, which may result in a bias in the research. To counteract this possible bias, a mixed method research was applied in which survey data could be triangulated by means of interviewing.

As this research follows an explanatory research, *internal validity* is of importance (Yin, 2018). To guarantee internal validity, the pattern matching and explanation building techniques were used (Yin, 2018). Since already research on this topic was conducted, this opened the possibility to develop hypotheses regarding the cause and effect of used concepts. When patterns coincide, internal validity is strengthened. When this is not the case, logic models will be drawn to identify the underlying reasons for cause and effect (Eisenhardt, 1989). Furthermore conflicting literature was reviewed, as a means to enhance the cause and effect relation between the concepts that were addressed in the research (Eisenhardt, 1989). Lastly, as this research consists of multiple cases, it allows the researcher to iteratively build explanations with data from multiple cases, increasing internal validity (Yin, 2018).

As a means to guarantee *external validity*, the decision was made to include multiple cases in the research, resulting in a multiple case study design. Comparing multiple cases was applied as a means of replication logic (Yin, 2018). Furthermore, various selection criteria for the sample were formulated to create a specific research population (Section 3.2.), strengthening the generalizability of the research (Eisenhardt, 1989). This research is focuses on collaborative developments the Complex Product Systems (CoPS) industry.

Lastly, to enhance the *reliability* of the research, every step in the research process is described by means of a case study protocol (Appendix F), as well as a coding protocol (Table 3 & 4). Additionally, the research uses NVivo as a means to create a case study database, increasing the reliability of the research (Yin, 2018). Furthermore, quantitative measures were incorporated to leave out the interpretation of the researcher by incorporating validated questions. Lastly, the sample identification could result in bias. As no documents were available in which collaboration parties were listed, snowball sampling was needed to identify the sample. This forms a limitation in the research.

4. Results

In this section, the effects of geographical, technological and organizational proximity on collaboration performance and innovativeness are exhibited. On top of that, an elaboration is given on the relation that exists between ACAP and proximity. These results led to the formulation of propositions to be tested in future research. The propositions are summarized in Table 5 and visualized in Figure 5 on the next page.

The section begins with the describing the findings for geographical proximity. Subsequently, the results for technological and organizational proximity are put forward. Thereafter, the mechanism of proximity growth is described. Four mechanisms are put forward that positively influence the different dimensions of proximity. The effect of this increased proximity is also denoted. In the last part, various serendipitous findings are presented as antecedents are for the researched concepts.

The arguments that are made in this section, are accompanied with a number which represents the number of interviewees that support the argument². Some of the findings are amplified by using quotes. Quotes include a reference interviewee in which the letter resembles the case, whereas the number refers to an internal (1) or external interviewee (2)³.

In Table 6, the key findings are presented, as well as the accompanying case which led to the formulation of this finding. In Table 8 and 9 in the back of this section, findings are described in more detail⁴. Interview data per concept is listed in Appendix G. The survey results are demonstrated in Table 7. Here, the length of collaboration in years (derived from the interviews) is included.

² For example, “(6)” refers to 6 interviewees which support the argument.

³ For example; “C2” reflects a quote from an external interview in case C.

⁴ Note, these are extensive tables, which could not be further reduced in order to keep data richness.

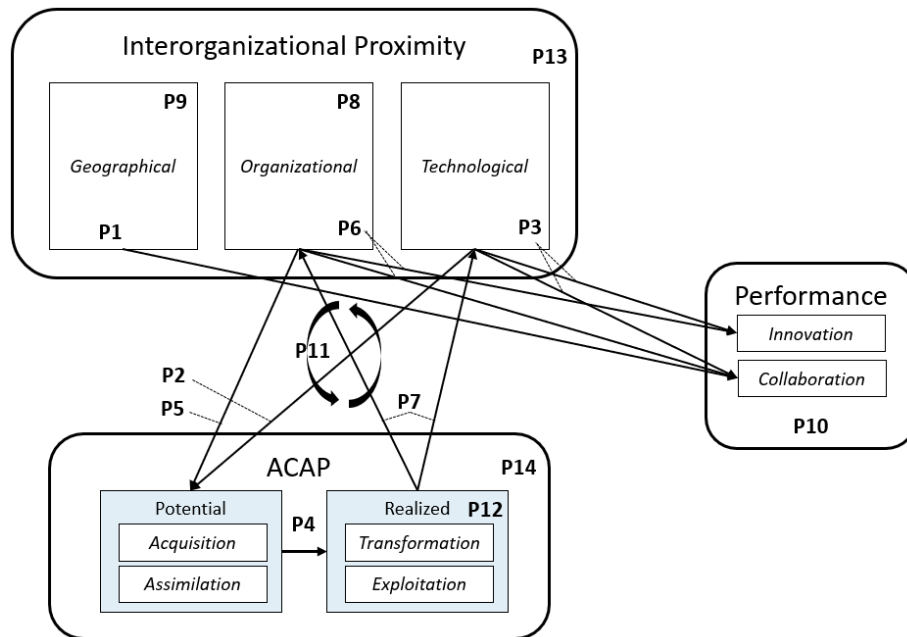


Figure 5: Conceptual model including propositions.

Table 5: Summary of propositions

Propositions

1	Between geographical proximity and collaboration performance, a U-shaped relationship exists.
2	Low technological proximity leads to more knowledge heterogeneity in a collaboration, this positively influences Potential Absorptive Capacity.
3	High technological proximity reduces innovativeness, but increases collaboration performance.
4	In ACAP, after external knowledge is Acquired in the PACAP function, Transformation does not necessarily take place in the RACAP function to successfully Exploit external knowledge.
5	Low organizational proximity leads to more knowledge heterogeneity in a collaboration, this positively influences Potential Absorptive Capacity.
6	High organizational proximity reduces innovativeness, but increases collaboration performance.
7	RACAP positively influences organizational and technological proximity, increasing collaboration performance, provided that knowledge is acquired from the collaborating party by the PACAP function.
8	Connecting with stakeholders positively influences organizational proximity, consequently increasing collaboration performance.
9	Relocation of employees positively influences geographical proximity, increasing collaboration performance.
10	Mechanisms of proximity growth increase collaboration performance, but decrease innovativeness in a collaboration.
11	Knowledge sharing positively influences organizational and technological proximity growth, provided that knowledge is absorbed from the collaborating party.
12	Relative bargaining power positively influences RACAP, leading to technological and organizational proximity growth.
13	Individual's knowledge, norms, routines and processes affect interorganizational proximity, consequently affecting innovativeness and collaboration performance.
14	Individual's traits affect ACAP, provided that interorganizational collaborations start on basis of existing ties between peers.

Table 6: Findings per case.

Section	Propo- sition	Concept	Finding	Case A	Case B	Case C	Case D	Case E	Case F	Case G	Case H	Case I	Case J	Case K	Case L	Case M	Case N	Case O	Case P	Times mentioned			
				1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2	1 2		1 2		
Effects of geographical proximity in collaboration																							
4.1	P1	Geo. prox.	Face-to-face contact preferred over virtual contact	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	26			
			Geographical proximity led to reduced tool use		+		+	+	+												4		
			Multiple-day visits increased information transfer			+									+		+					3	
			Working on location is desired (+/- = in some cases)		+/-	+/-		+	+	+	+				+/-			+		+	+	14	
Effects of technological and organizational proximity																							
4.2	P2 - P4	Techn. prox. & ACAP	Selected partner on bases of technological competences	+	+ / 0	+	+	+	+	+	+	+	+	+ / 0	+	+	+	+	+	20			
			Technological proximity increased mutual understanding		+								+		+		+				4		
			• Different knowledge bases led to misunderstandings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	
			Partner's technology remained black box	-		+							+	+		+ / -						7	
4.2	P5 - P6	Org. prox.	Profiting from external party's organizational dissimilarity	+				+		+	+	+								5			
			• Profiting from focal firm's organizational dissimilarity		+				+			+	+					+			5		
			Similarity in norms, routines and processes benefitted collaboration performance				+							+			+	+				4	
			• Low similarity in norms, routines and processes results in lack of understanding	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	
Mechanisms and effects of proximity growth																							
4.3	P7	Techn. prox. & ACAP	Absorption existed of technological and market knowledge	+	+	+	+	+		+	+	+	+		+	+	+	+	+	16			
			• From focal firm	+	+	+	+	+						+	+		+	+	+	+	11		
			• From third party		+	+					+ / 0	+ / 0						+	+	+ / 0	+	8	
		Org. prox. & ACAP	Absorption existed of norms, routines and processes	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	24	
			• From focal firm	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	14	
			• From third party		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	11	
	P8	Org. prox. & ACAP	Flexibility was asked to collaborate with partner		+	+	+	+	+		+				+			+	+	+	9		
			Routines were adapted in accordance to partner	+				+	+			+				+				+	+	6	
	P9	Geo. prox.	Connections arose between stakeholders		+		+ / 0			+				+				+	+		7		
	P10	Geo. prox.	Relocated peers closer to partner	+	+			+	+	+										+	8		
Prox.			Closer collaborations	+	+	+	+	+	+	+	+	+	+	+	+	+ / -	+ / -		+	+	19		
P10	Prox.	Collaboration duration decreased (-) or increased (+) innovativeness					+	+							-	-	-	-	-	9			
		Antecedents for ACAP and proximity																					
4.4	P11	ACAP	Clear definition of goals and expectations desired	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	21		
			• Expectations were not formulated well enough	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	
			Demos increased information richness in meetings		+	+		+	+	+			+ / -	+	+	+	+	+	+	+	+	18	
			Direct connections between organizations desired	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	16
			Openness in collaboration	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	18
	P12	Prox. & ACAP	Bargaining power was mentioned to affect collaboration	-	+	+			+	+ / -		+	-		+		+ / -	-			10		
P13 - P14	Prox. & ACAP	Collaboration dependent on individual	-	+	+ / -	+ / -	+	-	+	+ / -	+	-	+	+	-	+ / -	-	+	+	22			

+ = Perceived as positive for collaboration performance
 - = Perceived as negative for collaboration performance

+ / - = Perceived as positive and negative for collaboration performance
 ... / 0 = Not specifically mentioned in interview, but assumed

4.1. Effects of geographical proximity on collaboration performance

Geographical proximity was mentioned to be advantageous for collaboration performance, claimed by 20 interviewees. No interviewees refer to a direct effect of geographical proximity on innovativeness directly, and will therefore be taken out of consideration. The main mechanism behind the importance of geographical proximity is the facilitation of face-to-face contact (4). Overall, face-to-face contact is still preferred over virtual contact (26). Four advantages for face-to-face contact were distilled from the data, to be beneficial with face-to-face contact: more information transfer between parties as it is easier to demonstrate issues (11), faster interactions (4), creation of better team spirit/trust between team members (5) and better access to stakeholders in a company (3). The latter is illustrated by the following quote:

“Sometimes you need to get together. Especially with a big group. Scrolling through a document with 5 guys is impossible. 80 percent of the group is muted and doing something else.” (B2)

When not being geographically proximate, more effort and coordination seems to be needed (12). For example, collaborating parties need to overcome certain physical distances to have face-to-face meetings. Travel times reduce the willingness to visit. Also, travel times are deducted from the time which is allocated to the developments. This seems to be a problem in particular for the smaller collaboration parties, as they have less resources available (H & O), but is also mentioned by a larger party (C2).

Contrary to the expectations, geographical dispersion was mentioned to be advantageous in particular cases (5). In the interviews, three reasons were mentioned; the need for longer visits, the effective use of travel times, and a 24-hours serviceability. First, the necessity to make longer visits (multiple-days) when visiting each other’s locations had a positive effect on collaboration performance. This had two underlying reasons: on the one hand, when staying overnight there was an increase in informal (face-to-face) contact between employees of the two companies, leading to higher trust levels between the team members (C1). On the other hand, one would need more time until a sense could be gathered of the implicit feelings that exists in a collaboration. More time spent together creates a setting in which parties feel free to express its sentiment and issues that were run into during a collaboration (M2 & K1). An illustration is given hereafter.

“Interestingly, when they visit, the longer they stay, the deeper we get to the actual problem, the better we could react upon.” (M2)

Second, interviewee C1 mentioned travelling times to enable team members to spend more time together, discussing the experiences with the external party. These discussions led to well-prepared meetings with the external party, creating more effective meetings when being on site of the external party. Lastly, when 24-hours support is required, geographical dispersion is beneficial when time-zone differences are present (M1). In fact, one collaboration was killed because of the inability delivering 24-hour support (K1).

Hence, working under conditions of geographical dispersion does not only have negative results for the collaboration performance. The increase in face-to-face contact as a consequence of longer travel duration also positively affects collaboration performance. Also, certain mechanisms were found to collaborate more effectively under conditions of low geographical proximity, which are described in the following section.

4.1.1. Collaborating under conditions of low geographical proximity: adoption of virtual tools

Low geographical proximity makes collaboration dyads adopt virtual tools in order to communicate. Interviewees claim that the necessity for face-to-face contact had decreased as a consequence of the adoption of virtual tools (7). Interviewees N2 and F1 argument that no difference is experienced in virtual contact compared to face-to-face contact. The necessity of face-to-face contact depends on the NPD phase (21). Face-to-face contact remains relevant, especially to get to know each other in the beginning of a collaboration (4). For example, it was preferred to get a better sense of the collaboration partner and its problem (L1). Therefore, in all cases both face-to-face contact as virtual contact existed next to each other. Especially since certain topics are inappropriate to discuss by virtual tools, parties get together still. This is illustrated by the following example:

“If you make a drawing for example to demonstrate something. [These are things that do not lend themselves for virtual tools].” (J2)

Moreover, for the most geographically proximate collaborations the use of virtual tools was limited, as a consequence of easy of face-to-face contact (4). An illustration is given hereafter:

“We have [face-to-face] contact as much as possible, but also mail and Skype for quick interactions. When something happens, I drive to the site quickly.” (D2)

Apart from Skype, other virtual tools were used in the collaboration, such as cloud working tools (half of the cases) or project management tools (e.g. Jira, Redmine) (4). The latter were seen as advantageous, or even indispensable. Especially in the projects which are characterized by a large interplay between different actors, project management tools were used and considered beneficial as it prevents working with outdated documentation.

However, when dealing with low geographical proximity, clear coordination seems essential. For example, regarding tool use; frequent technical issues in virtual tools were mentioned to hinder collaboration performance (6). Additionally, confusion arose as various media were used concurrently during a collaboration. Besides, routines in tool use were affected by company culture (P1). On top of that, one interviewee (J2) claimed that agreements needed to be made on when the third party is required on location beforehand. For example, for the execution of durability tests.

To conclude, results show especially face-to-face contact to be an important mechanism to increase collaboration performance. This as a consequence of an increase in information transfer between collaborating parties. Clearly, most face-to-face contact exists when parties work next to one another, on location, resulting in highest information transfer. When working in dispersed setting, more coordination is necessary for information transfer, for example regarding the implementation of tools use. In addition, contact during visits between collaborating entities is more superficial. These arguments result in limiting information transfer and thus the thorough understanding of one another. Resulting in decreased collaboration performance.

When geographical dispersion increases, to a certain extent, paying one-day visits to each other would be unfeasible. Consequently, multiple-day visits between collaborating parties are required. Again, increasing information transfer as a consequence of increased face-to-face contact. Also, this increase of face-to-face contact was noticed during travelling of team members. Hence, information transfer and thus mutual understanding is realized with either geographical proximity or

geographical dispersion. This positively affects collaboration performance (Figure 6). This leads to the following proposition:

Proposition 1: Between geographical proximity and collaboration performance, a U-shaped relationship exists.

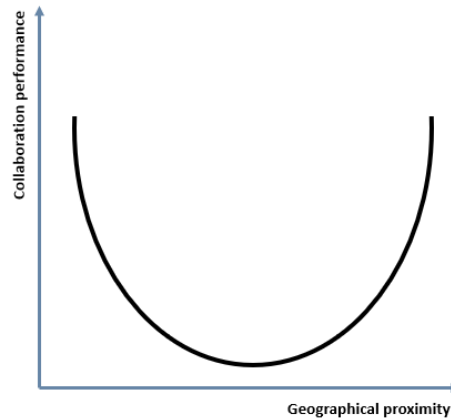


Figure 6: U-shaped relationship between collaboration performance and geographical proximity.

4.2. Technological and organizational proximity; advantages and disadvantages

For both technological and organizational proximity a two sided effects on collaboration performance seems to exist. On the one hand, when innovation is intended companies seem to look for companies who are less proximate, as a means to extend internal capabilities. On the other hand, technological and organizational proximity promote understanding and therefore increase collaboration performance. First, this phenomenon will be described for technological proximity. Thereafter, the consequences of both high and low organizational proximity will be described.

4.2.1. The effect of both low and high levels of technological proximity

Regarding technological proximity, technological competences or experience seems to be one of the main reasons to collaborate with a particular party. In 18 interviews was specifically mentioned that the focal firm selected its partner on bases of its technological competences. Of which 10 cases, technological competences were not possessed internally within the company. Here, the collaboration partner is seen as an extension of internal knowledge base, which is required to deliver a particular development. One of the advantages that was mentioned was that the external party applied its technology at other parties as well. This prevents the focal firm to commit mistakes which were done by the collaboration partner before (8). Thus, the focal firm seems to select a collaboration partner on basis of its previously assimilated knowledge to apply unknown technologies in developments, and consequently leading to more novelty.

However, not always is sought for an extension of internal knowledge. In some cases, an internal development was constrained by the availability of resources within Focallogistics (5). Knowledge which was necessary for developments existed internally, but work overload of employees led to the decision to collaborate with an external party. When contracting a firm in a need of resources, contribution of external knowledge was not desired per se. These developments were characterized by less innovativeness, in which many parties possess the necessary knowledge base (See F, G, K, M, N). This argument is illustrated by some quotes hereafter:

“We are also not going to make conveyer belts, we could do it, but we will not. If we would have done it, internal resources would have been a problem.” (N1)

“[We] needed developers, who built something, they were not looking for a partner who helped ‘developing’.” (K1)

Also was mentioned that external parties were attracted due to low technological proximity. For example, the collaboration was mentioned as a means to acquire knowledge about the (fast growing) logistics market, thus as a means to grow in technological proximity.

“We decided to grow in [the logistics market]. We had a strategic goal to go to this industry. It was not a coincidence that we met Focallogistics at the fair.” (M2)

Summing up, when innovation is intended, partners are selected on bases of its knowledge contribution to create the highest heterogeneity of knowledge in collaborative developments. This leads to a exposure to more heterogenous knowledge, leading to higher receptiveness of external knowledge, thus PACAP. This enables knowledge absorption. This leads to the following proposition:

Proposition 2: Low technological proximity leads to more knowledge heterogeneity in a collaboration, this positively influences Potential Absorptive Capacity.

However, low technological proximity could be detrimental to collaboration performance. When similar knowledge is present in both collaboration parties, this is beneficial to understand each other (4). Thus high technological proximity. An example is given by the following quote:

“The engineers really understood each other well [as they have the same knowledge]. This is key in the collaboration.” (J2)

On the other hand, interviewees claimed that when there is little overlap in knowledge bases, this limits mutual understanding (11). Thus, low technological proximity between collaboration partners, could lead to misunderstandings. This hindered the collaboration. For example, these misunderstandings could arise due to among others, the use of jargon (D1), or a lack of insight in customer applications of technology (M2). Another example is given in the following quote:

“We work with check-in, instead of luggage. We notice that they really don’t understand how this works.” (G2)

Hence, when innovation is intended, a partner is selected based on the contribution of its individual knowledge (Figure 7). By accessing knowledge of multiple firms instead of relying on the resources of one, innovation is created. This as a consequence of increased knowledge heterogeneity. However, this could result in misunderstandings, harming collaboration performance. This taken into account leads to the following propositions:

Proposition 3: High technological proximity reduces innovativeness, but increases collaboration performance.

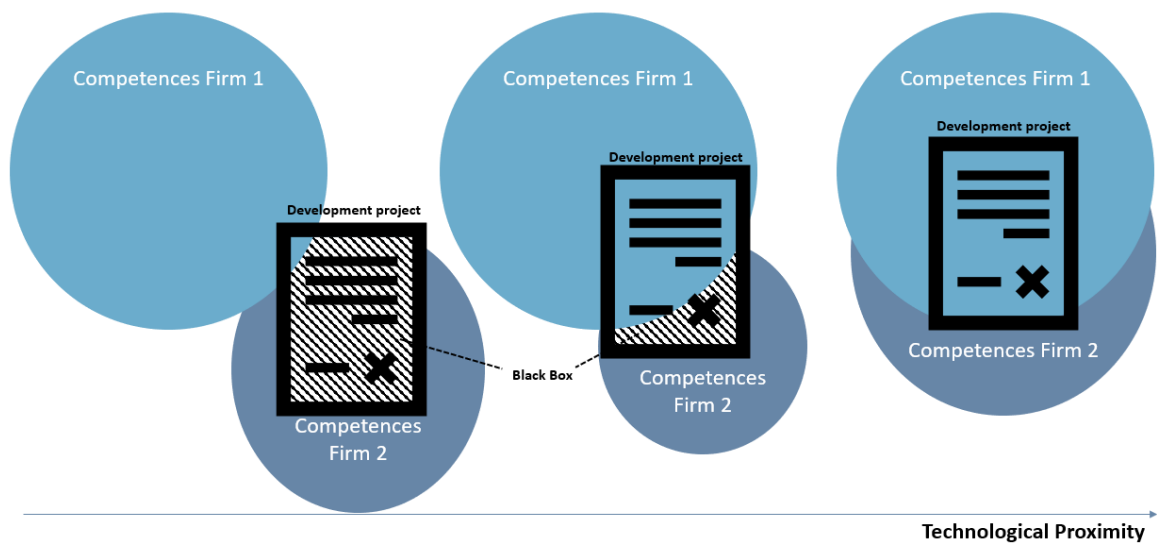


Figure 7: Examples of competence distribution in developments for low, medium and high technological proximity

Worth to mention here is that collaborating under low technological proximity was not necessarily impossible. For example, by seven interviewees, partner's technology remained a "black box" (to a certain extent), in which there was no full mutual understanding of the collaboration partner's technology. Predefined connections between the technology of both the focal firm and the partner were used. This enabled collaborations in which there was little understanding between both parties. A visualization of the competence distribution in a development is made in Figure 7.

Even though this could be a practical way to cope with low technological proximity, this could have negative consequences for collaboration performance. In the interviews, different risks were mentioned. For example, risk mitigations (E1) and error analyses (A1, E1 & G1) became more complex as a consequence of a lack of understanding of partner's technology. It was claimed that consultations are needed to intervene on the issues that exist (A1). Lastly, even though limited connections between technology of both parties was intended, this does not always remains the case. An external party claimed that the number of connections grew over time as a consequence of architectural changes within Focallogistics (E2). This led to a greater need of understanding of the technology of Focallogistics.

In these cases, external knowledge is acquired and assimilated by the PACAP function. Even though no full understanding existed, the development could be exploited by market introduction. This demonstrates a limited necessity of the transformation function as part of the RACAP function in these cases. Hence, this leads to the following proposition:

Proposition 4: In ACAP, after external knowledge is Acquired in the PACAP function, Transformation does not necessarily take place in the RACAP function to successfully Exploit external knowledge.

4.2.2. The effect of low and high levels of organizational proximity

Also, regarding organizational proximity, the external party could bring advantages as a consequence of differences in organizational context (A, E, G & H). This was mentioned in collaborations with start-ups mostly. Start-ups were mentioned to be advantageous for the focal firm as they were less restricted by bureaucratic processes. Therefore they were assumed to reduce

development time of a development. Nevertheless, remains subject of discussion, as characterized by the following quote:

"[They have lighter processes], by which they can make quicker iterations, than we could do. [...] I say it doubtfully, as we would have the same [team composition] in Focallogistics, then it would go faster as well, and we would have a broader approach in which we would have the reporting tools in order." (E1)

Third parties were also attracted by the low organizational proximity with Focallogistics. They mentioned to have specific motivations to work with the Focallogistics apart from monetary incentives. For example, the network activity of Focallogistics attracted external parties. This was seen as a manner to introduce their ideas on wide scale into the market (A2, E2, G2, H2 & M2). An example is given hereafter:

"One of the advantages is their organization, they are a global organization. They can help our product enter the market, we are just a startup company." (G2)

Thus, apart from the interest to select a partner on basis of low technological proximity, a selection could be done on basis of different organizational contexts, when innovation is intended. The differences in organizational contexts positively affect the capability to spread out innovative ideas, thus resulting in higher innovativeness. This leads to the following proposition:

Proposition 5: Low organizational proximity leads to more knowledge heterogeneity in a collaboration, this positively influences Potential Absorptive Capacity.

Also here a paradox seems to exist. While some partners were selected on bases of low levels of organizational proximity, collaboration performance benefits from higher levels of organizational proximity. The findings indicate that similar organizational contexts positively affects mutual understanding, increasing collaboration performance (3). For example, one interviewee mentioned a better access between actors that possess similar (national) culture (I2). Two external parties mentioned the presence of an R&D department within Focallogistics to be beneficial for collaboration performance. These both reflected research companies who have an internal R&D department as well. The presence of research routines in both sides of the collaboration reflected higher organizational proximity and led to mutual understanding regarding the development process (C1 & J2).

More obvious were the consequences of lower organizational proximity. Misunderstandings due to differing organizational context such as norms and routines existed (9). Specific consequences have been mentioned, such as: lacking quality awareness (8) implementation issues (4), and price discussions (3).

The focal firm's market is characterized by high quality and low risk norms. Developments need to sustain extensive endurance tests before market launch, as the logistics market requires to diminish risks to a minimum and determine occurring chances. External parties were in more or lesser amounts unfamiliar with these requirements of product launch. 8 interviewees mention that this resulted in the lack of delivering supporting tools and software or quality issues. For example, the lack of installation software or durability tests. Implementation issues arose as a consequence of different expectations. This is illustrated by an example:

“At the moment we push an update which includes a bug, we can shut down a whole [logistical] process on site. We became more structured [in our testing procedures].” (H2)

In conclusion, a difference in organizational contexts positively influences innovativeness, as both parties can bring their inputs to the table. However, different organizational contexts negatively affect collaboration performance, as it increases risks of misunderstandings. This taken together results in the formulation of the following proposition:

Proposition 6: High organizational proximity reduces innovativeness, but increases collaboration performance.

4.3. Proximity growth leading to collaboration performance, while harming innovativeness

Both high as low levels of proximity could be advantageous in a collaboration. Interestingly, one does not rule out another, as mechanisms were found that increase proximity. For technological and organizational proximity, similar patterns exist. These will be described first. Thereafter, for geographical proximity, growth mechanisms will be described. Even though increased proximity results in improved collaboration performance, it could harm innovativeness. This effect will be described lastly.

4.3.1. Growth of technological and organizational proximity leading to collaboration performance

Both technological and organizational proximity seems to be increasing during a collaboration. In 28 interviews was claimed that there was knowledge acquired from the collaboration partner. As discussed in Section 4.2., knowledge absorption existed due to both low technological proximity as well as low organizational proximity. In most collaborations knowledge absorption exists latently. However, the focal firm mentioned to actively educate third parties as well, in two interviews. For example, the focal firm brings the third party to the customer in order to see applications of certain technology (K1), or another educates them like a Focallogistics employee (F1). In one case, the third party actively decides to assimilate relevant knowledge about the logistical domain itself, by hiring professors from local universities (M2). Three types of knowledge acquisitions were distinguished, associated with both organizational proximity as technological proximity growth. These are respectively [1] acquisition of technological and market knowledge, [2] acquisition of norms, routines and processes and lastly [3] connecting to stakeholders.

First, an increase in technological proximity was found. During the collaboration, both knowledge regarding technology applications and market conditions were absorbed by either one of the parties (16). During the collaboration, a party acquires more insight in both partner’s market as technology. When having this insight, developments could be shaped to partners technology and market. For example, in the following quote adaptations are visible clearly:

“We adapt to the tooling which the client is working with.” (D2)

However, transformation of knowledge structures is less visible in the interview data. The latter quote clearly expressed a transformation to exist as a consequence of collaborating.

Interviewees claim to “learn” from the other party, adaptations are less clear. Nonetheless, consequences of this “learning”, interviewees indicated the knowledge to be transformed in the RACAP function. In the following example, is shown that expectation levels are matched to the customer:

“Also technologically we learnt regarding the projects that fail or do not fail. We can kill projects in an earlier stage. [...] Some products were too extensive and complex, which results in higher costs. Sometimes you just need the 'good enough' option.” (N2)

Therefore, it is proposed that technological and market knowledge, acquired in the PACAP is transformed in the RACAP function. Subsequently, this results in more knowledge base overlap, thus technological proximity. Nevertheless, this does not implicate that all critical knowledge that is needed for a particular development is absorbed. For example, an interviewee from the focal firm mentioned the following:

“Regarding the technology, we know more than before, but we have too little knowledge to do it ourselves” (G1)

Secondly, for growing organizational proximity, an acquisition of routines and processes (24) was found in the data. This refers to the knowledge acquisitions that were done by being exposed to different ways of working of the collaboration partner. Interviewees mentioned flexibility to be necessary in order to increase collaboration performance (9). In certain cases, it was explicitly mentioned that specific adjustments were done in routines and processes by both dyad entities to increase organizational proximity in the collaboration (6). For example, Focallogistics’ most evident adaptation was the creation of a separate R&D division which is less constrained by rules and deliverables. According to smaller third parties, Focallogistics is a large firm having a lot of bureaucracy which limit agility for innovations. This adaptation was intended to bridge the gap with smaller collaboration partners (E & G). This adaptation of the focal firm reflects a growth in organizational proximity. However, when no growth in organizational proximity was realized by possible adaptations, this could harm collaboration performance. This is illustrated by an example:

“We learnt that it is dramatic to work with such a small party!” (A1)

Whether either one of the firms actually adapts its routines to become more organizationally proximate depends on its ability to Transform, being part of the RACAP function. For example, the focal firm is characterized by standardization and high quality norms, which affects third parties. One external party mentioned that internal routines were transformed in accordance to Focallogistics. This is illustrated by the following quote:

“We learnt to be more structured in our testing. When we push an update, which includes a bug, we know that this could have a large impact on the rest of the process.” (H2)

Organizational proximity was attempted to increase on both sides. For example, smaller parties adjusted their routines and processes by the implementation of more standardized developments (A) or increased structure in performing tests (H & K). Apart from adapting the routines

and processes, external parties assigned particular individuals who corresponds most closely to the focal firm. For example, one party mentioned to assign specific individuals to a project which best meets the focal firm's culture (D). Also visible for international collaborations, Dutch intermediators were assigned in order to improve collaboration practices, as they correspond to the culture of Focallogistics (A & I). In both cases, this positively affected collaboration performance.

In conclusion, knowledge in terms of norms, routines and processes or market and technology reaches the RACAP function, after being Acquired and Assimilated in PACAP. If transformation exists, this results in growth of both organizational and technological proximity. This results in a better collaboration performance, as a consequence of increased mutual understanding. This results in the formulation of the following proposition:

Proposition 7: RACAP positively influences organizational and technological proximity, increasing collaboration performance, provided that knowledge is acquired from the collaborating party by the PACAP function.

Lastly, interviewees mention that individuals from one firm connect with stakeholders from the other firm during a development (7). Thus social connections arise, leading to a growth in organizational proximity⁵. When collaborating more frequently, this results in better knowledge sharing, also access to critical information within a firm is improved. Interviewees judge these connections as helpful for a collaboration, as visible in the statement hereafter. The example also embraces a growing understanding in routines of the other party, as mentioned before:

"Also at one time, you learn how the organizations is working, who you need in certain situations, and why they make certain decisions. So it would be advantageous to have continuous assignments." (J2)

The rise of social connections between collaborating parties, reflecting a growth in social proximity which is inherent to organizational proximity growth. These connection results in a better awareness where critical knowledge in a firm resides, this increases collaboration performance. This taken together, leads to the formulation of the following proposition:

Proposition 8: Connecting with stakeholders positively influences organizational proximity, consequently increasing collaboration performance.

4.3.2. Growth of geographical proximity leading to collaboration performance

Also for geographical proximity a mechanism of proximity growth was noticed. It was found that employees were relocated to increase face-to-face interactions in 5 cases. For 4 cases it was decided to send employees to work at Focallogistics' site for longer duration; working at the desk next to other team members (Case B, D, E, P). This resulted in an increase in knowledge sharing, reducing the risk of misunderstandings, consequently leading to collaboration performance. Interviewee P2 even insisted to let their employees work on location, as he found working in a geographically dispersed setting hindering.

For case A, the location of interaction of the external party was changed more geographically proximate to Focallogistics. Hence, these collaborating parties became more geographically proximate when collaborating. This led to collaboration performance. This is illustrated by an example:

⁵ Reflects a growing social proximity, which is incorporated in organizational proximity (Knoben and Oerlemans, 2006)

“We shifted the location [of interaction] more closely to Focallogistics. This is easier when escalations arise within a collaboration because personal contact is better than calling.” (A2)

This taken together leads to the formulation of the following proposition:

Proposition 9: Relocation of employees positively influences geographical proximity, increasing collaboration performance.

4.3.3. The effect of proximity growth

It would be no surprise that it was mentioned frequently to intensify collaboration practices. This as a consequence of increased proximity and collaboration performance (19). Two ways of intensifying collaborations were mentioned. On the one hand, using the same knowledge of the external party in other existing developments of Focallogistics as well (6). On the other hand, a partner would be capable of contributing other knowledge apart from what it contributes now (12). For example, C2 mentioned that until now, only advise is incorporated on synthetic materials, whereas some other of their expertises could be valuable for the focal firm as well. C2 mentioned price reductions as a possible consequence.

However, increased proximity seems to reduce innovativeness. The quantitative measures of Table 7 already indicated patterns in which innovativeness decreases with duration of collaboration⁶. After collaboration partners acquired technological and market knowledge, as well as the norms, routines and processes, this reduced innovativeness. Hence, there needs to be sought for new manners in which partners could contribute to one another. This is expressed in the following quote:

“We had a workshop, it was probably already 3 years ago. Out of these requests, we develop a prototype product that was tested and was shown on innovation day, and now is becoming a serial product. But we see that we don’t do enough of these meetings and joint workshops to identify what other innovation potential is there.” (I2)

Another partner actively tries to counteract reduced innovativeness, by making continuous suggestions for improvements to Focallogistics:

“Every remark I make, they try to follow up in a business case, or service. [...] It can help sometimes to win over Focallogistics.” (D1)

However, external parties get demotivated by Focallogistics, as their suggestions are not being followed up (M2 & N2):

“When we put a lot of effort in [a development], and if it is not implemented in their systems, it works demotivating.” (N2)

In another case, the partner was claimed to be uncomfortable with starting new innovative collaborative developments after fulfilling a buyer-seller relationship. The project was intended to be

⁶ As this research is not of quantitative intend, these results could only be used to identify for potential patterns. No generalizable conclusions can be drawn upon these results.

highly innovative. Feasibility studies with the partner were conducted, which were judged as positive. However the partner could not follow up on innovative requests during the collaboration. This led to low collaboration performance (L1). This is expressed by the following quote:

“We challenged them a lot, but I think it was out of their comfort zone.” (L1)

In conclusion, proximity growth seems to positively affect collaboration performance, as mutual understanding is improved. However, after knowledge absorption existed, and parties became more proximate it could be detrimental for innovativeness. This leads to the following proposition:

Proposition 10: Mechanisms of proximity growth increase collaboration performance, but decrease innovativeness in a collaboration.

Table 7: Overview of survey outcomes per case.

Case	Years of collaboration	Geographical proximity (km)	Organizational proximity (Likert 1-7)	Technological proximity (Likert 1-5)	Innovativeness (Likert 1-7)	Collaboration performance (Likert 1-5)
A	6	392	2,2	2,0	4,5	2
B	9	18	3,8	3,7	5,3	3
C	5	193	4,4	1,3	5,3	5
D	19	18	2,8	3,0	3,5	3
E	3	13	4,0	3,3	6,0	4
F	21	29	4,2	3,0	2,5	2
G	2	95	2,4	3,0	4,3	2
H	1	92	4,8	3,0	6,0	4
I	18	397	5,0	4,3	2,5	4
J	3	115	6,2	3,3	5,5	5
K	12	1335	3,6	3,7	4,0	5
L	14	92	2,8	1,7	5,8	1
M	5	1335	4,6	3,7	5,0	3
N	21	248	3,4	2,7	2,0	5
O	2	469	2,8	3,0	6,5	2
P	2	47	2,8	2,0	4,0	4

4.4. Antecedents of ACAP and organizational and technological proximity

Also serendipitous findings were done as interviewees coined various ways to collaborate under conditions of low technological and organizational proximity. When taking a closer look at these measures, these seem to strengthen effect of ACAP on proximity growth. These include both knowledge sharing routines as well as bargaining power. Lastly the importance of an individual for both ACAP and proximity is illustrated.

4.4.1. PACAP by sharing knowledge: openness, demonstrations and direct connections

When asking interviewees how to collaborate effectively, frequently their answers are measures that increase knowledge sharing. Making the knowledge available to a collaboration partner results in higher receptiveness of a partner, thus PACAP. In this section, a distinction is made in knowledge sharing before the collaboration start and during the collaboration.

Before the collaboration start, information exchange exists by formulating the goals of the collaboration. Interviewees agree that the proper definition of goals and procedures of a collaboration before its start is essential (21). These could be an antecedent for technological and organizational proximity growth, as both technologically as procedural expectations of the collaboration should be expressed to a partner.

However, clear formulation of goals and routines have been neglected in some collaborations. In 15 interviews was mentioned that the definition of requirements was not done properly, reflecting 11 cases. It was mentioned that the development processes started too quickly, without proper formulation of end goals. For example:

“In an evaluation, you can say, look we agreed upon this, but it does not work. This could always happen, and then you discuss it. However, you need it to be documented first.” (L2)

Interesting to note here is that, this problem was only mentioned by the external party, for 5 cases (Table 6). For one specific case, it was mentioned that contract formulation was a hassle (J1). However, no issues arose as a consequence of insufficiently constructed requirements and expectations. Hence, the focal firm seems to underestimate the importance of well-defined requirements and expectations.

Formulation of requirements was mentioned to be a two way street, in which both parties are responsible for knowledge sharing. In certain cases was put forward that the external party lacked the capability to correctly develop requirements of the development (L1 & O1). On the other hand, one interviewee working at Focallogistics blames its company for not being clear in their goals, this led to problems in the collaboration:

“[We need to tell them] who we are, how we work and what we expect, this is what we guarantee. There has never been chosen a clear strategy.” (A1)

During the collaboration, apart from face-to-face contact (Section, 4.1), other measures were mentioned to improve knowledge transfer. These are respectively demo use, direct connections on all equivalent levels of the company and openness.

First, physical demonstrations were mentioned to collaborate under low levels of technological and organizational proximity. Demos are a measure to show something tangible, increasing information richness (18). These are desired prior to the start of the collaboration, as a means to check for collaboration potential. It increased the understanding of the problem to be solved forming the basis of a discussion. An illustration is given in the quote hereafter.

“We help to integrate [our technology] in a proof of concept. The reason why we do this, is because [our technology] is new to many parties.” (H2)

Second, having short (informal) communication lines between the collaborating parties was mentioned (16). Direct contact between equivalent levels of the two companies (e.g. engineering, project management and sourcing/sales level) were mentioned to be advantageous (Figure 8). In 5 cases, there has been someone assigned to keep an overview of the collaboration. However, it is claimed that the actual developments are preferably done when the engineers have direct contact. For example, adaptations could be realized most quickly when direct connections exists between the parties:

“Because our communication lines are short, and frequency is high, it allows us to steer [the developments] quickly, to prevent the wrong things from happening.” (P2)

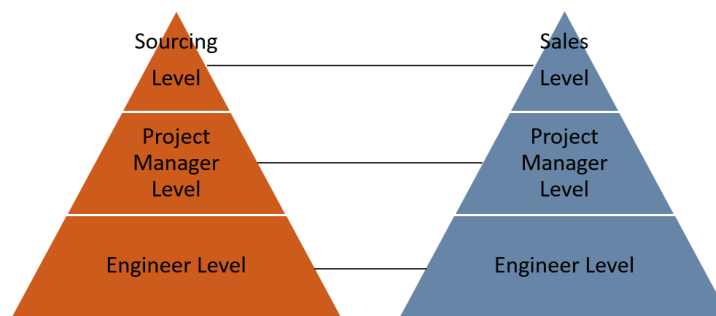


Figure 8: Direct connection lines between levels of the collaborating organizations.

Lastly, openness was mentioned as a measure to overcome low organizational and technological proximity (18). In the analysis, openness regarding three different topics was mentioned. These are; operational decisions and sentiments, technology and market potential and profits. The first two result in a growing organizational proximity. Openness in technology and market potential results in a growing technological proximity. Sharing profits would result in both a growing organizational proximity.

“We are very transparent in the goals we want to accomplish. [...] When there are issues, we listen closely to their arguments, then we make adaptations in the planning.” (C2)

For organizational proximity, first, the reasoning behind operational decisions and sentiments need to be expressed to the partner (12). Discussing those openly is favored. This reflects openness in routines and processes to the collaborating firm. In addition, when issues arise within a collaboration, honest feedback and sentiments are discussed between the collaboration parties (E2). This kind of openness creates a better understanding under which conditions a development needs to suffice.

“[When coping with differences] you create a discussion that you want to do it differently.” (F2)

Openness in market and technological knowledge refers to the insights on how partners’ technology works and what conditions it should suffice (4). This kind of openness was mentioned to be advantageous by interviewees within the focal firm mostly. As mentioned previously, black box engineering exists in certain collaborations as a means to collaborate without mutual (technological) understanding. Nevertheless, one third party decided not to share technological insights as a means to increase bargaining power in a relationship (G2). This frustrated Focallogistics (G1).

Also, sharing market insights are beneficial for a collaboration, as a party could adapt accordingly. Interviewees mentioned requirements changing during a collaboration (7). These incorporate changes in design as well as contextual details such as customer insights. On top of that, 4 interviewees mention openness in sales potential to be beneficial (Table 6). For example, insight in sales potential enables the prediction of the scale of the development, which is especially relevant for a smaller party (A1, A2, B1 & E2). This results in a higher knowledgeability about the market, thus increased technological proximity.

Lastly, openness in pricing structures was mentioned to be advantageous. For example, it was mentioned that the external firm could adapt its revenue model in favor of Focallogistics when margins are low in certain projects. This could lead to a better (financial) performance for Focallogistics (A2). However, this was done another case (G), which led to continuous pricing discussions between the two parties. Hence, unclarity remains in the effectiveness of openness in pricing structures.

Summing up, sharing knowledge by one party, which is absorbed by the collaboration partner could strengthen growth in both organizational and technological proximity, as knowledge is absorbed from the collaborating party. Therefore is proposed:

Proposition 11: Knowledge sharing positively influences organizational and technological proximity growth, provided that knowledge is absorbed from the collaborating party.

4.4.2. RACAP by bargaining power

Interesting to note is that third parties mention to learn more often rather than vice versa. Regarding acquisition of technological knowledge, the external party mentioned knowledge acquisitions from the focal firm in 11 times, whereas the focal firm mentioned to acquire knowledge from the third party 8 times. For routines and process knowledge, a similar pattern exists (14 versus 11 times). Hence, internal adaptation of processes seems to be dependent on the bargaining power in a collaboration. Third parties are either forced or willing to adapt internal processes as a consequence of bargaining power of the focal firm. This was argued by the smaller firms in the sample (start-up/scale-up) in 4 out of 5 cases. However, one startup mentioned to have technological knowledge as a means to acquire bargaining power (G2). Interestingly, any further adaptation were not identified for this case.

Also bargaining power as a consequence of buyer-supplier relations in general affected the adaptation of internal processes, leading to organizational proximity growth (A2, B1 & B2, K1, L2). Here was mentioned that Focallogistics steered, or at least tried to steer, certain decisions within the collaboration partner. Clearly, these firms were willing to adapt in favor of Focallogistics. A typical illustration is given below:

“Focallogistics is an important player in the Netherlands, thus an important customer. We are always willing to do something extra for a customer in which we see a large potential.” (L2)

Therefore, it is suggested that relative bargaining power increases the willingness to make adaptations in knowledge base, as well as in routines, processes and norms in direction of a partner. Subsequently, this results in a growth in organizational proximity. This could be done by absorbing external knowledge and subsequently transforming internal knowledge structures. As mentioned in the Section 2, transformation is allocated to the RACAP function. Therefore is proposed:

Proposition 12: Relative bargaining power positively influences RACAP, leading to technological and organizational proximity growth.

4.4.3. Predominant effect of the individual on technological and organizational proximity and ACAP

It needs to be noted that collaboration performance seems to be highly affected by the personal traits of the stakeholders within the collaborating dyad (22). Even though this analysis is conducted on the

firm level of analysis, the individual could have both positive as negative effects on the collaboration (Table 6).

17 interviewees mentioned that a collaboration could thrive or decline by the assignation of an individual. To be more concise, it was mentioned that peers differ in knowledgeability, routines and processes, commitment and intentions in general. One typical example was case L1, in which the focal firm was in contact with someone who had extraordinary innovative ideas in relation to the development. In the end, these ideas could not be established, as these could not be executed by the firm.

"[During the preparations of the development] I think we were talking to the visionary of the company." (L1)

In this case, the differences in knowledge bases between the individual and the rest of the firm seem to be differing. Hence, technological and organizational proximity between collaborating parties do not seem to be consistent throughout the organization. Rather, these are dependent on the individual. Subsequently, this could affect both collaboration performance as well as innovativeness, as mentioned in Section 4.2. Therefore, this thesis proposed:

Proposition 13: Individual's knowledge, norms, routines and processes affect interorganizational proximity, consequently affecting innovativeness and collaboration performance.

Apart from the effect on proximity, an individual could also affect ACAP. In fact, in 10 out of 16 cases collaborations started as a consequence of existing ties within the collaboration dyad. In the interviews was mentioned that directors, business developers or sourcing managers introduced the partner. One example is given in the following quote:

"A strategic sourcing manager [from Focallogistics] knows one of our consultants quite well. The link was made quickly, he said to [the project manager] that he should contact us." (C2)

Individuals which possess a larger network, make suggestions on incorporating third parties in developments. Thus, the individual could make firms more receptive for external knowledge. This leads to the formulation of the following proposition.

Proposition 14: Individual's traits affect ACAP, provided that interorganizational collaborations start on basis of existing ties between peers.

Table 8: Findings listed per case A-H.

Case		A		B		C		D		E		F		G		H	
Concept	Finding	Internal	External	Internal	External	Internal	External	Internal	External	Internal	External	Internal	External	Internal	External	Internal	External
Geographical proximity	Section 4.1. Virtual or face-to-face contact	Having face-to-face contact really makes a difference, travel times are surmountable, but we need to plan every visit.	[...] when escalations arise within a collaboration [it is nice to be closely located] because personal contact is better than calling.	Being proximate results in easier face-to-face contact, nice when you need to agree on certain decisions [or showing] demos and tests.	We do not use Skype that much, I prefer going by them. Sometimes you need to get together. Especially with a big group.	[Virtual tools are effective]. Distance and the travel times could be a valuable means to prepare on meetings with the third party. We took a hotel the night before. We drank a beer together [...]. It's team building.	When we are prototyping [...] we see each other more often face-to-face. [...] Otherwise we have conference calls.	[Face-to-face contact] is not per se necessary, but it really helps to keep in touch with the stakeholders. Proximity facilitates the ability to work on location.	We have live contact as much as possible, but also mail and skype for quick interactions. I am here [very often] to find out exactly what is going on! [...] In 20 mins I am there!	We can not have really less face-to-face contact. Also when starting to work together you need to see each other face-to-face, you need to know who you are working with.	[Regarding discussions] we made the decision for me to work one day a week on location of Focallogistics.	I would like to see them working here on location, this facilitates the collaboration. As we are proximate, this should be possible.	working next to each other creates trust [as you have a better sense of what the other is doing]. Geographical proximity facilitates working on location.	It is most important to sit next to the customer of the developments.	External	Sometimes you need to get together, face-to-face contact is a different experience, you want to see the faces of the others.	We are now collaborating with 4 parties. It is hard to have a conversation with all stakeholders by phone only.
Org. & Techn. proximity	Section 4.2. Effects of technological/organizational proximity	We need the third party to diagnose the problem. We have limited ability to identify the problems.	We are coming from an industry which is matching well with the industry of Focallogistics. So we didn't need to do that much new development to create a whole new system.	They are active within other companies as well, of which we can learn. Sometimes we could use these technologies which were effective in other collaborations.	We make an addition to each other. [...] Sometimes we underestimate technological effects.	Their knowledge is complementary. They can give input from another perspective. We make sure their developments are implemented in our system [...] They don't need a lot of knowledge about our systems.	Regarding the knowledge differences, we can make [them] suggestions and test them quickly.	We have a lot of jargon. This makes working together difficult. [Suggestions from the external party could help] to improve our tool use.	We could advise them how to use [a tool] most effectively.	Their quality and delivery times weren't that good. [We collaborate closely] to understand their solution works and questioning them how they work. [They have lighter processes], by which they can make quicker iterations, than we could do.	Focallogistics acknowledged that the competences [needed for the development] were not available in the firm. They have a [complex system architecture]. In the beginning we agreed on me connecting with one system.	[The collaboration extended] majorly because they help other parties as well. We are quite similar [...] The challenge is to imprint our way of working. Otherwise this could lead to quality issues and overwork.	We are broader oriented, that's why we can do engineering better than just the market in which Focallogistics is active. With another customer, something is called differently than at Focallogistics.	When I noticed them, was like; "I can redefine the passenger process!". You have no idea of what happened [in their technology]. When ours and theirs are out of sync, we did not know what happened.	We work with check-in, instead of luggage. We notice that they really don't understand how this works. They can help our product enter the market, we are just a startup company.	That is exactly the reason to collaborate, they know everything about the solution. They are leaner in their developments, but they are less mature. [as a consequence of the differences in size] We try to isolate the complexity [for the other party].	We can have larger focus on our solution, because everything around is covered. Sometimes the goals are too ambitious, as they do not fully understand the complexity of the problem. We try to isolate the complexity [for the other party].
ACAP and Geo., Org. and Techn. proximity	Section 4.3. Acquisition of knowledge from external partner Adaptation/flexibility to partner Increased proximity's effect	We learnt that it is dramatic to work with such a small party!	We learn a lot about the logistics market. [...] We are also getting more structured when we are working with Focallogistics.	They are active within other companies as well, of which we can learn. [...] Also internally, our processes. [...] We get to know them better how are they organized, how are they organized.	We acquired a lot of technical knowledge. We take it in to future developments.	You can see that they gathered system knowledge. [...] We also acquire knowledge, the project leader is getting more knowledgeable regarding [their technology].	We learn really well how to manage risks within a project.	They suggested to act as a co-development partner.	We get to know cultural things, domain knowledge; when someone is coming here they learn from the logistical domain.	Every quartile we make progress, [them adapting to our standards].	I really value to keep the differences, respect them. Take the power of both. Try to learn from each other, the optimum is in the middle.	We learn how to create faster innovation and how to adjust our processes in order to enable innovation. Regarding the technology, we know more than before [...]	Nuance differences are interesting to learn from each other.	We learnt how to improve our processes. We learnt majorly to improve our processes.	We try to understand their solution on high level. But it remains a black box in which we have an input and an output.	[As we know the technical consequences], we learnt to be more structured in our testing.	
		Also our processes have gotten more mature. We shifted the location [of interaction] more close to Focallogistics.		Also regarding processes, our communication to Focallogistics changed. [...] you learn [how to work with them] over time.	In the beginning, they had a hard time with the way we worked. We take into account a lot of input. In the end, they just were flexible with our way of working.	You need to find each other in [their way of working]. This could be hard sometimes. [But we] always adjust to the customer's processes.	We adapted to a whole new way of working by outsourcing working packages.	It is important to identify and understand how you can collaborate most successfully. We adapt to the tooling which the client is working with.	We insist them to work in a particular way. They restructured the R&D organization. [...] Now we are reporting on all different levels. It can go both sides.	We brainwash them to certain amounts, to think like we do. We first need to get to know their working practices, [and] communication lines. When knowing this, you are more aligned and working as a partnership.	We adjusted our R&D organization to free innovation from bureaucracy.	As they really want to work with us [because we are a large firm], it gives us "power" to steer them to small extends.	We became more structured in [our testing procedures].				
			I think it would be better to organize the collaboration on all different levels, to invest more in each other.	I think it is important to keep the communication going. We need to keep improving each other.	[I think the collaboration could be improved] when we see them as a preferred partner. We could agree on hour rates and roles. We can also get to know their other experiences.	We should keep continuity of projects. The people [who know a lot about them] will otherwise be assigned to other tasks.	Every remark I make, they try to follow up in a business case, or service. [...] It can help sometimes to win over Focallogistics.	We have 35 people from our company working here. They hear and see a lot and they know what [our company] has to offer. They can tell to me: could you explain Focallogistics how we do this?	They are improving their quality. It needs some time.	We should aim at a long-term partnership with [them]. They were always willing to collaboratively reach the goals.	We actually went from being a partner in which we could work on the entire project together, to a supplier. The collaboration is not performing well now.						
ACAP	Section 4.4. Knowledge sharing affects absorption	[We need to tell them] this is who we are, how we work and what we expect, this is what we guarantee. There has never been chosen a clear strategy.	[openness] in what are the margins, how can we share those, who benefits from what. When we know that in one project there is limited margin, we can change [our revenue model]	Openness and contractual agreements on what is allowed [would help the collaboration].	Sometimes we need to communicate better. This is something we can learn.	We discuss critical issues [regarding the design]. They are willing to share information.	We are very transparent in the goals we want to accomplish. [...] When there are issues, we listen closely to their arguments, then we make adaptations in the planning.	If we would have a mutual goal, we would chose to collaborate more often. We could intensify the collaboration	If you are open to each others vision, you could only be better.	They are very open and willing to help, but we get a lot of criticism for the fuss around the development.	Focallogistics is really open, which I admire.	You create a discussion that you want to do it differently [when coping with differences].	I think the discussions arose because of their protectionism [...]. They did not share all their information, [which hindered troubleshooting]	There has been a [profit] calculation model, on which we had a lot of discussions.	They do not want to tell too much regarding their tooling and how smart they work with them.	We need to have open communication in which we state what we are doing, and share hard decisions we need to make.	
Org. & Techn. Prox. & ACAP	Effect of individual	The director of [a company we bought], knew [them]. They got into a quarrel. The collaboration is now hampered on the highest level.	Our director knew [the acquired company's] director. This led to the collaboration.	We are dependent on which individuals with what vision are assigned to the development.	[The effectiveness] really depends on the team of Focallogistics and how much experience you have with them.	[The senior buyer] knew them from before, this led to the collaboration.	The collaboration started as [the sourcing manager] knew us. We notice that when someone in Focallogistics gets a new role, we always need to get used to this person.	The collaborator started as [we sent] employees before. They suggested to set up collaborative developments	The product owner is very important, he needs to fulfill his role well. When it doesn't happen, we have a problem.	[Our suggestions are taken differently], it depends on what engineer you are working with.	We got in contact via one of our former employees. There were individual's traits which limited the [collaboration's] effectiveness.	[The success of a collaboration] is depending on the experience of the engineer who is assigned.	One person gives you information easier than the other. I was planning to make it big. There was little attention within Focallogistics	When looking back, it seems like we were in touch with the wrong [department].	[The start of the collaboration] was highly dependent on [one of the project managers].		

Table 9: Findings listed per case I-P.

		Case		I		J		K		L		M		N		O		P	
Concept	Finding	Internal	External	Internal	External	Internal	External	Internal	External	Internal	External	Internal	External	Internal	External	Internal	External	Internal	External
Geographical proximity	Section 4.1. Virtual or face-to-face contact	It is very nice that the collaborating party is willing to come over when needed.		You can keep track on what the collaboration party is working on when you have frequent face-to-face contact. If we would have a ticket system, this would be very helpful.	With current technologies, distant collaborations are facilitated. [If you make a drawing to demonstrate something. (These are things that do not lend themselves for virtual tools)]	When someone is new to the project, they first stay 2 days here. [...] Not all topics will be discussed by Skype. When the project [is in further stages], there is less necessity for face-to-face interactions.	[Face-to-face meetings] are more effective. [...] when you meet each other for the first time, it is nice to have face-to-face. Communication tools are highly developed they are advantageous.	Always face-to-face meetings in the beginning [...] you just need to understand each other. At one moment, you can start with working by Skype.	We need to Skype, because travel time is too valuable. If you are more distant it is much harder [to have a continuous flow of information]	You can show videos to explain how it works, but the best way is to show it in practice.	Preferably, the teams are sitting next to each other. [...] This is the only way to see what the client really means. Interestingly, when they visit, the deeper they stay, the deeper we get to the actual problem, the better we could react upon.	We had engineers from them here on location to test together. In this collaboration there was no need for collaboration software [as the developments were really separated]	We use a lot of new technologies, which reduce time spent on travelling.	We don't have any view on what the other party is doing when you don't sit next to each other.	We have advanced tools, we can have Skype calls and share screens. But integration, there is no doubt about it that being on site if beneficial. both parties learn more and get more done when that happens.	Tools have been put in place to overcome far distances. However, it gets hard as everyone speaks on another medium [...] For learning, sitting next to each other is important.	Being at the customer's site, gives us the ability to have direct connection line.		
Org. & Techn. proximity	Section 4.2. Effects of technological/organizational proximity	They have quite an open culture, this matches Focallogistics'. They really proposed a solution which matched our expectations.	I believe that there is an easier access for people with the same culture and the same background, than between other nations in general. It is a strategic decision to collaborate with Focallogistics[as we learn].	The precision of work which [they have], is applicable in our development. They deliver us progress [in the development], that is the most important for now.	We had some knowledge which was not available in Focallogistics. That's why they came to us. The engineers really understood each other well [as they have the same knowledge]. This is key in the collaboration	They have a lot of knowledge regarding software, but no knowledge regarding logistics. They made a lot of good decisions [regarding software architecture] in the beginning.	[The integration works] good. Focallogistics has really high quality Software Architect which have good understanding and alignment with our Software Architects.	They are a really good component supplier. They are not designed for running more innovative projects.	I think it is a good combination that they have their specific market knowledge and we have knowledge of other industries. I found the project management of Focallogistics quite weak. It is really going with the flow.	Their knowledge is just right. They are good software engineers. They have a different sense of quality. Sometimes this goes wrong.	We decided to grow in [the logistics market, as we did market research on what industry would grow the most]. The end client, [I do not understand], I am not experienced in this, Focallogistics has 70 years of experience.	We have some knowledge to create power modules, but it is not our core business. [As they have different knowledge] they tried to push us in a certain direction.	[Focallogistics is a fast growing company, which is for us a challenge.] They challenge us to think about the technologies of tomorrow.	Because they are working with limited resources, [it limited their flexibility]. We were like, just get some guys together. However, they couldn't realize it.	The interest [to collaborate] was due to the fact that we had the ability to help companies develop an autonomous guided vehicle.	They are a software company, we aren't. We can learn from their best practices they developed, which are new to us.	We try to prevent Focallogistics making the same mistakes as we did within other organizations [as we have more experience].		
ACAP and Geo., Org. and Techn. proximity	Section 4.3. Acquisition of knowledge from external partner Adaptation/flexibility to partner Increased proximity's effect	We found that the requirements weren't developed clearly. We need to look into it in the future.	We grew our knowhow in the market, and we benefit from this.	We learnt how to produce with an innovation partner. [...] We also need to learn from them how they work with startups.	[We learn] regarding the technology and its applications. Also [...] you learn how the organizations is working, who you need in certain situations, and why they make certain decisions	I try to educate them, take them to the end client. I heard they develop some what-if analyses, what kind of questions I could pose to them.		We didn't learn anything from them. The lessons we learnt is how to collaborate in innovation...	We learnt in terms of project management. [...] But also in the technology we made improvements.	From domain knowledge point of view, we learnt a lot, because Focallogistics is a mastermind in that.	[During testing] they explain to us; because of your system, the technology is reacting like this. We had a constant learning curve. [...] We also got to know the right people.	Also technologically we learnt regarding the projects that fail or do not fail. [...] We get to know them much better and which connections should be tapped. [...]	[...] we did not have the smartest algorithms. There has been some learning. Basically we learnt why we want things different now, and work in a whole different way with another party.	I think there were some advantages [to learn from the external party. [...] we bring things to the table.	The main goal is to learn from the external party. [...]	The major advantage is that we have advanced knowledge and more experience in certain areas. The collaboration is designed to transfer this [knowledge].			
		They assigned an intermediary from the Netherlands. However, an intermediary [as a filter] inbetween actors in a R&D collaboration does not really make an addition.	We hired a [Dutch] account manager, as we decided to become more proximate to Focallogistics. We try to bridge those gaps with extra effort from our side.			They celebrate Christmas on a different day as we do. [...] I try to be available during Christmas.							We had to prove their ideas were not appropriate to us.			we are going to move in to ourselves [to their communication technology].	They adjust themselves to our pace. I really like the party we are working with.		
		But we see that we don't do enough of [information exchange sessions] to identify what other innovation potential is there.	We should be connecting on other levels of the company as well. [...] We can maybe also do more [projects] in other domains].			We should educate these kind of companies the context [of logistics]. My gut says that there is more potential in these companies.			They are a component supplier, they are used to deliver according specs. [...] We challenged them a lot, but I think it was out of their comfort zone.	We did some collaborative developments before, but this was on another scale! This was really R&D, instead of adding a particular component.			We just need to practice to collaborate more often. However, when we put a lot of effort in [a development], and if it is not implemented in their systems, it works demotivating.					We know there are ideas to do something with data. [...] The collaboration is going well, but we can build on our new collaboration.	
ACAP	Section 4.4. Knowledge sharing affects absorption	[We miss some evaluation moments in the collaboration], that we express everything freely.	It is hard to say [if the implementation of the product works]. They are not transparent to us.	It would be nice to meet with the higher management to see how they think about [certain decisions that were made].	We do not really learn from them [...]. Because they are developing really isolated, nobody is keeping contact with them.		I think they need to be open in what kind of party they are. If you are not working like this, it hurts your reputation.	I think it is important to have continuous information exchange on what the companies are doing. Something without a result, is also a result.	When I run into issues, I discuss it with the team.		[During testing] they explain to us; because of your system, the technology is reacting like this. We had a constant learning curve		[We dealt with the differences between the companies by having] honest and open conversations on both sides.		Issues are always addressed consciously, in a discussion and open communication, setting goals.				
Org. & Techn. Prox. & ACAP	Section 4.4. Effect of individual	[One of our employees] suggested that we wanted to collaborate with a party like [I]		We had a shift in project managers, up to 3 times. This did not favor our developments.	When you have a more technically oriented manager, he understands. A more commercial one does not.	Our department in Germany did developments with them. We made a direct link after. This led to the start of the collaboration		[During the preparations of the development] I think we were talking to the visionary of the company	They are good software engineers. Nevertheless, sometimes teams are varying.		We also got to know the right people. The right people for the right questions.	We started the collaboration as someone we knew started [there]			Someone knew [P], so they thought we will have a pilot with them.	We started the collaboration as we knew their directors from previous jobs.			

5. Discussion & Conclusion

Taking the previous findings into account, this section attempts to put these into perspective. Several contributions were made in this study, which will be reflected to the theory. For the different literature strands that were tapped, respectively OI, Proximity and ACAP a reflection is given. Subsequently, it provides an concluding answer on the main research question on *how should the company make better use of external partners in their innovation process to improve collaboration performance?* Thereafter, the limitations of the research as well as suggestions for future research are given. Lastly, this thesis denotes the practical implications relevant for company managers.

5.1. Theoretical implications

This paper began with the description of the “*proximity paradox*”, in which collaborations benefit from both high as well as low levels of proximity. This research underlines findings of previous research in describing that paradox. However, it contributes by delivering empirical evidence to support a dynamic approach of proximity. Thus, one does not exclude the other per se. For the dimensions of proximity that were proposed to be relevant in interorganizational context (geographical, organizational and technological), results show that a dynamic approach would be more appropriate. This is in accordance with the recent literature review by Balland, Boschma and Frenken (2014). However, as Knobon and Oerlemans (2006) pointed out that proximities could be analyzed on both structural and dyadic level of analysis. This research started with the problem of a company and therefore the dyadic level of analysis was taken into account. Hence, this research makes a contribution by illustrating that dynamic approach of proximity would also be appropriate on the dyadic level of analysis (Table 10).

In fact, ACAP was put forward as the dominant mechanism in order to create organizational and technological proximity growth (Section 4.3.). In the recent review of Balland and colleagues (2014), the increasing knowledge base overlap was accounted as a consequence of learning (Balland et al., 2014), a similar mechanism (Volberda et al., 2010). Previous research already demonstrated that a firm’s changes are a consequence of ACAP (Todorova & Durisin, 2007; Van den Bosch, Volberda, & de Boer, 1999; Volberda et al., 2010; Zahra & George, 2002). However, this research delivers an in-depth description of the knowledge absorption process. This thesis split ACAP in two consecutive functions; PACAP and RACAP (Zahra & George, 2002). By making this distinction, the richness and multidimensionality of the concept remained (Volberda et al., 2010), leading to greater understanding of the concept.

Findings demonstrate that a company could decide to collaborate with a partner under conditions of lower technological and organizational proximity. In accordance with the proximity paradox, this leads to more innovativeness, while hindering mutual understanding in the collaboration (Enkel et al., 2018; Nooteboom et al., 2007). This positively influences PACAP, as collaborating firms are exposed to new knowledge, such as market and technological knowledge as well as norms, routines and processes. Subsequently, the actual technological and organizational proximity growth is accounted to the RACAP function, as it contemplates the transformation of knowledge structures (Zahra & George, 2002)(Section 2.3.). As a consequence of these transformations, mutual understanding is increased, increasing collaboration performance. Interestingly, when becoming more proximate, this is detrimentally for innovativeness in a collaboration. This was previously questioned by Balland and colleagues (2014). Namely, PACAP evades over time, given that less *new* knowledge is absorbed. A similar phenomenon was previously described in the co-evolutionary theory of firm ACAP,

in which one firm acquires only knowledge which is related to its existing knowledge base (Van den Bosch et al., 1999; Volberda et al., 2010). In this case, the cumulative knowledge base of both collaborating parties, seen from a relational view perspective. Thus, after increasing proximity, companies risk a competency trap (Van den Bosch et al., 1999).

Taking the latter into account, this fills in a research gap that was defined by Volberda and colleagues (2010). They state that research should be explicit about what knowledge is absorbed. This research suggests that, when collaborating under conditions of low technological and organizational proximity, absorption exists of market and technological knowledge, norms, routines and processes.

Also other mechanisms were found to increase proximity, such as arising connections between peers from both firms during a collaboration. This reflects an increase in social proximity, being part of organizational proximity (Knoben & Oerlemans, 2006). Arising connections come with better access to critical information within a firm. The improved access to critical information, by the formulation of interaction routines was previously described as “Partner-Specific ACAP” (Dyer & Singh, 1998). Hence, the creation of Partner-Specific ACAP in a collaboration seems to be highly dependent on arising connections between peers.

Lastly, increasing geographical proximity was noticed as a consequence of the relocation of employees more closely to the collaboration partner. A summarization of the mechanisms which are relevant in the creation of proximity is delivered in Table 10.

Table 10: Mechanisms leading to proximity growth.

Proximity	Technological	Organizational	Geographical
Mechanism for proximity growth	PACAP and RACAP of: <i>Market & Technology knowledge</i>	PACAP and RACAP of: <i>Norms & Routines</i>	Relocation of employees
		Connecting	

At a certain moment, new collaboration partners are connected with. In general, new collaborations started when particular knowledge is required for a development. Perhaps, as a consequence of changing environmental conditions, as for example the introduction of new technology as mentioned in co-evolutionary theory of ACAP (Van den Bosch et al., 1999; Volberda et al., 2010). However, many new collaborations start as a consequence of already existing peer connections between partners. This implicates that organizational ACAP is highly dependent on actions of the individuals within an organization. This is in accordance with previous suggestions in literature (Cohen & Levinthal, 1990; Volberda et al., 2010). On top of that, one individual seems to be responsible in determining whether future collaborations are characterized by lower or higher levels of proximity (Section 4.4.3.). After starting a collaboration, a repetitive pattern exists of proximity growth between partners (Figure 9). The characteristics of each phase are given in Table 11.

The company benefits from both low as high levels of proximity, dependent on whether innovation is intended or not. Hence, a firm needs to carefully balance both low as high levels of proximity collaborations to increase innovativeness, while keeping collaboration performance. Hence, the company would benefit from creating long-term oriented partnerships to benefit from proximity growth and improved collaboration performance. In the meantime, partnering with other (low-proximate) firms would be advisable in order to keep the inflow of new knowledge.

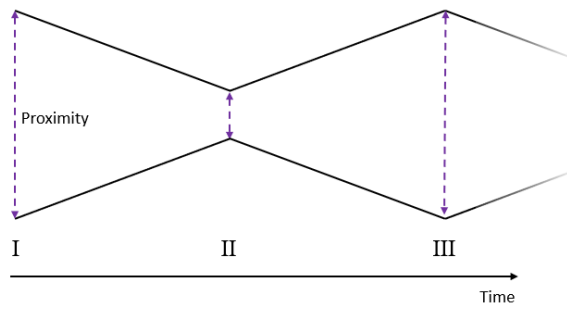


Figure 9: Co-evolution of ACAP and Proximity.

Table 11: Relation of Proximity on ACAP, Transaction Costs and Innovativeness

Time Phase	I	II	III
Proximity	Low	High	Low
Potential ACAP	High	Low	High
Realized ACAP	Low	High	Low
Innovativeness	High	Low	High
Collaboration performance	Low	High	Low

The finding that ACAP could create proximity growth, also comes with further implications for the ACAP concept. The widely accepted consensus was that knowledge base similarity is beneficial for ACAP (Cohen & Levinthal, 1990). As mentioned in theory Section 2.5., understanding between collaboration partners to a certain extent need to exist, but knowledge could be varying on the specialized level in order to create knowledge absorption (Cohen & Levinthal, 1990; Enkel et al., 2018; Knoblen & Oerlemans, 2006; Lane & Lubatkin, 1998; Nootboom et al., 2007; Volberda et al., 2010). Therefore, previous research demonstrated organizational and technological proximity as an antecedent of ACAP. This research contributes that low technological and organizational proximity could also increase ACAP, as more *new* knowledge is brought to the company, increasing PACAP (Section 4.3.). However, whether this knowledge is transformed into existing knowledge structures, is accounted to the effectiveness of the RACAP function.

In addition, this thesis contributed to the debate regarding the definition of ACAP (Section 2.3.1.). This research adopted the Zahra and George (2002) definition of ACAP; *acquisition, assimilation, transformation* and *exploitation* of external knowledge. Findings in this thesis support the argument of Todorova and Durisin (2007) that knowledge structures do not necessarily need to transform after the Acquisition of external knowledge. Namely, they argue that firms “*transform their knowledge structures when knowledge cannot be assimilated*” (p.778). Collaborations which are characterized by low technological proximity use predefined connection points to interact with external technology. Thus, by surpassing the Transformation function, companies are able to both successfully Acquire, Assimilate and Exploit external knowledge.

5.1.2. Individual effects of the dimensions of proximity

Also, this thesis would like to reflect on the effects that the proximity dimensions have on collaboration performance and innovative performance. Regarding geographical proximity, debate exists regarding its effect. Recent research argues that the need for geographical proximity declined, as a consequence of the increase in adoption of virtual tools (Guan & Yan, 2016). Other research stated that geographical

proximity positively affected a collaboration (Boschma, 2005; Knobens & Oerlemans, 2006), by bringing parties together to increase tacit knowledge exchange (Gattringer et al., 2017). In this research, the latter is proposed. In fact, face-to-face contact remains an important factor, leading to collaboration performance. As proposed in the results, this comes with either geographical proximity or geographical dispersion (Section 4.1). Two explanations could be given. First, the intensity of interaction is increased when having multiple day visits. An increase in intensity of a firm's efforts to identify and gather knowledge can determine the quality of a firm's acquisition capabilities (Zahra & George, 2002). Another possibility could be the creation of stronger ties when having informal contact by staying multiple days. Relationships could be strengthened as a consequence of informal contact. Previous research mentioned a relation with tie strength and tacit knowledge sharing (Volberda et al., 2010). In fact, this could be an explanation for the unexpected finding of Bell and Zaheer (2007) who found an increase in knowledge flow exists when parties are more geographically dispersed.

Regarding the other two dimensions, respectively organizational and technological proximity, similar patterns seem to exist. The dimensions are highly interrelated, which could be an explanation of these pattern similarity (Knobens & Oerlemans, 2006). Results accord with previous proximity research in which technological proximity increases mutual understanding in a collaboration (Enkel et al., 2018; Nooteboom, 2000). Also, it corresponds to the findings of Lane and Lubatkin (1998). They argued that not only knowledge base similarity, but also organizational similarity to be relevant to create mutual understanding. This reflects organizational proximity. However, when innovation is intended, firms tend to look for complementary knowledge which is not available within the firm to enable certain developments, thus low technological proximity. This matches the finding of previous research, which stated that collaboration parties are selected on bases of its knowledge contribution (Emden et al., 2006; Rothaermel & Boeker, 2008). When firms look for dissimilar knowledge bases, the highest heterogeneity of knowledge could be realized in order to generate innovation (Nelson & Winter, 1982).

One serendipitous finding is the effect that an individual has on proximity. In this research, the group level of analysis was adopted (Section 3.2.). Knobens and Oerlemans (2006) already defined a difference between the structural and the dyad level of proximity. Here, the findings suggest to also analyze proximities on the individual level. For ACAP, this is actually already the case. In the literature review of Volberda and colleagues (2010), is described that ACAP is dependent on the traits of an individual.

5.1.3. Implications for Open Innovation

Lastly, a reflection is given on the context of the research, Open Innovation. This research brings the proximity dimensions which are relevant in interorganizational collaboration (Knobens & Oerlemans, 2006) together with the ACAP (Cohen & Levinthal, 1990) and OI literature (Chesbrough, 2003). The results in this thesis give an explanation why certain collaborations provide more value than others. This research fills the research gap which was defined by West and Bogers (2014), which asked for a research that could better describe the differences in OI value capturing between project and firms (p.825). This research contributes by suggesting that the proximity that exists within a collaboration, as well as ACAP, explains the difference in OI outcomes. Specifically, the greater the ability one party has to grow proximity with a partner which is characterized by low technological and organizational proximity, the more innovativeness could be acquired while keeping mutual understanding, thus collaboration performance. Taking this all together, results in the suggestion that the ability to select

on both low organizational and technological proximity, while growing proximity during a collaboration, the highest value could be acquired by a collaboration partner.

Also, in Open Innovation, a debate exists whether companies benefit from either more openness or protection of their knowledge (Lauritzen & Karafyllia, 2019; Laursen & Salter, 2014). The findings in this thesis suggest that more openness would be advantageous. It increases knowledge sharing which is beneficial to increase both organizational and technological proximity. In previous research, knowledge sharing was already showed to bridge the knowledge gap as a consequence of low technological proximity (Enkel et al., 2018). It was also shown to increase ACAP (Volberda et al., 2010). This thesis brings the arguments together by describing the effect of knowledge sharing on ACAP in a collaboration, consequently increasing technological proximity. Also, it demonstrates that not only technological proximity could be increased, but also organizational proximity.

Lastly, this research denotes the effect of power relationships in OI. Namely, bargaining power increases ACAP, resulting in proximity growth. As the focal firm is characterized by high bargaining power, it was proposed that this affects the motivation to adapt for the collaboration partner. In the model of Todorova and Durisin (2007), power relationships were already mentioned to moderate between ACAP and competitive advantage, as parties are risking to become customer compelled. Apparently, this also applies for this research, as companies become less innovative when collaborating. Previous research already demonstrated that adaptations by a supplier in buyer-supplier relationships as a consequence of power are a common phenomenon, (Nyaga, Lynch, Marshall, & Ambrose, 2013). Thus, these also apply in the context of OI.

5.2. Conclusion

This thesis remains only to reflect upon the main research question. In this section, the thesis provides an answer on *how should the company make better use of external partners in their innovation process to improve collaboration performance?* In short, companies could benefit from both high as low levels of geographical, organizational and technological proximity. However, most value is acquired when selecting on low levels of proximity. Subsequently, the firm would benefit from increasing partner proximity, resulting in increased collaboration performance.

On the one hand, to improve innovativeness, the firm would benefit from collaborations in which less organizational and technological proximity exists. An increased heterogeneity of knowledge could be realized when collaborating under conditions of low organizational and technological proximity. However, it increases the risk of misinterpretations between collaborating parties. On the other hand, collaboration performance is mostly benefited from high levels of organizational and technological proximity, as it increases mutual understanding. Also for geographical proximity a paradox seems to apply. The collaboration is benefited by both low as high levels of geographical proximity. This implicates that collaborations would be best off when either sitting next to each other, or when longer visits (multiple-days) are necessary, as travel times do not allow for single day visits.

Even though paradoxes were described, one does not rule out another. This research found that mechanisms exists that could increase proximity. Thus, companies tend to become more proximate during a collaboration over time. These mechanisms are respectively ACAP, connecting and relocation of employees. For ACAP, both absorption of market and technology knowledge, as well as norms, routines and processes contribute for an increase in technological and organizational proximity. Connecting with stakeholders also results in greater organizational proximity. Lastly, relocation of employees reduces spatial dispersion, thus increasing geographical proximity. However, an increase in proximity could result in an decreased innovativeness.

5.3. Limitations and suggestions for future research

This research comes with several limitations. The sample that was used is limited to the collaboration partners for only one company, active in the CoPS industry. The findings are based on an industry which is characterized by high impact of risks. This strongly affects organizational culture, and thus findings for organizational proximity. Generalizability must therefore be considered. Even though both internal and external perspectives of the collaboration are evaluated, additional research is needed to show whether noticed effects are also apparent in other firms.

Also, the firm brought limitations in the sampling method. As snowball sampling was needed in order to identify collaboration partners, this could lead to bias in the data which could be a limitation to the reliability of this work. As only one individual was interviewed per collaboration, perceptions could only be assessed of one person. As mentioned before, collaborations are affected by the actions and opinions of one individual. Hence, opinions regarding the collaboration could be differing throughout the firm.

As proximities are highly interrelated (Knoben & Oerlemans, 2006), discussion could arise whether some of the findings would be allocated accordingly. For example, the organizational dimension is rather extensive. As the focal firm is active in the logistical market, which is focused on risk reduction, this leads to the creation of high quality norms. This reflects a high interrelatedness between the concepts.

On top of that, validity of the questionnaire that identified for existing partner proximities could be questioned. Especially for the proxy of organizational proximity was found that interpretations of certain questions was not conform expectations. Therefore in future research, proxies should be validated in order to identify for the dyadic level of organizational proximity. Furthermore, as employees are relocated frequently, the validity of the geographical proximity proxies in the survey could be questioned. The physical distance between interacting firm locations does not seem an appropriate measure for geographical proximity when employees are relocated in a collaboration. Future research could correct for detached employees.

As mentioned in section 3.1.1., no questionnaire items were found for the concept of ACAP in a dyadic relationship. However, to quantify whether knowledge is absorption from a partner, validated questions could be posed. The interview guide (Appendix F) offers a starting point in developing those questionnaire items.

This research also forms a basis for other research topics. First off, even though this research tried to show correlation between the concepts, the dataset did not allow for the use of statistical tests. Hence, these propositions need to be tested by means of quantitative research. Here, also a longitudinal research designs would be beneficial in order to describe the dynamic process of proximity growth (Langley, 1999). Besides, many research on interorganizational collaboration has been conducted on the firm level of analysis. This research demonstrates that understanding could be improved by analyses on multilevel perspective, including the individual. For example, the motivations for an individual on the decision for a particular party would increase understanding on how firms remain innovative.

Second, this research proposes a balance to be made in partnerships in which low and higher levels of proximity exists. However, unclarity remains on what balance is would be most beneficial in a CoPS industry for increased competitive advantage. Lastly, with further proliferation and improvements of virtual tools (Gilson et al., 2015), it would be interesting to reanalyze the effect of geographical proximity in the long run. As certain interviewees already mention now; face-to-face

contact was replaced by virtual tools. However, face-to-face contact still existed next to virtual contact. Technological developments in virtual tooling may further replace face-to-face contact by tools.

Lastly, this research only describes the phenomenon of increasing proximity. Future research could specifically analyze whether proximity could also decrease proximity after a collaborations stops.

5.4. Managerial implications

Companies face the “*proximity paradox*” in the decision of a collaboration partner. This paradox implicates that lower levels of proximity increase innovativeness, while hindering mutual understanding, thus collaboration performance. The contribution of technological and market knowledge, norms, routines and processes result in greater innovativeness instead of when collaborating with a partner with equivalent knowledge (Nooteboom et al., 2007). When there is little understanding of the external technology, it could be incorporated as a “*black-box*”. It should be taken into account that this comes with risks; misunderstandings could arise and inability to deliver to certain requirements could exist. However, these problems could be overcome when collaborating for longer durations, as parties become more proximate, thus similar to one another over time.

Different mechanisms were found to become more proximate. To achieve more technological and organizational proximity, knowledge absorption from the collaboration partner needs to exist, as well as rising connections between stakeholders. Lastly, to become more geographically proximate, teams could be relocated. The latter is important, as face-to-face contact remains an important factor in order to enhance the mutual understanding.

Sharing knowledge contributes on the knowledge absorption. This is realized by proper goal formulation, being open to a partner by sharing decisions, sentiments and technology. On top of that, direct connections on equivalent levels between firms and demonstrations of technology to one another are a manner to increase knowledge sharing.

To reap the benefits from this proximity growth, a firm should create a network of specific partners to whom development tasks could be outsourced. In this research is suggested that synergies could be created when collaborations have long-term collaboration intentions instead of single projects. Companies seem to acquire better understanding of each other’s technology, market, norms, routines and processes while collaborating. Collaboration performance is proposed to increase by creating this mutual understanding. Hence, shifting from collaboration partner would result in a loss of accumulated knowledge regarding a collaboration partner. Therefore, compiling a specific set of development partners which demonstrated to have the ability to adapt to the focal firm in certain developments would be advisable to take advantage of broader capabilities than the firm could in isolation. But again, when innovation is intended, the incorporation of a new partner would increase “*out-of-the-box*” insights.

One serendipitous finding is that personal traits of an individual who is active in a collaboration seems to affect the described proximity thus similarity between the companies. Consequently, companies need to be carefully allocate stakeholders (both internally and externally) to a collaboration. When a collaboration performs well and stakeholders are assigned to another project, this comes with risks, as accumulated knowledge on technology, market, norms, routines and processes could set off.

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Appendix A: Explorative Interviews

Abbreviation	Role	Department
R&D1	Managing Director R&D	R&D
R&D2	Senior Patent Counsel	R&D
R&D3	Senior Manager Technology Exploration	R&D
R&D4	Program Manager	R&D
R&D5	Senior Systems Engineer	R&D
R&D6	Senior Manager Technology and Intellectual Property	R&D
SC1	Senior Sourcing Manager	Supply Chain
SC2	Executive Manager Supply Chain Development	Supply Chain
<i>Total sources</i>		<i>8</i>

Appendix B: Managers' correspondence

From: [redacted]
Sent: donderdag 19 juli 2018 18:41
To: [redacted]
Subject: Thesis topic - Increase R&D's innovation capability by developing its absorptive capacity capabilities
Categories: Red Category

Hoi [redacted] nog even voor mijn vakantie hieronder de info tav thesis opdracht. Ik heb de aanpak van [redacted] overgenomen. Deze lijkt me hier ook van toepassing. Ik zag ook dat literatuurbronnen (o.a. Chesbrough) overeenkomen met dit onderzoek.

Groet, [redacted]

Thesis topic - Increase R&D's innovation capability by developing its absorptive capacity capabilities

Research Question

→ How can a firm's R&D improve its innovation capability by developing or improving its absorptive capacity capabilities, to better assess decisions regarding external R&D and manage the R&D absorptive capacity in a more systematic, validated and well-informed manner?

Approach

According to the conceptual Project Design method inspired by the book 'Problem Solving in Organizations' by van Aken et al. (2012). An overview of the Conceptual Project Design can be seen in Figure 4 below. The research approach of the thesis should take two different pathways, a theoretical and a practical approach. The theoretical approach uses academic literature as a secondary data source to define the research problem and to produce a theoretical background and framework. This information was gathered through a systematic literature review as large varieties of academic literature need to be reviewed to identify a gap (van Aken et al., 2012). The empirical pathway gathered primary empirical data through interviews, documents and archives in a cross-case analysis.

Appendix C: Case and interviewee characteristics

Case	Nr. of employees	Multinational company	Dutch contact available	Spending position*	Focal firm contact		External contact			
					Position	Years of experience in role	Position	Years of experience in role		
A	100-499	Yes	Yes	C	Business Development Manager	3,5	4	Product Manager	2	2
B	100-499	No	Yes	B	Technical Architect	5	9	Business Developer	9	9
C	100-499	Yes	Yes	A	Project Manager	0,5	0,5	Account Manager	4	0,5
D	>500	Yes	Yes	A	Product Owner	3	2	Account Manager	3	3
E	1-49	No	Yes	A	Project Manager	6	2	Director	4	3
F	>500	Yes	Yes	D	Senior Engineer	5	12	Engineering manager	4,5	8
G	1-49	No	Yes	B	Senior Engineer	12	2	Director	2	2
H	1-49	No	Yes	B	Project Manager	6	1,5	Director	3,5	2
I	>500	Yes	No	C	Senior Engineer	0,5	5	Director Sales & Marketing	8	12
J	100-499	No	Yes	A	Program Manager	0,5	2,5	Business Developer	0,5	0,5
K	100-499	No	No	A	Product Architect	3,5	3	Project Manager	1,5	0,5
L	>500	Yes	Yes	B	Program Manager	0,5	1	Account Manager	5,5	4,5
M	>500	Yes	No	A	Product Owner	5	3	Project Manager	2,5	1,5
N	>500	Yes	Yes	D	Project Manager	1	3	Account Manager	2	5
O	1-49	No	No	B	Project Manager	5	1	Sales director	4	8,5
P	100-499	Yes	Yes	A	Director	2,5	2	Commercial manager Development manager	5	3
								Commercial director	2	2

*Spending position on R&D budget	
A	1-10
B	11-20
C	21-30
D	31-40

Appendix D: Questionnaire development

Question	Dimension	Question	Scale	Adapted from
1	Geographical proximity	Location from which main developments are made? (Distance between the interaction organizations)	km	Sorenson & Audia (2000); Guan & Yan (2016); Funk (2014)
2	Development phase activity	In which phases of developing a new product is the external party incorporated?	<ul style="list-style-type: none"> Idea screening, market and technology feasibility assessment, and marketing plan development Product design and development Prototyping and trial tests Full production and market launch 	McNally et al. (2011)
3.1	Organizational proximity	Between our firm and the supplier (or customer), we share common goals and objectives.	Likert-type 7-point scale format ("strongly disagree" to "strongly agree")	Cheung et al. (2010)
3.2		There is a match in our philosophies/approaches to business dealings.		Sáenz et al. (2014)
3.3		We share a similar corporate culture and management style.		
3.4		Between our firm and the other, we have a similar organization structure.		
3.5		Our firm has similar contacts as the other (e.g. competitors, customers).		Knoben & Oerlemans (2006)
4.1	Technological proximity	Between our firm and the other, we work with similar or related technology.	Likert-type 5-point scale format ("strongly disagree" to "strongly agree")	Knoben & Oerlemans (2006)
4.2		The technological knowledge with which the other party works, is similar to ours.		
4.3		The market knowledge with which the other party works, is similar to ours.		
5.1	Radical/Incremental innovation	This was a unique new product project that did not directly build on technology of an existing product line.	Likert-type 7-point scale format ("strongly disagree" to "strongly agree")	Sivadas & Dwyer (2000)
5.2		This project capitalized on existing technology but represents a significant extension of technology existing within the company.		
5.3		The product was pioneering, first of its kind (e.g., the first PC, portable stereo, or diet soda ever introduced in the market).		
5.4		Similar products were available in the market when we introduced our product into the market.		
6.1	Collaboration performance	In your overall assessment, how has the alliance performed as compared to your expectations?	Likert-type 5-point scale format ("very poorly" to "very well")	Parkhe (1993); Lane & Lubatkin (1998)
6.2	Time-to-Market	How would you rate the collaboration on the time taken to develop the product?	Likert-type 5-point scale format ("strongly disagree" to "strongly agree")	Sivadas & Dwyer (2000)
7	Incompleteness of contract	Purchasing contracts may specify the design features of the item(s), such as the type of materials to be used. How would you describe the arrangement for design specifications for the item(s) under this contract?	<ul style="list-style-type: none"> No changes in design specs permitted. Mutually approved changes in design specs permitted. Unilateral changes in design specs are possible. Contract does not specify the design features of this item(s). 	Ghosh & John (2005)

Appendix E: Questionnaire

Answer the following questions from your company's perspective:

1. Location from which main developments are made: _____

2. In which phases of developing a new product is the external party incorporated?

Idea screening, market and technology feasibility assessment, and marketing plan development	Product design and development	Prototyping and trial tests	Full production and market launch
--	--------------------------------	-----------------------------	-----------------------------------

3. To what extent do you agree or disagree with the following statements?

strongly disagree

strongly agree

	1	2	3	4	5	6	7
3.1 Between our firm and the other, we share common goals and objectives.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.2 There is a match in philosophies/approaches to business dealings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.3 We share a similar corporate culture and management style.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.4 Between our firm and the other, we have a similar organization structure.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.5 Our firm has similar contacts as the other (e.g. competitors, customers).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. To what extent do you agree or disagree with the following statements?

strongly disagree

strongly agree

4.1 Between our firm and the other, we work with similar or related technology.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2 The technological knowledge with which the other party works, is similar to ours.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.3 The market knowledge with which the other party works, is similar to ours.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. To what extent do you agree or disagree with the following statements?

		strongly disagree					strongly agree	
		1	2	3	4	5	6	7
5.1	This was a unique new product project that did not directly build on technology of an existing product line.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.2	This project capitalized on existing technology but represents a significant extension of technology existing within the company.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.3	The product was pioneering, first of its kind (e.g., the first PC, portable stereo, or diet soda ever introduced in the market).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.4	Similar products were available in the market when we introduced our product into the market.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. How would you evaluate the collaboration on the following statements?

		very poorly			very well	
6.1	How would you rate the collaboration on the time taken to develop the product?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.2	In your overall assessment, how has the collaboration performed as compared to your expectations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7. Purchasing contracts may specify the design features of the item(s), such as the type of materials to be used.

	No changes in design specs permitted.	Mutually approved changes in design specs permitted.	Unilateral changes in design specs are possible.	Contract does not specify the design features of this item(s).
How would you describe the arrangement for design specifications for the item(s) under this contract?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Interview guide

Proximities in interorganizational collaboration: its effect on Absorptive Capacity

By Doeke Dorhout BSc.

Name respondent: _____

Date: _____

Introductie (max. 2 min)

- Bedanken deelname interview
- Doel: Samenwerking verbeteren tussen VI en partners.
- Soort vragen: vragen met betrekking tot de verschillen tussen ontwikkelingspartners en VI en wat voor effect zij hebben op de samenwerking.
- Verantwoordelijke instantie: TU/e en VI
- Duur: 40 min
- Publicatie resultaten: van de zomer
- Steekproef: 20 belangrijkste ontwikkelingspartijen in 2018 van VI worden meegenomen.
- Mogelijkheid tot anonieme verwerking
- Mogelijkheid om interview op te nemen

Achtergrond informatie (2 min)

Wat is uw rol binnen...?

Hoe lang bent u werkzaam in deze rol en binnen dit bedrijf?

Vanaf wanneer werken de twee partijen samen?

Vanaf wanneer bent u zelf betrokken in de samenwerking?

Hoeveel werknemers heeft uw bedrijf?

Middenstuk (30 min)

1. Hoe is de samenwerking tot stand gekomen?

- Hoe kennen de bedrijven elkaar?
- Bijv. vakbeurs/congres, advertentie, via-via, bekenden binnen bedrijf

2. **Alleen VI interview:** Waarom is de keuze voor juist deze betreffende partij gemaakt?

- Bijv. er was een 'click' tussen de twee bedrijven
- Bijv. de partij liep voorop in dit technologische vlak

Alleen extern: Was er een specifieke reden om opdrachten van deze partij aan te nemen?

- Was er meer dan alleen een financieel motief?

3. Hoe onderhouden jullie het contact gedurende de samenwerking/ontwikkeling?

- Bijv. elkaars vestigingen bezoeken
- Bijv. gebruik van IT tooling (Zie vraag 6)

4. Hoe intensief is het contact tussen de twee samenwerkende partijen?

- Opdracht wordt weggelegd en daarna in afgezonderd ontwikkeld
- Er is veel interactie van bedrijven (wekelijks/dagelijks)

5. Hoe wordt er gebruik gemaakt van (IT) tooling voor informatie-uitwisseling?

- Skype/mail/andere
- Werken vanuit de Cloud
- Projectmanagement tools etc...

6. Hoe verloopt de integratie/opname van de extern ontwikkelde technologie, in de systemen van VI?

- Hoe sluiten de VI en externe technologie op elkaar aan?
- Is er weerstand vanuit VI?
- Is het plug 'n play of heeft het meer voeten in aarde?



7. Hoe trekken jullie lering uit een samenwerking?
- Wat hebben jullie geleerd van de ander partij?
 - Wat voor lering zou je verwachten?
(tooling/technologie/praktijken/processen)



Bedrijven zijn verschillend op allerlei manieren:

- **Geografische ligging**
- **Organisatiestructuur en cultuur**
- **Technologische kennis**

8. Wat zijn de voordelen voor de samenwerking, als gevolg van de verschillen?

- Innovativiteit, creativiteit, “out-of-the-box thinking”
- Complementariteit van middelen/snelheid van ontwikkeling
- Risico's van een project konden beter worden geïdentificeerd

9. Wat zijn de problemen/uitdagingen voor de samenwerking (als gevolg van de verschillen)?

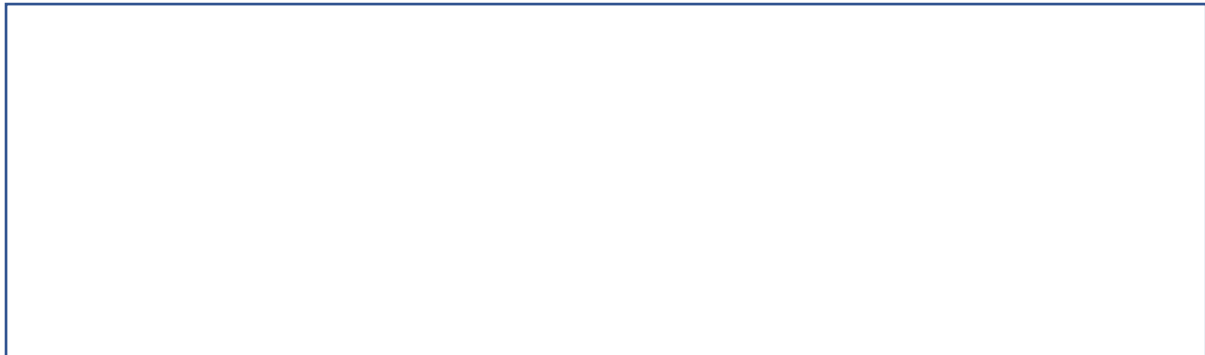
10. Hoe wordt er omgegaan met de verschillen tussen de organisaties ter behoeve van een goede samenwerking?

- in technologische kennis en achtergrond
- in bedrijfscultuur/structuur/doelen
- in locatie



11. Kijkend naar de verschillen, hoe goed verloopt de samenwerking?

- Time-to-market beter dan interne productie?
- Innovativiteit / “out-of-the-box thinking” / creativiteit
- Effectiviteit
- Efficiency
- Uitkomst van de samenwerking
- Communicatie



12. Hoe zou de samenwerking verbeterd kunnen worden?

- Wellicht nog iets buiten de context van het voorgaande?

Epiloog (1 min)

Heeft u nog verdere vragen of opmerkingen?

Hartelijk dank voor het kunnen afnemen van het interview.

Zal ik u op de hoogte houden van de resultaten van het onderzoek?

Interview guide

Proximities in interorganizational collaboration: its effect on Absorptive Capacity

By Doeke Dorhout BSc.

Name respondent: _____

Date: _____

Interview (EN)

Introduction (max. 2 min)

- Thank interviewee
- Goal: improve collaboration between VI and external parties
- Sorts of questions: questions regarding the differences between collaboration parties and their effect on the collaboration performance
- Responsible authority: TU/e and VI
- Duration: 40 min
- Results publication: during summer
- Sample: 20 most important development parties of VI in 2018.
- Possibility for anonymous processing
- Possibility to record the interview

Background information (2 min)

What is your role within ... ?

Since when are you working in this role and within this company?

Since when are the two companies collaborating together?

Since when are you involved in the collaboration?

Main part (30 min)

1. How did the collaboration start?

- How did the companies meet each other?
- E.g. industry meeting/congress, advertisement, knowing people within the company

2. **Only VI interview:** Why did you select this particular partner?

- E.g. there was a 'click' between the two companies
- E.g. the party was leading in technology

Only third party: What was the reason for accepting this particular assignment(s)?

- Was there more than just financial motives?

3. How do you monitor/report during the collaboration/development?

- E.g. visit each other's firm
- E.g. use of IT tools (question 6)

4. How close is the contact between the your company and the other?

- Assignment is delivered, no further contact exists until implementation
- Close contact between the companies, exchanging feelings regarding the development (weekly/daily)

5. How do you use (IT) tooling for information exchange between the collaborating parties?

- E.g. Skype/mail/other
- E.g. cloud based working
- E.g. other project management tools

6. How does the integration work of external technology in the systems of VI?

- Is it 'plug and play' or are there any complications?
- Was it hard to manage the stakeholders?

7. How do you learn from this collaboration?
- What did you learn?
 - What kind of learning would you expect?
 - (tooling/technology/practices/processes)

Companies are different in all sorts and manners.

Geographically

Organization structure and culture

Technological knowledge

8. What are the advantages for the collaboration as a consequence of the differences?

- Innovativeness, creativity, out-of-the-box thinking
- Complementarity of resources/speed of development
- Risks could be identified better

9. What are the problems/challenges for the collaboration as a consequence of the differences?

10. How are the differences between the companies being dealt with in order to collaborate successfully?

- Technological knowledge and background
- Organizational culture
- Geographical dispersion

11. Looking at the differences, how would you rate the collaboration?

- Time-to-market better than internal development?
- Innovativeness/"out-of-the-box thinking"/creativity
- Effectivity
- Efficiency
- Collaboration output
- Communication

12. How could the collaboration be improved?

- Maybe something which has not be mentioned before?

Epilogue (1 min)

Any further remarks?

Thank you for the opportunity to have an interview with you.

Should I keep you informed about the outcomes of the research?

Appendix G: Framework matrix per concept⁷

Respondent	Geographical proximity	Technological proximity	Organizational proximity	Absorptive Capacity
A1	Having face-to-face contact really makes a difference, travel times are surmountable, but we need to plan every visit. More issues arise when time zone differences exist. This helps us to keep contact lines short.	When there are issues in using the technology, we need [the third party] to diagnose the problem. We have limited ability to identify the problems. Even when the issue is not created by [the third party]. When this issue is tracked quickly, we have satisfied customers.	If you take a look at what we paid to them, everyone can see that not everything was allocated to development. This is a continuous point of discussion. Also, they did not deliver enough rapport tooling. Every time when we have an issue, they need to come over to diagnose the problem. The director of [a company we bought], knew [them]. They got into a quarrel. The collaboration is now hampered on the highest level.	They can do rapid prototyping, but we fail to incorporate this in our organization. We learnt that it is dramatic to work with such a small party! [We need to tell them] this is who we are, how we work and what we expect, this is what we guarantee. There has never been chosen a clear strategy. [They are a small company], that's why you speak directly with the owner or developer. This makes it easier to make decisions.
A2	We shifted the location [of interaction] more close to Focallogistics. This is easier when escalations arise within a collaboration because personal contact is better than calling. This helps us to keep contact lines short.	We are coming from an industry which is matching well with the industry of Focallogistics. So we didn't need to do that much new development to create a whole new system. However, the market knowledge at Focallogistics is much larger. This is sometimes hindering the collaboration. [As we] have no insight in how much projects will come to us in the upcoming year. It is hard to predict, [...] but it is improving over time.	Since the start of the collaborating with Focallogistics, also our processes have gotten more mature, but this comes with bureaucracy. We started developing in a more standardized way. Now you see with the standardization that developments are getting more efficient. As a consequence of that Focallogistics is much larger, this result in extra overhead costs, answering all the questions of Focallogistics. [...] Also, Focallogistics makes us ignore other outstanding projects with smaller companies, when delays occur. Our director knew [the acquired company's] director. This led to the collaboration.	One of the advantages is that we learn a lot about the logistics market. During the collaboration we learnt certain requirements that need to be fulfilled. We are also getting more structured when we are working with Focallogistics. This makes the projects more efficient. They get to know how we work, and we get to know how they work. We get to know each other's competences [and how to apply them most effectively]. This helps the collaboration. [openness] in what are the margins, how can we share those, who benefits from what. When we know that in one project there is limited margin, we can change [our revenue model]

⁷ Where the letter reflects the case, whereas the number reflects either internal (1) or external (2) interviewee.

B1	<p>Being proximate results in easier face-to-face contact, nice when you need to agree on certain decisions. Also [proximity] facilitates the ability to demonstrate things by demos and tests. We do not need virtual meeting rooms, because we are so close to them.</p>	<p>They are active within other companies as well, of which we can learn. Sometimes we could use these technologies which were effective in other collaborations. I would say; share them.</p>	<p>The challenge is that we are working together on many levels. I would like to work together with a long term goal. This is not the case in all parts of the company. Some are only working on their own project. Where we want to go is to formulate strategic partnerships and really get together.</p>	<p>I learn from their technology. We spend a lot of time together exchanging ideas on future developments.</p> <p>Also internally, our processes. Our evaluation could be improved for example.</p> <p>We get to know them better how are they organized, how are they organized, what is our vision, what do we want to accomplish and how do we favor both from it.</p> <p>Openness and contractual agreements on what is allowed [would help the collaboration]. Preferably, this is accomplished very informally, which is also done in the collaboration.</p>
B2	<p>We do not use Skype that much, I prefer going by them. Proximity facilitates the ability to work on location, we have tables here assigned for Focallogistics employees, so they can work here during projects. Sometimes you need to be together, especially with a large group. [...] For the rest calling is fine.</p>	<p>Our roadmap matched theirs a lot. We spoke about it and developed a product together.</p> <p>We make an addition to each other. Sometimes we underestimate technological effects. We take it as a learning for next collaborations. Therefore, the risk analysis before the actual collaboration is enhanced.</p>	<p>[It is definitely useful that we worked together more often.] It really depends what kind of team you are working with at Focallogistics, how much experience you have with them.</p>	<p>You learn [how to work with them] over time. [...] We acquired a lot of technical knowledge. We take it in to account for future developments. For example testing software while developing it...</p> <p>Also regarding processes, our communication to Focallogistics changed; for example hour registration and planning update. Sometimes we need to communicate better. This is something we can learn</p> <p>Our collaboration is effective [...] because we discuss everything openly.</p> <p>We use field tests to decide upon the developments. With the tests results, we make a further iteration.</p>
C1	<p>Distance and the travel times could be a valuable means to prepare on meetings with the third party. We do brainstorming sessions while we are in the car. I wouldn't see it as a problem. The contact could be via mail or phone. It does not necessarily always need to be face-to-face.</p> <p>We were often [at</p>	<p>Their knowledge is complementary. They can give input from another perspective, when they do not have the Focallogistics culture, it is easier to take a step out.</p> <p>They also work with other companies, their experience could be helpful to us. They can share it with us, to improve our products.</p> <p>We make sure their</p>	<p>In the beginning, they had a hard time with the way we worked. We take into account a lot of input. In the end, they just were flexible with our way of working.</p> <p>They found it really nice that we understood the way how R&D works. Apparently, some other companies do not see it as a flexible process.</p> <p>[The senior buyer] knew them from before, this led to the collaboration.</p>	<p>They get to know our system, and what our critical factors are. You can see that they gathered system knowledge, and they are thinking with us in that respect.</p> <p>We also acquire knowledge, The project leader is getting more knowledgeable regarding [their technology].</p> <p>Every time when you start working with a new technology, you need to get to know each other. How we work, how they work</p> <p>We discuss critical issues [regarding the</p>

	<p>another supplier], we took a hotel the night before. We drank a beer together, we took it more informally. [...] It is a sort of team building.</p>	<p>developments are implemented in our system [...] They don't need a lot of knowledge about our systems.</p>		<p>design]. They are willing to share information. We have very short lines of connections with the current project leader, to discuss these.</p>
C2	<p>Visiting the focal firm is a long drive. We have travel costs and travel time, but if we go there once in a month, it is fine. We have a customer in Germany which is much further.</p> <p>When we are prototyping [...] we see each other more often face-to-face. [...] Otherwise we have conference calls.</p>	<p>We took the assignment, because it is part of our knowledge domain. However, we have more competences. I think it would be valuable if they also use these, as we already know each other.</p> <p>Regarding the knowledge differences, we can make suggestions and test them quickly with [the project leader].</p>	<p>We have always worked this way, that does not mean the same way of working as the other company. You need to find each other in this. This could be hard sometimes. [But we] always adjust to the customer's processes.</p> <p>The fast growth of Focallogistics is a challenge. We had a project manager who had 3 months of experience within Focallogistics. He did not know Focallogistics himself.</p> <p>[On project level, collaboration is going smoothly because of] a culture match.</p> <p>The collaboration was started as a consequence of the strategic sourcer knowing us.</p>	<p>We notice that when someone in Focallogistics gets a new role, we always need to get used to this person. Everyone has their way of working, you need to find the click again.</p> <p>You learn really well how to manage risks within a project. We are very transparent in the goals we try to meet. We celebrate successes together and we discuss frustrations.</p> <p>We are very transparent in the goals we want to accomplish. [...] When there is issues, we listen closely to their arguments, then we make adaptations in the planning.</p>
D1	<p>Geographical proximity facilitates the ability to work on location, they are here full time. Technically it is not per se necessary, but it really helps to keep in touch with the stakeholders.</p>	<p>We have a lot of jargon. This makes working together difficult. In some meetings, everyone understand what is meant, except for the third party.</p> <p>[Suggestions from the external party could help] to improve Focallogistics tool use. Sometimes we are hesitant to change tooling, or unfamiliar with the abilities.</p>	<p>If we would have a mutual goal, we would chose to collaborate more often. We could intensify the collaboration</p> <p>The collaboration started as we [worked with their] employees before. They suggested to set up collaborative developments</p>	<p>They suggested to act as a co-development partner. We adapted to a whole new way of working by outsourcing working packages. We need to look for the mutual goals</p> <p>To overcome [the differences that were running in to] we learn on the job and give context. They have access to our technology, as the product need to work in our environment.</p>

D2	<p>We have live contact as much as possible, but also mail and skype for quick interactions. When something happens, I drive to the site quickly. In 20 minutes I am there!</p> <p>I am here [very often] to find out exactly what is going on!</p> <p>Our consultants that come here can do a much better proposal for a solution, they know exactly what matches the requirements.</p>	<p>We adopt to the tooling which the client is working with.</p> <p>If you are open to each others vision, you could only be better. We have people located here. Sometimes they find that Focallogistics work with a particular tool, we could advise them how to use it most effectively.</p>	<p>It is important to understand the culture of the collaborating firm, so we can designate the right people to the assignment. [...] We think that matching cultures could result in synergies. It is therefore important to identify and understand how you can collaborate most successfully.</p> <p>People in Focallogistics are very focused on their projects. [...] They think they need to do everything themselves [...] This reduces the time to adopt new technologies. They do not have time to implement it.</p>	<p>I have 35 people who are working [at Focallogistics]. When they notice that they are working with a different tool, they suggest me to talk with them on improving their practices with the tool. We also get to know cultural things, domain knowledge; when someone is coming here they learn from the logistical domain.</p> <p>We adapt to the tooling which the client is working with.</p>
E1	<p>It is very nice to have them close! When something new has developed we can quickly go there to see what's new. It facilitates the collaboration. We cannot have really less face-to-face contact. They need to come here for tests [...] as we have very interconnected systems. Also when starting to work together you need to see each other face-to-face, you need to know who you are working with.</p>	<p>Their quality and delivery times weren't that good. Therefore, we wanted to have a closer collaboration, to understand better how their solution works and questioning them how they work.</p>	<p>The integration of the development is tough. This has to do with cultural things. When they fix something one time, they think it is alright, but we need endurance tested developments. [They have lighter processes], by which they can make quicker iterations, than we could do. [...] I say it doubtfully, as we would have the same [team composition] in Focallogistics, then it would go faster as well, and we would have a broader approach in which we would have the reporting tools in order.</p> <p>They are open and willing to help, but we get a lot of criticism for the fuss around the development. They just want to focus on the robot. This is a really cultural thing. In the end we insisted them to enable automatic testing.</p>	<p>We insist them to work in a particular way. [...] We ask them; how are your testing procedures, how do you do this, how do you do that, we expect them to deliver a test report. Every quartile we make progress, it is impossible to change them from one another day. We try to explain them what the risks are.</p> <p>they show us how cumbersome our processes are. However, we do not really do something with it. They are very open and willing to help.</p>

E2	<p>If you want to set up a collaboration in the beginning, being close to each other facilitates it.</p> <p>I have a lot of discussions with Focallogistics. That is why we made the decision for me to work one day a week on location of Focallogistics.</p>	<p>Focallogistics acknowledged that the competences [needed for the development] were not available in the firm. So they decided to work together with us.</p> <p>They have a [complex system architecture]. In the beginning we agreed on me connecting with one system. However, now we need to assign one FTE, to make changes in the interfaces. This is a huge loss, I would like to assign my FTE differently!</p>	<p>Accepting the differences or trying to adjust it, results in a continuous struggle on which we have intense discussions. I really value to keep the differences, respect them. Take the power of both. Try to learn from each other, the optimum is in the middle. The robustness [of Focallogistics' processes] is really complementary to us.</p> <p>As a consequence to the size differences, we assigned key contacts, which I contact. There is no way for me to have contact with everyone.</p> <p>One of our employees started working at Focallogistics. He said to us that we should contact them.</p>	<p>Now we are reporting on all different levels. Focallogistics also adapts to us. They restructured the R&D organization. [...] They adopt things that are working well for us. It can go both sides.</p> <p>Focallogistics is really open, which I admire. Other companies were not. Then we thought a collaboration could not exist with those companies.</p>
F1	<p>I would like to see them working here on location, this facilitates the collaboration. As we are proximate, this should be possible.</p> <p>With Skype there is no difference [compared to face-to-face], but we notice that things take more time.</p>	<p>[The collaboration extended] majorly because they help other parties as well. They are also focused on the machine development, they are a good match.</p> <p>We brainwash them to certain amounts, to think like we do. Thereafter, the biggest challenge is to remain with the same contacts. We send more assignments to them, to keep the same individuals assigned to our company. If the way of thinking it is not like our company, then it is not a good one.</p>	<p>We are quite similar. The challenge is to imprint our way of working. Otherwise this could lead to quality issues and overwork.</p> <p>However, we see that someone new, could lead to different ideas. [Within Focallogistics, the developments] need to be done quick and well, so not too difficult. When we let them have more time, at their other customers we see more advanced developments. Within us, time pressures are too high to develop something innovative.</p>	<p>We learn how to better prepare assignment and how to communicate to external parties. I created a work flow on how to collaborate with external parties.</p> <p>We have weekly contact [on all equivalent levels].</p>
F2	<p>Geographical proximity was probably one of the reasons why we got connected. On top of that, working next to each other creates trust [as you have a better sense of what the other is doing]. Geographical proximity facilitates working on location.</p> <p>When face-to-face contact is needed, we</p>	<p>We are broader oriented, that's why we can do engineering better than just the market in which Focallogistics is active. We can use our knowledge from previous projects.</p> <p>With another customer, something is called differently than at Focallogistics. But it has a similar structure. Nuance differences are interesting to learn from each other.</p>	<p>Focallogistics is much larger, so they are faster than the group that we have.</p>	<p>We learn how to work with the Focallogistics' employees; one person we need to ask more than the other.</p> <p>You first need to get to know their working practices, then you get to know how the communication lines are organized. [...] Now they have direct contact with the project lead [to coordinate the assignment]. Shortening communication lines is the goal!</p> <p>When knowing this, you are more aligned and working as a partnership. You create a discussion that you want</p>

	<p>go to their location. [For example,] when there is a kickoff, or we need multiple stakeholders.</p>	<p>As much as possible, we use similar tools [as Focallogistics]. In the end, we need to implement it in their tools anyway.</p>		<p>to do it differently [,when coping with differences].</p>
G1	<p>It is most important to sit next to the customer of the developments. On top of that, 1,5 hours of traveling is still doable.</p>	<p>When I noticed them, I was like; "I can redefine the passenger process!". The connection is what we didn't know about.</p> <p>If you have no idea of what happened [in their technology]. When ours and theirs are out of synch, we did not know what happened.</p>	<p>We had a lot of discussions regarding pricing. They didn't understand that we couldn't split the revenues. We have a lot of overhead, which they didn't understand.</p> <p>Internally, there is a lot of bureaucracy. This is why we consciously made the decision to let them make the developments, they just start! They were much faster than us, because they didn't have any overhead.</p> <p>We made some shortcuts to pay more quickly. We were very slow in paying our bills. Paying on time is necessary for a startup, as they are dependent on us.</p>	<p>We learnt how to create faster innovation and how to adjust our processes in order to enable innovation. We adjusted our R&D organization to free innovation from bureaucracy.</p> <p>Regarding the technology, we know more than before, but we have too little knowledge to do it ourselves.</p> <p>I think the discussions arose because of their protectionism. I was open in our pricing strategy, but they did not agree!</p> <p>They did not share all their information, [which hindered troubleshooting]</p>
G2	<p>Our market is the whole world. The distances are not that large.</p>	<p>They are working in a different market. We work with check-in, instead of luggage. We notice that they really don't understand how this works.</p>	<p>We have a calculation model, created by Focallogistics. All the costs are listed in the model. There have been significant discussions on that. We have the feeling that we are exploited. This really led to a bad collaboration.</p> <p>One of the advantages is their organization, they are a global organization. They can help our product enter the market, we are just a startup company.[...] They have 5000 employees, which are able place our product in the market, we are a name which could be marketed in an easy way.</p> <p>Also their organization was very slow in making decisions. When you want to be decisive, you need to make decision!</p>	<p>Some things were shared to show what we did, but to a minimum extend. We learnt majorly to improve our processes, how to make agreements. There has been a calculation model, on which we had a lot of discussions.</p>

H1	<p>[...] you need to plan your visits instead of visit spontaneously [when you are distant]. When being closer to each other, this costs less time. When good reporting tooling is in place parties could react more quickly.</p> <p>Sometimes you need to get together, face-to-face contact is a different experience, you want to see the faces of the others.</p>	<p>Sometimes it is a good idea to outsource particular jobs, when they did make solutions for different parties.</p> <p>That is exactly the reason to collaborate, they know everything about the solution. We try to understand their solution on high level. But it remains a black box in which we have an input and an output.</p>	<p>They are leaner in their developments, but they are less mature. [as a consequence of the differences in size] we both have a strong focus. They do their small job, we need to oversee everything on our side [such as installation tooling and guides]. They have their focus on the technological solution, not on everything around.</p> <p>As they really want to work with us [because we are a large firm], it gives us 'power' to steer them to small extends.</p>	<p>They do not want to tell too much regarding their tooling and how smart they work with them.</p> <p>We learn from their solution . However, I doubt whether we could apply them effectively.</p> <p>You can see that they learnt on making a test report, to show the relevance of their model. They show us everything, but not how smart their technology works.</p>
H2	<p>It is very nice that the office of interaction is located in the Netherlands. This results in a similar culture. But we do not work together in one location, this reduces team spirit.</p> <p>[...] working on location [reduces] reaction time.</p> <p>We are now collaborating with 4 parties. It is hard to have a conversation with all stakeholders by phone only.</p>	<p>Focallogistics is doing really well in the integration of the process. We can have larger focus on our solution, because everything around is covered.</p> <p>Sometimes the goals are too ambitious, as they do not fully understand the complexity of the problem. We try to isolate the complexity.</p> <p>We deliver our technology out of the box. We help to integrate it in a sort of proof of concept. The reason why we do this is that [the technology] is new for many parties.</p>	<p>At the moment we push an update which includes a bug to a site, we can shut down a whole [logistical] process. We became more structured in [our testing procedures].</p> <p>[...] we are more flexible than large organizations. When we have new ideas, we can easily shift people to follow up on these ideas. They do not have any other tasks. Therefore, I think it is really helpful to innovate with startups. [...] However, the big [customers] want to do business with Focallogistics, just like they are doing now. We can have more focus since we now the rest is covered</p>	<p>We learnt to be more structured in our testing. When we push an update, which includes a bug, we know that this could have a large impact on the rest of the process.</p> <p>We need to have open communication in which we state what we are doing, and share hard decisions we need to make. All the communication is done over direct connection. [...] The developers need to be able to collaborate continuously on the development.</p> <p>We do not have unlimited resources, by means of a demonstration we can show what we can and cannot do.</p>
I1	<p>Germany is still surmountable in the collaboration. It is very nice that the collaborating party is willing to come over when needed.</p>	<p>They really proposed a solution which matched our expectations. That's why we would go with this party.</p> <p>This is also the case, because they were involved in the early NPD process, they set better requirements.</p>	<p>In the past [the German culture] was more hierarchical, but for this company I do not really notice it.</p> <p>They have quite an open culture, this matches Focallogistics'. They assigned an intermediary from the Netherlands. However, an intermediary [as a filter] in-between actors in a R&D collaboration does not really make an addition.</p> <p>[One of our employees] suggested that we wanted to collaborate with a party like [them]</p>	<p>We found that the requirements weren't developed clearly. We need to look into it in the future.</p> <p>[We miss some evaluation in the collaboration], that we express everything freely.</p> <p>They assigned a local intermedator. It is good from one side, for the regular orders. On the other side, I want to talk directly to the engineers in Germany. I don't see an additional value of the filter.</p>

12			<p>I personally still believe that there is a easier access for people with the same culture and the same background, than between other nations in general. I think it helps. We hired a [Dutch] account manager, as we decided to become more proximate to Focallogistics. We try to bridge those gaps with extra effort from our side.</p> <p>[...] Focallogistics is experiencing and enormous growth at the recent years. Numerous people being involved and all the projects being managed. [This decreases efficiency]</p>	<p>We grew our knowhow in the market, and we benefit from this. It is a strategic decision to collaborate with Focallogistics.</p> <p>Every time in the developments we get valuable feedback when they test our products, their engineers have a very high knowhow.</p> <p>It is hard to say [if the implementation of the product works]. They are not transparent to us. We don't know then really, what is the status. [...] What are the quantities planned, what is the information to the sales done, what are the program managers thinking, this information is not available to us.</p>
J1	<p>You can keep track on what the collaboration party is working on when you have frequent face-to-face contact, also this makes processes faster.</p> <p>They we here often to fix bugs. [...] If we would have a ticket system, this would be very helpful.</p>	<p>They also develop for other companies. The precision work which is needed for them, is applicable in our development.</p> <p>They deliver us progress [in the development], that is the most important for now.</p>	<p>[...] they are slightly more theoretical than us. Sometimes it difficult that they do not deliver supporting software. If they keep doing so in product developments, resistance to implement their products could grow. Developers would say; nice what they deliver, but we need to service it as well. This does not help the decision for X. It would be nice to meet with the higher management to see how they think about it.</p> <p>We had a shift in project managers, up to 3 times. This did not favor our developments.</p>	<p>We learnt how to productize with an innovation partner. We also need to think of servicing the products. Only innovating isn't that big of a problem, implementing it in a system is. [Therefore,] we take the developed technology other suppliers of these scanners. We explain it to them, and now they want to produce it for us, including service delivery.</p> <p>We also need to learn from them how they work with startups.</p>
J2	<p>Testing needed to be done on location. It is very good that we agreed to let Focallogistics do the testing. If we needed to do it, it would be hard [because of the distance] Sending someone to perform those tests is not desirable.</p> <p>With current technologies, distant collaborations are facilitated. If the project is performing as it should be, then we quickly update each other [via virtual tools]. First, we would pick</p>	<p>Every company that wants to solve complex problems is a potential customer to us. We had some knowledge which was not available in Focallogistics. That's why they came to us.</p> <p>The engineers really understood each other well [as they have the same knowledge]. This is key in the collaboration.</p>	<p>We have a very similar [informal] culture. Connection lines are short. This comes out very handy.</p> <p>Customers sometimes underestimate the development process. They think it is the first time right. Focallogistics did not, because they are involved in R&D themselves.</p>	<p>During the project we develop a lot of experience [...] regarding the technology and its applications.</p> <p>Also at one time, you learn how the organizations is working, who you need in certain situations, and why they make certain decisions. So it would be advantageous to have continuous assignments.</p> <p>We always do a quick scan first, [to see what the technology is able to].</p>

	Skype, otherwise email.			
K1	<p>When someone is new to the project, they first stay 2 days here. [...]</p> <p>However, it costs so much time to get there. So you do not travel for one day only. It doesn't matter when there is 150km or 1500km in distance. Therefore, face-to-face meeting definitely need to have a goal. Not all topics will be discussed by Skype. I am really visually oriented.</p> <p>When the project [is in further stages], there is less necessity for face-to-face interactions.</p>	<p>They have a lot of knowledge regarding software, but no knowledge regarding logistics. This results in mistakes. I try to educate them, take them to the end client.</p> <p>Now after 3 years of collaboration, we decided to shift the developments to another company. When transferring the knowledge, you will lose relevant information.</p> <p>They made a lot of good decisions [regarding software architecture] in the beginning. They still deliver advantages to me.</p> <p>Actually, we do not use the possible potential of the company. [...] They needed developers, who built something, they were not looking for a partner who helped 'developing'.</p>	<p>We noticed some cultural differences. When we say something stupid, they just do it. I prefer when the team replies to me that my decisions are bad.</p> <p>For the rest we only have practical effects of the culture differences. They celebrate Christmas on a different day as we do. you need to take that into account, it has its impact: when we work, they don't. I try to be available during Christmas.</p> <p>They learnt to look in a broader context, instead of just the ticket. I heard they developed some what-if analyses, what kind of questions I could pose to them.</p>	<p>We do not really learn from them [...]. Because they are developing really isolated, nobody is keeping contact with them. That's why we get them over here, to show the application at the customer and to transfer the knowledge that is needed with the application.</p> <p>In the beginning, we had to document everything we wanted. When there were changes, [our department in Germany] was responsible for transferring this information. This was horrible!</p>
K2	<p>[Face-to-face meetings] are more effective. [...] when you meet each other for the first time, it is nice to have face-to face. Communication tools are highly developed they are advantageous.</p>	<p>[The integration works] good. Focallogistics has really high quality Software Architect which have good understanding and alignment with our Software Architects.</p> <p>We like robots. We have a commitment to moving parts, we thought it was cool [this was an extra reason to collaborate].</p>		

L1	<p>Always face-to-face meetings in the beginning [...] you just need to understand each other. At one moment, you can start with working by Skype.</p>	<p>We were much further [in technological knowledge]. We did a lot of suggestions to them, but I think it was out of their comfort zone.</p>	<p>They are a really good component supplier. They are not designed for running more innovative projects. This is leading to reputation losses.</p> <p>We started collaborating as we know them for a long time. They used to supply us.</p>	<p>We didn't learn anything from them. The lessons we learnt is how to collaborate in innovation.... We need to be clear beforehand that innovation cannot be done when assigning requirements.</p> <p>Beforehand, we also want to have a demo together. Then you know how the collaboration will work in practice, he needs to ask me questions. We need to collaborate already. I think they need to be open in what kind of party they are! If you are not working like this, it hurts your reputation.</p>
L2	<p>We need to Skype, because travel time is too valuable.</p> <p>I also think it is important to have a continuous flow of information to the client. If you are more distant this is harder. [...] One party in the collaboration was located very close to Focallogistics. We had issues with defending our work, as this party had more influence on the focal firm's thinking. Skype is used to reduce travel times.</p>	<p>I think it is a good combination that they have their specific market knowledge and we have knowledge of other industries.</p> <p>Collaborating with the other parties is something that went wrong. They just come out of university. I am also from university, but when you just finish you are lacking practical knowledge.</p>	<p>Not to be rude, but I found the project management of Focallogistics quite weak. It is really going with the flow. This creates results really fast, which do not function well. However, you create something that leads to new insights. [...]</p> <p>To say it boldly, Germans want to formulate everything in advance. In other countries, we just go with the flow, but you have a lot of afterwork. It is a matter of finding that balance.</p> <p>We always look at the type of customer. Big customer, Big project, then we made the decision to step in the project. Looking back, we should have kept to the record.</p>	<p>We learnt in terms of project management. [...] But also in the [...]technology we made improvements.</p> <p>I think it is important to have continuous information exchange on what the companies are doing. Something without a result, is also a result.</p>
M1	<p>The geographical location could be seen as a disadvantage. [However] it is reachable in one day. [...] I am there a few days in a row, once every few months. They were here often to do tests. [...]</p> <p>If you connect with India, you could create 24 hour cover. However, going there for one day is not possible.</p>	<p>Their knowledge is just right. They are good software engineers. Nevertheless, sometimes teams are varying.</p>	<p>Regarding cultural differences, I think they are really open and little hierarchy, this matches ours. When I run into something, I discuss this with the team.</p> <p>However they have a different sense of quality. Sometimes this goes wrong. We have discussions regarding this topic often.</p> <p>Sometimes is it hard to communicate, as some do not speak proper English.</p>	<p>You can show videos to explain how it works, but the best way is to show it in practice. They came here often to test with us. We invested in them. [But now] they don't use the direct connections they made to pose their questions.</p> <p>I don't really know whether we learnt on how to improve collaboration processes. When I run into issues, I discuss it with the team.</p>

M2	<p>Preferably, the teams are sitting next to each other. [...] This is the only way to see what the client really means [...] However, negative consequences are surmountable, especially if you are willing to travel a lot. In some phases face-to-face contact is more important. Then you need to travel more. Interestingly, when they visit, the longer they stay, the deeper we get to the actual problem. The better we could react upon.</p>	<p>Few years before we contacted Focallogistics, we did a market research [...] which type of industry will grow the most.</p> <p>[Focallogistics and I] perfectly understand each other. [But the] end client, [I do not understand]. I am not experienced in this, Focallogistics has 70 years of experience.</p> <p>they need to listen a bit more at technical points. [...] time-to-market could be speeded up if they are not involved in the old technology.</p>	<p>[Cultural differences were] a disadvantage to understand each other in the beginning, [...] we had to find out how it worked.</p> <p>with the majority of the peers, we perfectly understand each other. I know what they think, they know what I think. From that point, the corporate cultures are similar, we know how the games are played.</p>	<p>We started building domain knowledge and building the teams. [...] We like to start from the client premises. This is the only way to see what the client really means.</p> <p>We had a strategic goal to go to this industry. It was not a coincidence that we met Focallogistics at the fair.</p> <p>But from domain knowledge point of view, we learnt a lot, because Focallogistics is a mastermind in that. Whenever we talk with them, we are getting something new, how the processes look for the different industries, whatever industry it is.</p>
N1	<p>We had engineers from them here on location to test together. In this collaboration there was no need for collaboration software [as the developments were really separated]</p>	<p>We have some knowledge to create power modules, but it is not our core business. So we have gathered free knowledge.</p> <p>They have different knowledge, they tried to push us in a certain direction. This was quite a disadvantage. We had to prove they their ideas were not appropriate to us.</p>	<p>It is nice to have a similar forms of contact. [...] At one moment we knew who we needed to ask for particular questions. This works nicely in overseeing the differences between the companies.</p> <p>We started the collaboration as someone we knew started [at their company]</p>	<p>[During testing] they explain to us; because of your system, the technology is reacting like this. We had a constant learning curve. We tried to involve multiple R&D employees to make sure that the knowledge is kept within the organization.</p> <p>We also got to know the right people. The right people for the right questions. If it was technical they call me, [...] or I called [the product manager]. When it was financial, they didnt call me but [the sourcing manager]. I called [the account manager]. When we needed extra effort, we called the higher management.</p>
N2	<p>We use a lot of new technologies, which reduce time spent on travelling.</p>	<p>[Focallogistics is a fast growing company, which is for us a challenge.] Then we learn to develop smarter products, and shortening development times.</p> <p>They challenge us to think about the technologies of tomorrow.</p>	<p>The most important thing is practicing [to collaborate effectively]. You get to know each other much better.</p> <p>Focallogistics is a company which is project based. Communications are sometimes hard. Everyone is really focused on their projects, and it is hard to get together. [...] This hinders the collaboration.</p>	<p>Also technologically we learnt regarding the projects that fail or do not fail. We can kill projects in an earlier stage. [...] Some products were too extensive and complex, which results in higher costs. Sometimes you just need the 'good enough' option.</p> <p>We get to know them much better and which connections should be tapped. [...] The most important is practicing in a collaboration.</p>

O1	<p>We don't have any view on what the other party is doing when you don't sit next to each other. What would have been beneficial is sending someone, to teach them the processes and documentation of Focallogistics. However, it could be hard to find someone to travel every week. With a party that is located closer, this wouldn't have been a problem</p>	<p>Technologically we didn't get any advantages. Nothing like, this is what they do well. Maybe regarding technology. Functional things, how to develop the application, that is something we wouldn't do ourselves. There has been some learning in that.</p> <p>We did not have the smartest algorithms. We learnt from that, how we do things differently now. However, I cannot think of any positive things to remember for the future.</p>	<p>[The efficiency was not going well], it keeps coming back at the [structure] of the [development] processes, and how to cover the requirements.</p> <p>The expectations [from us to them] did not meet the outcomes.</p> <p>Because they are working with limited resources, [it limited their flexibility]. We were like, just get some guys together. However, they couldn't realize it. This is a problem where we ran into.</p>	<p>Technologically, we did not learn anything. However, we did not have the smartest algorithms. There has been some learning.</p> <p>Basically we learnt why we want things different now, and work in a whole different way with another party. For example, from day one we would send an employee to support the external party, both technically and on processes.</p>
O2	<p>from a software perspective, it really doesn't matter. We have advanced tools, we can have Skype calls and share screens. That's fine. But integration, there is no doubt about it that being on site if beneficial. [...] both parties learn more and get more done when that happens. [...] we don't have any time to work during travelling. This is a trade-off for a small firm.</p> <p>If we would both have access to the [database of issues], we could both see what was going on.</p>	<p>The interest [to collaborate] was due to the fact that we had the ability to help companies develop an autonomous guided vehicle. [...] I think there were some advantages [to the differences in background], where we bring things to the table. That is more aligning to the familiarity to move vehicles with a payload in an optimal manner. We are not constrained by something like a conveyer system. Some roots [of the development] were conveyer like, which you can have for a vehicle, but that brings some limitations in terms of the benefits of using the technology. [...]</p> <p>I underestimated in my opinion the level of integration that is required.</p>	<p>I think because there was a lot of open communication on how we could have improved the communication and how we could make the collaboration more effective. Although we are running similar Agile methodologies, we implemented them slightly differently, again based on resources.</p>	<p>Internally we use a program called Red Mind. Focallogistics uses Jira, which is a much better tool, and we are going to move in to ourselves.</p> <p>[We dealt with the differences between the companies by having] honest and open conversations on both sides. If something wasn't working or there was a bug on one side, either side we raise it and discuss it and how to resolve it.</p>

P1	<p>Tools have been put in place to overcome far distances. Especially with the team members who are working abroad on the project. [...] However, it gets hard as everyone speaks on another medium [...] For learning, sitting next to each other is important. Therefore we decided to also send someone from the third party abroad.</p>	<p>They are a software company, we aren't. We can learn from their best practices they developed, which are new to us. However, you shouldn't make them design a conveyer belt. [...] They tell us how to do everything different.</p> <p>I think they really give directions in the collaboration and thinks with us.</p>	<p>Sometimes [we need to search] search to overcome cultural differences. Everyone has their way of working.</p> <p>They adjust themselves to our pace. I really like the party we are working with.</p> <p>Someone knew [them], so they thought we will have a pilot with them.</p>	<p>The main goal is to learn from the external party. [...] The knowledge transfer is going relatively slow. I hoped it would have been quicker.</p> <p>We work very isolated from the rest of the company, because many people are sceptic. This is maybe not the brightest idea, but we need to show if it work first.</p> <p>Our people are learning on the job. How to work with Assure, Cloud technology, and how to test cases and test ware. [...] At one moment we can do it ourselves.</p>
P2	<p>Being at the customer's site, gives us the ability to have direct connection line, no short lines, but direct lines. For the rest we from the management make visits multiple times a week, which is more focused on progress and quality we deliver. We try to be as similar as the focal firm, so integration processes are improved.</p>	<p>The major advantage is that we have advanced knowledge and more experience in certain areas. The collaboration is designed to transfer this [knowledge]. We try to prevent Focallogistics making the same mistakes as we did within other organizations.</p>	<p>Focallogistics has an interesting software setting, in which you cannot access its location.</p> <p>We started the collaboration as we knew their directors from previous jobs.</p>	<p>The model we use [regarding learning], which we learn from is people process tools. So we learn not only on process level, but also people and technology. Technologically we learn from the case of Focallogistics.</p> <p>It is a challenge. In fact we create organizational change, a new way of working. We supply knowledge and experience.</p> <p>Issues are always addressed consciously, in a discussion and open communication, setting goals. Because our communication lines are short, and frequency is high, it allows us to steer [the developments] quickly, to prevent the wrong things from happening.</p>