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Managing Suppliers in Business Networks:

Exploring Innovation, Capability Development, and
Network Pictures

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Preface and acknowledgments

Some years ago I never imagined that I would pursue a PhD degree. I hardly even knew what it was. Looking back, I see that a number of coincidences have led up to this point. When I was studying for the Bachelor's degree at Bournemouth University, I became acquainted with the Industrial Network Approach by Rhona Johnsen, an inspiring teacher in international marketing. My interest in this theoretical perspective was further developed while I was studying for the Master's degree at Trondheim Business School. Under the supervision of Espen Gressetvold, I learned more about the IMP perspective when writing my Master's thesis on innovation development across company boundaries. When I was given the opportunity to take on a position as a PhD student in the area of "Supply Networks and Innovation", it seemed interesting, given my previous interest and knowledge in this area. However, at this time, I had no idea of what a PhD process required. Without Espen's encouragement, I would probably never have applied for the PhD scholarship.

This PhD project was carried out at the Department of Industrial Economics and Technology Management (IØT) at the Norwegian University of Science and Technology (NTNU). The project was funded by Trondheim Business School (TBS), where I have spent most of my time. Additional funding in the final stage was provided by IØT, NTNU as well as Stiftelsen den Nordenfjeldske Handelshøyskole.

Writing this thesis has not been a solo task and I am grateful for the contributions and guidance of my supervisors. Professor Ann-Charlott Pedersen at IØT, NTNU has been the main supervisor. She has shown great interest in discussing my work and has also made sure that progress has been made. Professor Elsebeth Holmen at IØT, NTNU has been a great discussion partner in relation to theoretical concepts of the thesis. Her analytical abilities and theoretical overview have been invaluable. Finally, Associate Professor and Dean Espen Gressetvold at TBS has been the most important person in the supervisor group, especially during the first years. His enthusiasm and energy, as well as his great attention to detail, has been a great source of inspiration.

During my time as a PhD student I have had the pleasure of spending some time as a visiting scholar at other institutions. In the autumn of 2005, I spent a few inspirational weeks at Chalmers University of Technology in Gothenburg, where I became acquainted with a number of people working with industrial networks and supply. During the autumn of 2007, I spent six months at the Science & Technology Studies Center at Uppsala University. This was a very enjoyable experience, both in relation to my work and socially. A number of people made this a pleasant stay, and I would like to mention Sofia Wagrell, Åse Linné, David Sörhammar, Tommy Shih, Sophie Cantillon and Alexandra Waluszewski in particular.

I have also been very fortunate to be able to present my work and discuss papers with other researchers highly familiar with my field of interest. Five people deserve special

Abstract

Suppliers are becoming increasingly important for firms. Reasons for this can be found in companies' growing attention to outsourcing and globalization, as well as the increasing specialization of companies. Because of their high dependency on suppliers, companies aim to build close and long-term relationships with their most important suppliers. Following this trend, there is mounting interest in the management of suppliers as parts of larger business networks. This means acknowledging that buying firms are connected indirectly to the supplier's business network. The impact of the network surrounding the supplier in the buyer-supplier relationship should therefore be considered in the management of suppliers.

A key aspect of supply management is how to involve suppliers in innovation processes. Innovation has become essential for a firm's survival, and finding ways of utilizing suppliers' specialized capabilities for technological innovation has attracted mounting interest. The increasing complexity of products and companies' need to specialize imply that there is a need to involve a network of companies during innovation processes. Managing the involvement of suppliers in a network context for innovation development is therefore essential. As suppliers are becoming highly important to companies, it is also imperative that suppliers have capabilities that meet the needs of the buying company. How suppliers develop their capabilities and the direction in which these capabilities are developed will therefore be of interest to a buying company. Previous studies have shown that a company's capabilities are often developed in interaction with its surrounding business network. Having insight into how the surrounding network impacts the capability development of suppliers may therefore be highly important for a buying company. Such insight can be explored by studying companies' supplier-related network pictures.

The industrial network approach, as presented by the IMP Group, provides a central theoretical foundation for this thesis. In this research tradition, the company is seen as a part of a network of relationships. The industrial network approach presents a view on innovation and capability development as processes that transcend company boundaries and involve a network of relationships. In the interface between different knowledge areas, the conditions for innovation and capability development seem to be fruitful.

This thesis explores supply management in business networks with a focus on innovation, capability development and network pictures. Innovation and capability development are studied as outcomes of interaction across company boundaries, and network pictures are studied as the views held by actors of the extent, structure and operation of the network, as well as the connections between the actors involved in it. The purpose is to add to the existing knowledge on innovation involving suppliers, supplier development and network pictures related to suppliers by including a managing-in-networks perspective. The thesis poses three research questions:

1. How can innovation involving suppliers be important for the way suppliers are managed in a network context?

2. How can capability development involving suppliers be important for the way suppliers are managed in a network context?

3. How can supplier-related network pictures be important for the way suppliers are managed in a network context?

The empirical basis of the research is three single case studies of medium-sized technological companies and a selection of their most important supplier relationships as well as their connections to third parties. Four papers are written based on the three case studies that in different ways contribute to discussions related to the three research questions. The first research question is addressed in Paper 1. The second research question is addressed in Paper 2 and Paper 4. The third research question is addressed in Paper 2 and Paper 3.

Paper 1 "Supplier involvement in innovation processes: A taxonomy", directs attention towards a variety of approaches to organizing supplier involvement in innovation processes by introducing a taxonomy. This comprises two dimensions that are central in relation to supplier involvement in innovation processes: *degree of cooperation between the customer and the supplier* throughout the innovation process, and the *scope of company involvement on the supply side*. The taxonomy identifies four distinctly different approaches to organizing supplier involvement in innovation processes and it may be useful in initiatives to increase awareness of the organization of innovation projects and to improve innovation process performance.

Paper 2 "The house of supplier capabilities: A tool for scrutinising the ways in which different customers deploy and develop the capabilities of a key supplier", focuses on development and deployment of suppliers' capabilities with emphasis on the impact of suppliers' customer relationships. It is proposed that a key supplier's capabilities are differentially deployed and developed by different customers. A matrix, coined the "House of Supplier Capabilities", is introduced as a tool for gaining an overview of the customer-related capability deployment and development of the supplier's capabilities. It is argued that use of this method enables a buying firm to obtain an overview of and analyse who influences the capabilities of a key supplier, and how the influence of other customers differs from its own influence on the supplier's capabilities.

Paper 3 "Network pictures for managing key supplier relationships", deals with the use of network pictures for managing key suppliers in their wider network context. It is proposed that a buying company may consider whether its present supplier-related network picture is in line with the supplier's network context by assessing whether elements in its supplier-related network picture are *obsolete*, *incorrect*, *incomplete* or *generic*. Furthermore, five rules for revision are introduced for exploring how a buying company can become aware that its supplier-related network pictures may benefit from being revised. Lastly, it is suggested that a

buyer may uncover new opportunities in its suppliers' networks by pursuing four strategies: *systematic search*, *systematic discovery* and *chance discovery*.

Paper 4 "Beyond dyadic supplier development efforts: The multiple roles of the network in bringing about supplier development", directs attention towards supplier development and the influence of the business network in which the supplier development efforts are embedded. It is suggested that companies may activate third parties in the wider network in order to bring about supplier development by pursuing three strategies: *indirect and peripheral*, *direct and central*, and *direct and networking*. The findings have implications for buying companies that wish to gain insight into how supplier development can be conducted, for the suppliers that are developed, and for companies in the network to which the supplier development efforts are connected.

In conclusion, the findings of the thesis point at innovation involving suppliers, development of suppliers' capabilities and supplier-related network pictures as important elements of supplier management. A central finding is the importance of taking the network context of the supplier into account. It is demonstrated that third parties play a particularly important role for how suppliers develop and how innovation can be conducted, as well as providing opportunities or restrictions on the buyer-supplier relationships.

Taking a managing-in-networks perspective highlights the potential for analysing the organization of suppliers in technological innovation by focusing on the scope of company involvement on the supplier side and on the degree of cooperation with the supplier. Furthermore, it is possible to analyse the development of suppliers' capabilities by focusing on identifying relevant third parties and their importance for the development and deployment of a supplier's specific capabilities, as well as on how third parties may be activated for developing suppliers. Lastly, it is highlighted that that it is possible to analyse supplier management and potentials for finding new opportunities on the supply side by studying the congruence between a buyer's and a supplier's supplier-related network pictures.

List of papers

Paper 1

Aune, T.B. & Gressetvold, E. (2011). Supplier involvement in innovation processes: A taxonomy, *International Journal of Innovation Management*, 15(1), pp. 121-143.

Paper 2

Holmen, E. & Aune, T.B. The house of supplier capabilities: A tool for scrutinising the ways in which different customers deploy and develop the capabilities of a key supplier, (Submitted to the *Journal of Purchasing and Supply Management*).

Paper 3

Holmen, E., Aune, T.B. & Pedersen, A.-C. (2013). Network pictures for managing key supplier relationships, *Industrial Marketing Management*, 42(2), pp. 139-151.

Paper 4

Aune, T.B., Holmen, E. & Pedersen, A.-C. (2013). Beyond dyadic supplier development efforts: The multiple roles of the network in bringing about supplier development, *The IMP Journal*, 1(7), pp. 91-105.

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Chapter 1
Introduction

The general phenomenon studied and discussed in this thesis is 'managing suppliers in business networks'. The purpose of the present chapter is to discuss and argue for the importance of studying and conceptualizing this phenomenon. Supply management has gained growing attention in recent years, both from practitioners and from academics. Central and emerging topics within the supply management literature and the focus of the thesis include innovation involving suppliers, capability development involving suppliers and supplier-related network pictures. These topics are believed to be important for the way in which suppliers are managed in a network context. Section 1.1 focuses on the increasing importance of supply management, pointing at outsourcing and globalization as important drivers. Section 1.2 discusses the growing attention to managing suppliers as parts of larger business networks. Section 1.3 highlights the importance of innovation involving suppliers, Section 1.4 focuses on capability development involving suppliers, and Section 1.5 discusses the relevance of considering supplier-related network pictures during the management of suppliers. Section 1.6 presents the purpose of the thesis and Section 1.7 provides an overview of the research method and approach adopted in the thesis. The chapter concludes with an outline of the structure of the introductory part of the thesis in Section 1.8.

1.1 The Increasing Importance of Supply Management

Supply management is widely considered important for companies, by both academics and managers. Whereas the earlier opinion regarding buyers was that "freedom from dependence" was the optimal solution for effective purchasing, the 1980s and 1990s witnessed a drive towards more collaborative relationships and long-term partnerships with suppliers (Gadde & Håkansson, 1993; Lamming, 1993). The business world is radically different and more complex than it was a few decades ago due to globalization, technological development (primarily information and communication technologies), and the strong focus on information, knowledge and relationships as important capital assets. For these reasons, companies need to re-evaluate how they do business, and especially to pay more attention to the supply function (Harland, Nassimbeni & Schneller, 2013). As a result, purchasing and supply management has gained growing attention among business schools. Several handbooks and textbooks have appeared over the last twenty years – thus corroborating the perception of purchasing and supply management as an institutionalized field of management (Spina, Caniato, Luzzini & Ronchi, 2013).

The past twenty years or so seem to be dominated by increasing specialization regarding business activities. As technological development progresses and technology becomes more and more complex it becomes increasingly difficult for firms to possess all the knowledge and competences necessary to develop, produce and sell products internally. It may no longer be effective to carry out all sorts of activities in-house. The trend is for companies to focus on

their distinctive competences and to outsource activities that do not rely on these competences (e.g. Freytag, Clarke & Evald, 2012; Gadde & Håkansson, 2001; van Echtelt, Wynstra, van Weele & Duysters, 2008). In times of consistently high outsourcing rates and sourcing volumes often above 50% of a company's expenditure, the purchasing function has outgrown its former, rather operational focus and gained an increasingly strategic role (Paulraj, Chen & Flynn, 2006; Terpend, Tyler, Krause & Handfield, 2008).

The combined effect of outsourcing, globalization and increased specialization has raised several critical issues for purchasing and supply management as a function within organizations as a process that spans organizational boundaries and as a profession. Both companies and purchasing professionals face new challenges as purchasing and supply management becomes increasingly strategic and complex. Given the importance of suppliers for a company's performance, increasing attention has been paid to how supplier relationships are (or should be) managed in order to create collaborative advantage (Dyer, 2000; Gadde & Håkansson, 1993; Gadde & Snehota, 2000; Harland et al., 2013; Lamming, 1993; Liker & Choi, 2004).

A recent literature review by Spina et al. (2013) indicates that the supply management field has changed pace in the last five years. This trend is also consistent with the industry: companies are increasingly considering purchasing and supply activities as a source of competitive advantage (CAPS, 2012). Furthermore, there is an emerging trend in terms of the unit of analysis in recent studies on supply management. There is a shift from the buyer perspective to the supply network perspective. According to Spina et al. (2013), the reason for this shift may be related to the widespread impact of outsourcing and globalization. Companies that have outsourced more operations and sourced globally have an increasing need for coordination with their network of suppliers worldwide.

1.2 A Business Network Approach to Supply Management

The recent developments related to purchasing and supply have led to mounting interest in the management of suppliers in business networks (Axelsson & Baraldi, 2013; Choi & Kim, 2008; Choi & Wu, 2009; Dubois & Fredriksson, 2008; Gadde, Håkansson & Persson, 2010). This means acknowledging that buying firms are connected indirectly to the supplier's business network, including the connections to customers, sub-suppliers, competitors, and other horizontal actors (Choi & Kim, 2008; Gadde & Håkansson, 2001). Many of the potential benefits and constraints of a company's supplier relationship are affected by the relationships the suppliers have with their other counterparts (Roseira, Brito & Ford, 2012).

The thesis is rooted in a network approach to business studies, more specifically to a research tradition based on the Industrial Marketing and Purchasing (IMP) Group. This tradition studies industrial firms and their behaviour mainly in terms of interorganizational relationships and the connections between these relationships (as described by the word 'network'). An industrial network is defined as *"a set of two or more connected business relationships, in which each exchange relation is between business firms that are*

conceptualized as collective actors" (Anderson, Håkansson & Johansson, 1994, p. 2). Each actor of a network makes its own choice on participation or not, which means that every specific actor is dependent on others' willingness to participate in a suggested cooperative venture (Axelsson & Baraldi, 2013).

Since the early 1980s, IMP researchers have paid great attention to purchasing and sourcing issues as a key element in a research agenda focusing on buyer-supplier relationships in industrial markets. The unit of analysis in IMP studies has also shifted from the buyer perspective and buyer-supplier interactions to the connections between several suppliers and buyers related through multiple relationships within industrial networks (e.g. Axelsson & Easton, 1992; Dubois & Fredriksson, 2008; Gadde, Håkansson & Persson, 2010).

Within the purchasing and supply management literature, a vast number of aspects and concepts are discussed. Axelsson & Baraldi (2013) have identified the following central topics and problems investigated in the IMP tradition when it comes to supply and purchasing issues: innovation and technical development, technology connections with suppliers, purchasing efficiency and supply network effects, structuring of supply networks, and purchasing and strategy. In a review of 1055 articles from the period 2002-2010, Spina et al. (2013) identified the following topics as receiving emerging attention among purchasing and supply management researchers: reverse marketing, contract management, outsourcing, local/global sourcing, risk management, efficiency, supplier involvement, partnership, cost, innovation, and quality.

Inspired by the central topics highlighted in previous research, the empirical data, as well as the author's and the supervisors' research interests, this thesis focuses on exploring the following topics related to supply management in more detail: innovation involving suppliers, capability development involving suppliers, and supplier-related network pictures. These topics are identified as central for managing suppliers in business networks. Each of these topics is presented below.

1.3 Innovation Involving Suppliers

Innovation has long been argued to be the engine of growth. For many companies, competitive advantage is gained and maintained through innovation. In their famous study of the economics of innovation, Freeman and Soete even state that *"…not to innovate is to die"* (Freeman & Soete, 1997, p. 266). This is widely recognized, since multiple studies have been published exploring determinants of technological innovation (e.g. Cohen & Levinthal, 1990; Nelson & Winter, 1982; Pavitt, 1990; Prahalad & Hamel, 1990). The importance of innovation seems to be increasing due to a number of emerging factors. Companies are becoming more globalized, the technological development is very rapid, customers change their needs and desires faster than before, and the product life cycle is shorter than it was a few decades ago. The combination of these factors requires companies to be able to adapt and evolve if they wish to survive.

Whereas the traditional view of innovation has focused on innovation as a process of managing internal development activities, recent innovation theories acknowledge that innovation increasingly extends beyond the boundaries of the company. In the "border zone" between different companies, the conditions for development and innovations seem to be fruitful (Håkansson, 1990; Laage-Hellman, 1989). According to Håkansson and Eriksson (1993, p. 30), *"New knowledge often develops in the interface between different knowledge areas and, furthermore, the meeting of different actors can in itself have an energizing effect on the development process"*. Several authors suggest that close interactive buyer-supplier relationships may result in innovative effects, in terms of combining highly specialized resources of the companies involved (Bessant & Phillips, 2013; Bidault, Despres & Butler, 1998; Håkansson & Eriksson, 1993; Lakemond, Berggren & van Weele, 2006; Wynstra, van Weele & Weggemann, 2001). This puts functions like supply management centre-stage in the emerging innovation agenda and there is growing evidence of the important role that suppliers can and do play for innovation development.

Although suppliers have long been identified as one of the key sources of inputs into the innovation process, it is really only since the late 1990s that there has been a substantive body of research centred on the role and integration of the supplier into the innovation process. Seminal work in this area was undertaken during the 1980s, triggered by an attempt to understand the success of Japanese manufacturing companies – and automotive firms, in particular. These studies showed that Japanese manufacturers were able to turn out new automobiles at a faster pace, with more innovative features, and with less effort in terms of development hours or number of engineers involved. The explanation put forward was that in developing new cars, Japanese manufacturers relied more heavily on their suppliers.

Today, partnerships and alliances with suppliers are seen to be an increasingly important component of developing and maintaining competitive advantage. However, from a managerial perspective, companies are still struggling to find suitable practices to facilitate supplier integration and innovation (Chesbrough & Crowther, 2006). In addition, the existing literature about how such supplier integration and innovation practices should be organized and managed is scarce (Sjödin & Eriksson, 2010). However, this phenomenon has gained growing recognition among companies and among academics (e.g. Clark, 1989; Hoegl & Wagner, 2005; Johnsen & Ford, 2007; Lakemond et al., 2006; van Echtelt, 2004; Wynstra, 1998).

Although the main focus has been on a dyadic approach to involving suppliers in innovation projects, a network approach to supplier involvement is definitely gaining increased attention (Dyer, 1996a; Håkansson & Eriksson, 1993; O'Sullivan, 2006). Studies taking a network view on innovation find that there seems to be a need for involving a network of companies in the development process to supplement a company's in-house knowledge and capabilities (Alderman, Thwaites & Maffin, 2001; Håkansson & Eriksson, 1993; Powell, Koput & Smith-Doerr, 1996). The increasing complexity of products and companies' need to specialize are factors that force companies to rely on the surrounding network. Although there is an increasing amount of research that focuses on the importance of

the surrounding network for a company's innovation, there seems to be a lack of studies that specifically focus on the network surrounding a buyer-supplier relationship and ways of organizing innovation involving suppliers by making use of this network.

In line with the recent focus on suppliers and their importance for innovation, growing attention has been directed towards having relationships with suppliers with world-class capabilities. According to Schoenherr et al. (2012, p. 4563), *"purchasing and supply management has undergone a paradigm shift, away from merely purchasing products and services from suppliers, toward managing suppliers' capabilities, market insight and knowledge"*. Building, adapting and improving supplier capabilities have therefore become strategically important for buying companies (Terpend et al., 2008).

1.4 Capability Development Involving Suppliers

Assets and capabilities have received increased attention in the recent research literature (Möller & Törrönen, 2003; Rosenbröijer, 1998; Teece, Pisano & Shuen, 1997). As firms struggle to supply from internal sources all the knowledge and skills required by present-day technologies, the emphasis has shifted towards firms' external relationships as a means of accessing and acquiring new capabilities; in order to remain competitive and in tune with technological advances, firms are now adopting a more collaborative approach (Bessant & Phillips, 2013; Håkansson & Snehota, 1995). Central issues within the IMP perspective are the focus on heterogeneous resources as well as the assertion that distinct capabilities are generated through interaction in relationships and have meaning in an organization only through the medium of other parties (Håkansson & Snehota, 1995). The capabilities of a company reflect the success in combining resources to perform activities through internal and external relationships (Håkansson & Snehota, 1995; Rosenbröijer, 1998).

In line with research on innovation involving suppliers, increased attention has been paid to the importance of having suppliers with strong capabilities, because this may represent a key to success. Studies on relationships and networks have shown that repeated interactions in substantial buyer-supplier relationships over time and across different projects and episodes influence the development of the supplier's capabilities (Ethiraj, Kale, Krishnan & Singh, 2005; Håkansson & Snehota, 1995; Rosenbröijer, 1998). Furthermore, increased attention has been directed towards supplier development to assist suppliers in developing their capabilities. Supplier development can be defined as *"any effort by a buying firm to improve a supplier's performance and/or capabilities to meet the buying firm's short- and/or long-term supply needs"* (Krause, 1999, p. 206). Buying companies engage in supplier development activities because they hope that the suppliers can complement, or help, the buyer to reduce cost, raise quality and provide other direct values.

Most research on suppliers' capability development has centred on the buyer-supplier relationship and has not investigated the role of the network surrounding the buyer-supplier dyad for developing suppliers' capabilities. According to the IMP tradition, a firm's network offers an access to assets and capabilities of other network actors (Håkansson & Snehota,

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1995; Möller & Törrönen, 2003). Exploring the impact of the network for developing suppliers' capabilities therefore represents an interesting area of further research.

1.5 Supplier-Related Network Pictures

In the light of the network's role in developing suppliers' capabilities, it is relevant to explore a buying company's insight into the suppliers' network contexts. Such insight can be studied using network pictures, a concept developed in the IMP tradition. Network pictures can be defined as *"the views of the network held by participants in that network"* (Ford, Gadde, Håkansson & Snehota, 2003, p. 176). Network pictures is a relatively new area of research, which has gained increasing attention in recent years (e.g. Corsaro, Ramos, Henneberg & Naudé, 2011; Ford & Redwood, 2005; Henneberg, Mouzas & Naudé, 2006; Roseira et al., 2012). A company's network pictures are important for how the company interacts with others. Network pictures are unique to a specific actor and likely to change as companies interact with each other. It is therefore important to understand how network pictures differ between companies, how these differences affect networking activities, and how contingencies affect actors' views of their surroundings (Henneberg, Rohrmus & Ramos, 2007).

The importance of understanding the supplier's network context has been addressed by Choi and Kim (2008) and Roseira et al. (2012). Choi and Kim (2008) argue that instead of managing a supplier as if that supplier exists in isolation, buying companies also need to consider the network surrounding the supplier, because this network can affect the buying firm's business decisions, behavioural choices, and economic outcome. It is therefore important for companies to consider how a supplier is embedded in its own network in order to gauge its performance truly (Choi & Kim, 2008). Although network pictures have received increased attention, there are not many studies on network pictures related to suppliers. A recent study by Roseira et al. (2012) suggests that scanning supplier networks strictly on the basis of current network pictures may limit the exploration of supplier networks' potential. Exploring how network pictures can be changed as well as the congruence between a buyer's network picture and the supplier's network picture therefore provides an interesting avenue for further research.

1.6 Purpose of the Thesis

This thesis seeks to explore supplier management in business networks. The chosen topics for studying this phenomenon are innovation involving suppliers, capability development involving suppliers, and network pictures related to suppliers. Overall, the industrial network approach has been used as a conceptual ground for approaching these topics.

With the background in this introductory chapter, the aim of the thesis is as follows:

To explore supplier management in a network context by focusing on innovation, capability development and supplier-related network pictures.

The first part of the aim is related to how innovation involving suppliers can be important for the way suppliers are managed in a network context. This is addressed in Paper 1, where the relationship between a buyer and a supplier is taken as the point of departure for finding ways in which innovation processes are organized through a varying scope of company involvement on the supply side and different degrees of cooperation between the buyer and supplier.

The second part of the research aim is related to how capability development involving suppliers can be important for the way suppliers are managed in a network context. This is addressed in two papers. In the study described in Paper 2, an investigation of the importance of customers for the development and deployment of the capabilities of suppliers was conducted. Paper 4 studies how the network can be used in order to develop supplier's capabilities by focusing on supplier development strategies.

The third part of the aim is related to how supplier-related network pictures can be important for the way suppliers are managed in a network context. This is addressed in two papers. In Paper 2, a buying company's insight into how it, as well as other customers of the supplier, contributes to the deployment and development of a supplier's capabilities is explored. In Paper 3, a buying company's perception of its suppliers' surrounding networks is taken as the point of departure for investigating how new opportunities in suppliers' networks can be found.

1.7 Overview of Research Method and Approach

The researcher chose to adopt realism (Easton, 1998, 2002) as the philosophical perspective underlying the thesis. The realist philosophy was adopted because it offers the potential to use case research to seek valid explanatory knowledge, and it is the orientation used by numerous other researchers within the IMP tradition. Furthermore, an abductive approach was adopted to reflect the 'systematic combining' (Dubois & Gadde, 2002) of reflections on the literature, empirical findings and the emerging research questions.

Three case studies (cases A, B and C) have been conducted that in different ways cover the areas of innovation involving suppliers, capability development involving suppliers and supplier-related network pictures. A case study method has been chosen because it is often identified as a suitable approach for the study of business relationships and networks, since it prepares for in-depth insight about a phenomenon (Easton, 1998). Case A explores innovation and capability development involving suppliers and third parties. Case B explores network

pictures related to suppliers. Case C explores capability development involving suppliers and third parties.

The combination of examining the literature and the evolving empirical research and research questions could be described as an iterative process that enabled the researcher to explore supplier management in a network context.

1.8 Structure of the Introductory Part of the Thesis

The introductory part of the thesis is divided into five chapters, which are organized as follows:

Chapter 2 contains the theoretical basis underlying the thesis. The chapter sets out to identify and review definitions, theories and frameworks that are relevant to the topics for the thesis. The chapter contains four main parts: industrial networks and the significance of the supply side, technological innovation and suppliers, capability development and suppliers, and supplier-related network pictures.

Chapter 3 includes a discussion of the method that has been used throughout the research process for the thesis. The chapter provides justification for adopting realism as the philosophical orientation and case studies as the research strategy. The research process for the three case studies is presented and the trustworthiness of the thesis is evaluated.

Chapter 4 provides a presentation of the three cases of the study: *Case A*: Innovation and capability development involving NSS, ABB and third parties; *Case B*: Supplier-related network pictures involving Alpha, four suppliers and third parties; and *Case C*: Capability development involving Electra, six buying companies and third parties.

Chapter 5 presents the main findings of the study. First, the four appended papers are briefly presented before a discussion across these four papers focusing on the different parts of the research aim is provided. The chapter concludes with some theoretical and managerial implications as well as limitations and suggestions for further research.

Chapter 2
Theoretical Basis

This chapter presents the theoretical basis of the thesis. In Chapter 1, the aim of the thesis was identified: *"To explore supplier management in a network context by focusing on innovation and capability development involving suppliers as well as supplier-related network pictures"*. Based on the formulated aim, this chapter begins by presenting the markets-as-networks view, which is a central aspect of the IMP tradition and is the theoretical foundation for the thesis. As the focus is on the supplier side of relationships, the significance of the supply side and the importance of managing the structural embeddedness of suppliers are explored in Section 2.2. This section thus establishes the theoretical foundation for managing suppliers in a network context. Sections 2.3 and 2.4 discuss innovation and capability development involving suppliers, highlighting the importance of the network in such processes. In Section 2.5, the focus is on network pictures, particularly the network pictures that buying companies have of their supplier networks. A final section presents the conceptual framework underlying the thesis as well as the research questions.

2.1 Industrial Networks

Over the last three decades, extensive research into business markets has been conducted, in particular by the IMP Group. The idea that no business works in isolation or that "no business is an island" (Håkansson & Snehota, 1989) is now widely accepted in the literature and this perspective is evident in the behaviour of managers in practice. Much of the research in this domain has concentrated on dyadic business relationships as being of paramount interest and importance (Anderson et al., 1994). However, a growing amount of recent research has looked beyond the dyad of buyer and seller and focused more specifically on the role of the network.

According to IMP theory, interactions between any two firms must be considered in the context of a web of continuous exchange relationships that constitute a business network (e.g. Axelsson & Easton, 1992; Håkansson & Snehota, 1989, 1995). Figure 2.1 depicts the network around two focal companies that hold a focal relationship.
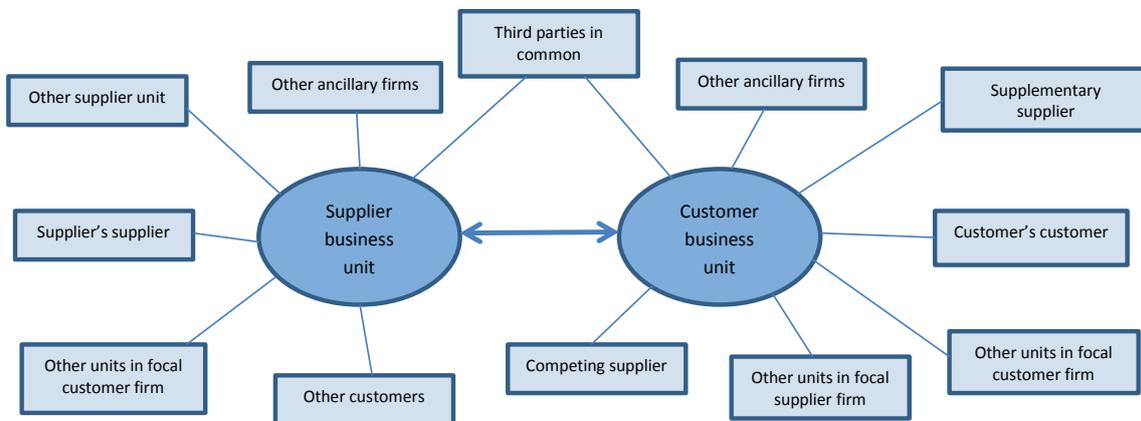
Figure 1: Connected relationships for companies in a dyadic relationship (source: Anderson et al., 1994, p. 3)

A basic tenet of the industrial network approach is that the industrial reality includes relationships among organizations, and connections between these relationships, which form network-like structures (Axelsson & Easton, 1992). Cook and Emerson (1984, p. 3) have defined the concept of connection in the following way: *"Two exchange relations are connected to the extent that exchange in one relation is contingent, positively or negatively, upon exchange in the other relation"*. Thus, what happens in one relationship between two parties affects and is affected by what happens in another, due to inter-connectedness. In this way, development of one relationship always depends on the broader network structure, and in order to understand a single relationship it becomes necessary to investigate it as part of a wider network context (Håkansson & Snehota, 1995).

Håkansson and Snehota (1995) propose a network model formed by actors, resources and activities, where companies develop networks of relationships through linked activities, tied resources and bonded actors, all of the elements being interdependent and interconnected. Each company's activities are embedded in a wider web of industrial resources and activities held and performed by different actors (Håkansson & Johanson, 1993; Håkansson & Snehota, 1995). The actors in a network are defined by the activities they perform and the resources they possess (Axelsson & Easton, 1992). Through interaction with other firms, activity links, resource ties and actor bonds are stimulated and developed, and relationships become embedded in networks (Uzzi, 1997).

These are but a few of the key features of the IMP view of business networks. However, these aspects are central to understanding the basic tenets underlying this approach. Building on the principle of interaction and business exchanges from the perspective of both the buyer and the supplier, most research within the IMP tradition cannot be said to focus entirely on purchasing or marketing issues. However, there are studies within IMP as well as within other

streams of research that focus more explicitly on the supply side of companies, as it is seen to be an area of significant strategic importance.

2.2 The Significance of the Supply Side

Since the 1980s, empirical evidence has mounted that a limited set of suppliers often account for a large proportion of purchasing spend, and that these relationships are characterized by interdependence, a collaborative spirit, and a long-term orientation (Håkansson, 1982, 1990; Håkansson & Snehota, 1995; Lamming, 1993). Studies have found that, for most companies, at least 50 percent of the value of their products comes from outside suppliers (DeBresson & Amesse, 1991; Gadde & Håkansson, 2001; Gadde, Håkansson & Persson, 2010). The attitude towards purchasing has therefore changed towards seeing the increasing strategic importance of the supply side of a company's operations, and it is widely accepted that companies must seek, build up and maintain relationships with capable suppliers in order to compete and survive (Dyer, 1996a; Lamming, 2013).

According to Axelsson and Håkansson (1984), the contribution of suppliers can be divided into two roles: the *rationalization role,* which is linked to how purchasing and suppliers can contribute to increased effectiveness, e.g. reduced production costs, and the *development role,* which concerns the suppliers' technological specialization that makes them highly valued as cooperative partners for customers. Further inquiries into supplier relationships, also spurred by management trends suggesting that companies should focus on their distinctive competences and outsource activities not relying on these competences, have revealed that such deep and collaborative supplier relationships heavily influence the buying firm's performance, operational efficiency, and innovative capability (Corsten & Felde, 2005; Dyer, 2000; Gadde & Håkansson, 2001; van Echtelt et al., 2008). Wagner and Johnson (2004, p. 728) state that managing supplier relationships *"can be a distinctive advantage for a firm, one that in turn contributes to sustainable competitive edge and high profitability"*. Given the importance of the supplier relationships, increasing attention has been paid to how such supplier relationships are (or should be) managed in order to create collaborative advantage (Dyer, 2000; Gadde & Håkansson, 1993; Gadde & Snehota, 2000; Harland et al., 2013; Lamming, 1993; Liker & Choi, 2004). Managing supplier relationships as interconnected in larger network structures has been highlighted as important to meet the challenges related to purchasing and supply in terms of cost reduction and development.

2.2.1 Managing Suppliers in a Network Context

While supplier relationships are important for the performance of buying companies, buyer-supplier relationships do not take place in a vacuum. The context in which buyer-supplier relationships are formed and evolve becomes the setting for the exchange between the companies. There is therefore a growing recognition that in order to understand a supply network and make strategic supplier-related decisions, it is necessary to look beyond the dyad

(Axelsson & Baraldi, 2013; Axelsson & Easton, 1992; Choi & Kim, 2008; Choi & Wu, 2009; Dubois & Fredriksson, 2008; Gadde & Håkansson, 2001; Håkansson & Snehota, 1989). In particular, Choi and Kim (2008) suggest that instead of managing a supplier as if that supplier exists in isolation, a buying company needs to consider the "structural embeddedness of the supplier", since the network surrounding the supplier can affect the buying firm's business decisions, behavioral choices, and economic outcomes. *"If structural embeddedness is not managed well, then the performance of the buying company may ultimately suffer"* (Choi & Kim, 2008, p. 6).

For buying firms, once they establish a relationship with a supplier, they are indirectly connected to the supplier's business network, including the connections to customers, sub-suppliers, competitors, and other horizontal actors (Choi & Kim, 2008; Gadde & Håkansson, 2001). Many of the potential benefits and constraints of a company's supplier relationships are affected by the relationships those suppliers have with their other counterparts (Roseira et al., 2012). An evaluation of a supplier's potential will therefore be incomplete if it is restricted to the supplier's own bundle of internal resources and capabilities (Ritter & Ford, 2004). A comprehensive supplier evaluation involves an analysis of a supplier's connection to others, as well as an evaluation of the implications of these connections for the customer. To understand the complex relationship interactions on the supply side of companies, one must therefore consider interdependencies in the larger supply network. (Dubois & Gadde, 2000; Dubois, Hulthèn & Pedersen, 2004; Dyer, 1996a; Gadde & Håkansson, 2001; Gadde et al., 2010; Harland, Lamming, Zheng & Johnsen, 2001; Sheth & Sharma, 1997). These interdependencies can provide considerable benefits for a customer who actively attempts to coordinate what happens between different suppliers and adapts the company's internal operations to networks of embedded suppliers rather than simply to individual suppliers.

Against this backdrop, the thesis takes connection and interdependence in networks as the point of departure for studying supplier management in a network context. Furthermore, the thesis focuses on three topics that are central to managing suppliers: innovation involving suppliers, capability development involving suppliers, and supplier-related network pictures. These topics are discussed below.

2.3 Technological Innovation

Within the IMP perspective, technological innovation is assumed to be an integral part of relationships and networks. Thus, innovation is regarded not as the result of the efforts of a single firm or innovator but, on the contrary, as the result of interplay between a number of different firms (e.g. Håkansson, 1987; Håkansson & Laage-Hellman, 1984). In relationships, different ideas are confronted and resources are combined in new ways that lead to the development of new knowledge. This section addresses a supplier's ability to contribute to a company's innovations, i.e. the development role, representing one of the two basic roles of suppliers discussed above (Axelsson & Håkansson, 1984). In general, an innovation can be regarded as *"the carrying out of new combinations"* (Schumpeter, 1934, p. 65). This

definition reflects the process of innovation where resources are combined in new ways (Penrose, 1959). Others refer to innovation as *"an idea, practice, or object that is perceived as new by an individual or other unit of adoption"* (Rogers, 1995, p. 11). The term "innovation" implies newness and it is generally seen as synonymous with words such as variation, transformation and renovation, and entailing changes in something established, especially the introduction of new methods, ideas, products, services, opening new markets, new sources of supply, and new ways of organizing (Johannessen, Olsen & Lumpkin, 2001).

Johne (1999) distinguishes between three types of innovations: *product* innovation, *process* innovation, and *market* innovation. Product innovation provides the most obvious means for generating revenues. Process innovation provides the means for safeguarding and improving quality and for saving costs. Market innovation is concerned with improving the mix of target markets and how chosen markets are best served. Innovations discussed in the thesis are mainly product and process innovations. While innovation was once considered the province of a company, researchers studying innovation increasingly stress the importance of cooperation across firm boundaries, in interfirm relationships and networks (Håkansson, 1987). This is discussed below.

2.3.1 Innovation Across Company Boundaries

Whereas the traditional view of technological innovation has focused on innovation as a process of managing internal development activities, this simplistic view of product development gave way to more complex views in the 1970s. One of these views focuses on innovation as an outcome of interaction across company boundaries. To innovate successfully, companies need to search for new sources of knowledge and technology in order to be able to develop new products and processes continuously. As a consequence, this "newer" innovation theory emphasizes the importance of established and long-lasting relationships between industrial actors for innovation development (Håkansson, 1987; Nooteboom, 1999; von Hippel, 1988). According to Håkansson (1987, p. 3), an innovation should, therefore, not be seen as the product of only one actor but *"as the result of an interplay between two or more actors; in other words as a product of a 'network' of actors"*.

In accordance with the "newer" innovation theory concepts such as 'open innovation' and 'connect and develop' have been advocated, focusing on the involvement of external parties, such as customers and suppliers, for cooperation, idea generation, trading of intellectual property rights, etc. (Chesbrough, 2003; Chesbrough & Garman, 2009; Huston & Sakkab, 2006). Within the IMP tradition, a number of studies have focused on innovation across company boundaries (e.g. Gressetvold, 2004; Holmen, 2001; Vercauteren, 2007). These studies provide insights into how companies may acquire or develop new resources related to a particular counterpart and how companies jointly develop new products, processes and technologies.

2.3.2 Innovation and Suppliers

Since the 1990s, the role and contribution of suppliers in a customer's innovation development has been a central topic. In the search for increased competitiveness and positioning for the organization it appears that *"supply managers must understand and call upon product and process innovation, especially in collaboration with suppliers, as primary strengths"* (Lamming, 2013, p. 477). For many companies, suppliers play an important role for innovation because of the extensive knowledge and capabilities they possess in relation to a company's products and technologies (Gadde & Håkansson, 2001; Håkansson & Eriksson, 1993; Sobrero & Roberts, 2001). This phenomenon has gained growing recognition both among companies and among academics (e.g. Clark, 1989; Dyer, 1996a; Hoegl & Wagner, 2005; Johnsen & Ford, 2007; Kamath & Liker, 1994; Lakemond et al., 2006; O'Sullivan, 2006; Rosell & Lakemond, 2012; van Echtelt, 2004; Wynstra, 1998).

At the same time as companies are increasingly making use of products and services based on a wide variety of technologies, companies are becoming increasingly specialized and narrowing their technological scope. The dramatic development of technology makes it increasingly difficult for a single firm to develop and maintain its own capability in each specific area of technology relevant to its operations. Buying firms are therefore increasingly relying on suppliers as sources of innovation and technical development because they represent more specialized companies for the innovation in hand (Gadde et al., 2010). Suppliers can thus play a vital role in the innovation process, whether as a source of ideas and technical expertise or as a co-developer.

2.3.3 Benefits and Challenges of Supplier Involvement for Innovation

Involving suppliers in innovation development offers a number of advantages. First, there are advantages for the product or process innovation itself. This includes reductions in time-to-market (e.g. Clark & Fujimoto, 1991), reductions in development costs, and quality improvements in the product or service that is developed (e.g. Primo & Amundson, 2002; Ragatz, Handfield & Scannell, 1997). Second, there are advantages for a buying company that involves suppliers in innovation development. These include a positive impact on the buying company's knowledge development, e.g. through joint learning (Nonaka & Takeuchi, 1995; Teece, 1992), as well as a stronger focus on core competences and on a higher level of specialization (Hamel & Prahalad, 1994).

Although involving suppliers in innovation development provides many benefits, it does not automatically lead to improved performance. Von Corswant and Tunälv (2002) stress that such involvement is much more demanding than most theory suggests, because of, factors such as uncertainties about the supplier's actual capability and motivation, risks of being stuck with the wrong supplier or technical solution, and the need to ensure connections with the supplier's own suppliers as well as between development and production. Other concerns that companies may have include the potential for loss of proprietary knowledge, reduced control over the innovation process, and the costs and resources associated with managing

collaboration with suppliers (Gadde & Snehota, 2000). Dyer (1996b, p. 43) further argues that: *"Although many managers now talk about their desire to turn their suppliers into developing partners, the fact of the matter is that actually doing it, after decades of exploiting suppliers by pitting one against the other, is exceedingly difficult"*. Involving suppliers in innovation is therefore a complex task and it can take time before the benefits of involving suppliers can be harvested. Managing the involvement of suppliers in innovation development while taking the network context into account adds to this complexity.

2.3.4 Towards a Network view on Innovation with Suppliers

The management of supplier involvement in innovation development varies across many dimensions. Much attention has been focused on the use of a dyadic versus a multilateral or network approach to suppliers in innovation development (Håkansson & Eriksson, 1993; O'Sullivan, 2006; Takeishi, 2001; Wynstra et al., 2001). Of these two approaches, the dyadic approach for involving suppliers in innovation projects has received the most attention. This approach builds on the widely used principle of dealing with suppliers directly and on an individual basis in the organization of innovation projects (Bidault et al., 1998).

Although not as widely studied as the dyadic approach, a network approach to supplier involvement for technological innovation is clearly gaining increasing attention (e.g. Dyer, 1996a; Dyer & Nobeoka, 2000; Håkansson & Eriksson, 1993; O'Sullivan, 2006; Tsai, 2009). As products are becoming more complex and compound several different technologies, there seems to be a need for involving a network of companies in the development process to supplement a company's in-house knowledge and capabilities (Alderman et al., 2001; Araujo, Dubois & Gadde, 1999). Ideas on how to shape the innovation and solve technical challenges may even come from the network, rather than from individual companies (Dooley & O'Sullivan, 2007; Powell et al., 1996). Furthermore, a buyer can acquire important knowledge, capabilities and ideas and develop them jointly with different actors surrounding the buyer and supplier involved in the innovation process. Examples of such actors include sub-suppliers, other suppliers of the buyer, other customers of the supplier, or customers of the buying company. Organizing an innovation process through the use of a network of companies has to be weighed against the costs, as the processes of networking may be resource demanding and impose demands on any company (Hallén, Johanson & Seyed-Mohamed, 1991).

Whereas previous research on supplier involvement in innovation development imply that a variety of supplier relationships are desirable, limited insight into practical issues like the management, organization and coordination of the desired involvement is provided (Lakemond et al., 2006). Furthermore, there seems to be a lack of studies that specifically focus on the network surrounding a buyer and a supplier and how this network can be utilized for technological innovation. Central themes of the thesis therefore involve exploring the organization and coordination of supplier involvement in innovation by taking a managing-in-networks perspective.

In line with the growing importance of innovation and the involvement of suppliers, increased attention has been paid to supplier capabilities. Research has shown that the value of a supplier – potential or realized – is related to its various capabilities (Möller & Törrönen, 2003), and that the quality of a company's products is ultimately determined by the capabilities of suppliers (Watts & Hahn, 1993). Having suppliers with strong capabilities is perceived as key to success and therefore building supplier capabilities through supplier development activities has become strategically important for companies. This is discussed further in Section 2.4 below.

2.4 Capability Development

According to authors such as Leonard-Barton (1992) and Teece (1998), capabilities of a firm can be a combination of knowledge and skills, technical systems, management systems, organization, and values. Rosenbröijer (1998, p. 36) employs the following definition of a firm's capabilities: *"a firm's ability and willingness to organise a mix of resources for productive activities, where resources are the basic elements of the activities in question. In other words, the capability of a firm is its ability and willingness to combine resources in order to perform required activities"*. The concept of capabilities is addressed in several different streams of literature; however, much of the capability concept has been developed around the resource-based perspective and the strategic management field. Much of this research emphasizes the importance of firm-specific capabilities as a source of inimitable and thus sustainable competitive advantage (Penrose, 1959; Prahalad & Hamel, 1990; Teece et al., 1997).

In discussions on the birth an evolution of capabilities, a distinction is sometimes made between deployment and development of capabilities; implying that whereas the deployment of capabilities has a strong element of routine, development of capabilities is more clearly marked by intent and deliberation (Helfat & Lieberman, 2002). Taking a more managerial view on capability development, it has been suggested that while capability development relies on more emergent and tacit accumulation of experience, it is important to stress and attend to the more deliberate efforts and investments in institutionalization of the lessons learnt (Kale, Dyer & Singh, 2002; Zollo & Winter, 2002).

Various factors can be expected to contribute to the development of capabilities for a firm. So far, the resource-based perspective of capability development focuses on how the individual firm controls and manages the development of its own capabilities, largely without the consideration of external influences (Loasby, 1999; Penrose, 1959; Teece et al., 1997). Knowledge and skills that employees have obtained through earlier experience, internal staff training, and 'learning-by-doing' are examples of internal factors that are expected to contribute to the development of a company's capabilities (Romijn & Albaladejo, 2002). Studies within this stream of research have been predominantly concerned with the criteria for capabilities to contribute to success and sustainable competitive advantage, rather than how capabilities are developed. Other studies have shown that capability development increasingly

depends on *external* sources. For example, Lane and Lubatkin (1998) argue that firms may acquire articulable knowledge about technical and managerial processes from sources such as journals, seminars and consultants, as well as providing a broader view of other firms' capabilities through benchmarking and competitor intelligence (Lane & Lubatkin, 1998).

2.4.1 Capability Development Across Company Boundaries

While much of the literature on capability development has been dominated by an intrafirm focus, a need for a network and interaction perspective has been suggested. Teece (2009) suggests that the development of capabilities should be studied by taking the business ecosystem into account, since it focuses on the firm's concrete customers and suppliers and all other organizations, institutions, and individuals that complement and impact the firm. Mahmood, Zhu and Zajac (2011) support this view and suggest that the development of capabilities should be studied from a network embeddedness perspective, and that the alternative forms of ties to different types of actors, such as customers, suppliers, and partners, may differentially impact the acquisition and building of a firm's capabilities.

Building on these lines of thought, researchers studying capability development increasingly emphasize that capabilities are interactively developed and adapted across episodes in business relationships over time (Brennan & Turnbull, 1999; Håkansson & Snehota, 1995; Rosenbröijer, 1998). Håkansson and Snehota (1995) comment that distinct capabilities are generated through interaction in relationships and that they have meaning in an organization only through the medium of other parties. Adaptations of capabilities on both sides of a relationship are required in order to maintain and build a long-term relationship, and they can be seen as the glue that keeps the parties together (Hagberg-Andersson, 2007). To develop and adapt capabilities, close interaction between the companies is important. This interaction enables the two actors to appreciate each other's needs and capabilities, so that they adapt their needs and match their capabilities accordingly. The capabilities of a supplier may thereby evolve from being used (i.e. deployed) by the buyer, as well as from being adapted to the buyer' needs (and thus developed) over time. In some situations, a firm may choose to interact with a specific customer or supplier primarily as a means of developing its own capabilities through interacting with others that have, for example, higher levels of technological experience in a particular field. According to Håkansson and Snehota (1995), the capabilities of a company reflect how successful it has been in combining relationships and its internal features. Managing the dyadic function is a condition for developing capabilities and for the strategy development of a company.

2.4.2 Capability Development and Suppliers

The capabilities of a firm may evolve in relation to all types of actors (Mahmood et al., 2011). However, in particular customers, and interaction with buyers in buyer-supplier relationships, have been emphasized as a key driver of the evolution of a firm's capabilities. For example,

Danneels (2002) stress the importance of product innovation related to customers for the evolution of a firm's capabilities, as well as the impact of customer linkages on the evolution of the firm's capabilities. The importance of clients for the development of a supplier's knowledge development has also been stressed by Bettencourt, Ostrom, Brown and Roundtree (2002) and Skjølsvik, Løwendahl, Kvålshaugen and Fosstenløkken (2007).

As companies are increasingly becoming more specialized and outsource areas that are perceived as non-core, the dependence on suppliers with specific capabilities increases (Arroyo-López, Holmen & de Boer, 2012; Modi & Mabert, 2005; Mollahosseini & Barkhordar, 2010). Acknowledging that relationships with suppliers possessing strong capabilities represent a key to success, many firms are focusing on *supplier development* to assist suppliers in developing their capabilities. According to Krause, supplier development broadly refers to *"any effort by a buying firm to improve a supplier's performance and/or capabilities to meet the buying firm's short- and/or long-term supply needs"* (Krause, 1999, p. 206). The purpose of supplier development is to improve suppliers' capabilities and enable them to enhance quality, delivery, and timeliness, as well as to reduce the costs of products and services. Supplier development may also stimulate innovation by suppliers to support the customer's sourcing and procurement targets and sustainable development objectives. These improvements may increase suppliers' profitability in addition to providing benefits to their customers.

Based on research on supplier development, a wide range of supplier development activities have been identified that aim to improve the suppliers' performance and/or capabilities. These activities may comprise efforts that are reactive, proactive and/or interactive (e.g. Krause, Scannell & Calantone, 2000); basic, moderate and/or advanced (Sánchez-Rodruígez, Hemsworth & Martínez-Lorente, 2005) as well as direct and/or indirect (Wagner, 2006). In a recent article, Arroyo-López et al. (2012) argue that the interaction between the buyer and the suppliers taking part in supplier development programmes is vital. They claim that a collaborative and relational learning context is important for successful supplier development.

2.4.3 Benefits and Challenges of Capability Development with Suppliers

Buying companies engage in supplier development activities because they hope that the suppliers can complement, or help, the buyer in reducing cost, raising quality and providing other direct values. Möller and Törrönen (2003) propose that suppliers can potentially provide their customers with value propositions in a number of areas based on their distinct capabilities such as production, delivery, and process improvement capabilities; capabilities for incremental as well as radical innovation; relational and networking capabilities; and capabilities for mastering the customer's business. Developing capabilities with suppliers is, however, not an easy task. According to Modi and Mabert (2007) as well as Wagner and Krause (2009), the development of a supplier's capabilities requires more than low-involvement activities such as audits or incentives. Successful supplier development must

entail high involvement, which implies coordination of activities, investment of resources according to the dyad's requirements, and close interaction between the buyer and the supplier (Arroyo-López et al., 2012; Gadde & Snehota, 2000). The buying company should therefore be very cautious with respect to which supplier development activity it pursues. Another challenge related to developing capabilities with suppliers can be to avoid controlling the supplier too tightly and making the supplier adapt too much to the buying company. In this way, the supplier will reduce its possibilities to sell its products directly to another buyer after it has made adaptations to the original buyer (Hagberg-Andersson, 2007). As capabilities are developed to match the two companies' needs, the buying company will also find it harder to start using alternative sources as switching costs arise.

The interactive nature of capability development means that the supplier also plays an active role in the creation of its capabilities, and is not only a passive recipient of the buying company's supplier development efforts. A supplier can focus on developing the areas in which its capabilities are weak or underdeveloped, thus arming it with greater power to act to change the nature of its relationships with its customers and establish a stronger position with them (Johnsen, 2005). By adapting its capabilities to demanding customers, the supplier can strengthen its competitive position, since the result can be superior products or production systems. Active involvement is also a means for the supplier to substantiate the relationship further by gaining more insight into how the buyer works and by enabling the buyer to gain a better understanding of the supplier (Arroyo-López et al., 2012). On the negative side, a supplier's customer relationships may control or restrict the development of its capabilities. For example, overly detailed directions by a specific customer can make it difficult for the supplier to use and develop its capabilities in a way that fits well with the supplier's total set of customers and their requirements. In this way, the supplier is becomes highly dependent on a single buyer.

2.4.4 Towards a Network View on Capability Development with Suppliers

So far, most studies of suppliers' capability development have focused on dyadic relationships between a customer and its suppliers. The focus has primarily been from the buyer's perspective and data have mostly been gathered exclusively from purchasers and/or supply chain managers (e.g. Krause et al., 2000; Sánchez-Rodríguez et al., 2005; Wagner, 2006). Furthermore, much of the literature has focused on identifying different approaches that a customer can pursue in order to develop its suppliers, e.g. direct and indirect supplier development approaches. Only to a very limited degree has research on supplier development investigated and conceptualized the role of the network surrounding the buyer-supplier dyad in bringing about capability development at suppliers.

Acknowledging that relationships are parts of larger network constellations, the IMP literature provides insight into capability development in networks. For example, Gadde et al. (2010) propose that a supplier's capability development results from combining the capabilities from the focal buyer-supplier relationship with resources in other relationships of

the supplier. As an example, a supplier can develop its capabilities through combining one of its own resources with a resource of a specific buyer and a resource of one particular supplier of the supplier. Figure 2 is an illustration of different actors involved in developing capabilities in interaction with a supplier. The spiral indicates the interaction process taking place between the companies that develop a specific capability. The arrows between each of the actors and the interaction are intended to show that resources are brought to the interaction process and resources evolve from the interaction process. The same potential for capability development can be identified on the buying side. A specific capability of the supplier can be tied to some specific capability of the buying company which, in turn, may be tied to a third capability of a customer or another supplier of the buying firm. In the long term, with well-developed and significant relationships, the total potential for all these opportunities for combining is huge, which *"creates a need for systematic and structured approaches"* (Gadde et al., 2010, p. 162).
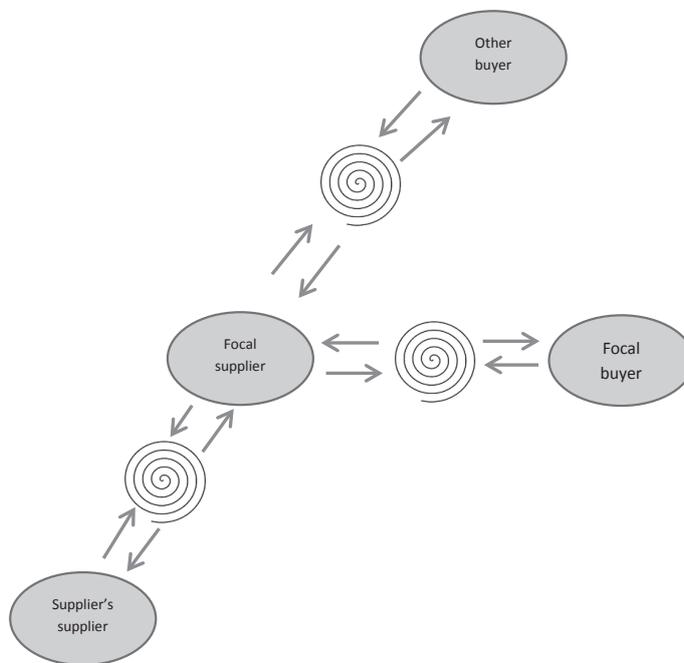
Figure 2: Development of a supplier's capabilities in interaction (source: Håkansson, Ford, Gadde, Snehota & Waluszewski, 2009, p. 32)

Building on the assertion that customers are emphasized as key drivers of the development of a firm's capabilities it is important for a buying firm to acknowledge that a supplier's other customers may be the most important drivers or "catalysts" of the supplier's capability development (Hartley & Choi, 1996). This issue has not been extensively investigated or discussed within the field of supplier development. One exception is

MacDuffie and Helper (1997), who suggest that when developing a supplier, a buying company may benefit from other customers' prior supplier development initiatives, since these may have improved the supplier's capabilities and thus raised the supplier's absorptive capacity for the buying firm's subsequent initiative. Furthermore, they conclude that when undertaking supplier development, there is little need to worry about knowledge spillover to other, competing customers via the shared supplier – since overall improvement of the supplier's capabilities will improve the self-reliance of the supplier which, in turn, benefits the buying firm.

A related area with a variation on this theme involves exploring the extent to which the buying companies tend to be aware of how the capabilities of their suppliers develop, and what role the suppliers' other partners play. Axelsson and Baraldi (2013, p. 161) argue that *"If other actors are key to the development of the supplier's capabilities shouldn't the buying firm take those connections into consideration when, for example, choosing their suppliers?"* One way of studying a buying company's awareness of its suppliers' network context is to focus on supplier-related network pictures.

2.5 Supplier-Related Network Pictures

Being aware of the impact a supplier's surrounding network has on the development and deployment of the supplier's capabilities might be very important to fully understand the supplier, the actions that the supplier takes, and how to manage (in) the relationship with the supplier over time (Mota & de Castro, 2005). Buying companies with such insight are more likely to perform better at supplier management compared with those without such understanding (Choi & Kim, 2008). A buying company may increase its awareness of suppliers' network contexts by building its network awareness capability (Choi & Kim, 2008). This capability refers to *"a buying company's ability to effectively and efficiently scan the external networks of its key suppliers beyond its direct relationships with them. It entails observing other, indirect relational dynamics that might potentially lead to future concerns and opportunities"* (Choi & Kim, 2008, p. 9).

The claims by Choi and Kim (2008) regarding supplier network awareness capability can be viewed in light of the work by Teece (2007, 2009) on dynamic capabilities. According to Teece (2007, p. 1320), a company requires dynamic capabilities to achieve long-run enterprise success. Important foundations of dynamic capabilities are the abilities to sense, shape and seize opportunities and threats, and to reconfigure the company accordingly. Sensing new opportunities is very much a scanning, learning, and interpretive activity, where companies must search the core as well as the periphery of their business ecosystem in order to identify and shape opportunities. In particular, a company's search must embrace the *"community of organizations, institutions, and individuals that impact the enterprise and the enterprise's customers and suppliers"* (Teece, 2007, p. 1325). One way of being aware, sensing and searching in a supplier's network is through systematic use of network pictures.

2.5.1 Network Pictures

Network pictures are a concept developed within the IMP tradition. They can be defined as *"the views of the network held by participants in that network"* (Ford et al., 2003, p. 176). This refers particularly to the views held by actors of the extent, structure and operation of the network, as well as the connections between the actors involved in it. Research that puts network horizons and pictures centre-stage is quite recent; see Corsaro et al., 2011; Ford & Redwood, 2005; Henneberg et al., 2006; Holmen & Pedersen, 2003; Leek & Mason, 2009, 2010; Mouzas & Naudé, 2007; Mouzas, Henneberg & Naudé, 2008; Ramos & Ford, 2011; Roseira et al., 2012.

It is generally agreed that network pictures provide a context, and are framing and sense-making devices as well as possible triggers for managerial activities (Colville & Pye, 2010; Hennberg et al., 2006; Mouzas & Naudé, 2007; Mouzas et al., 2008; Öberg, Henneberg & Mouzas, 2007). Network pictures thus act as a reference point for the way in which actors interact with each other and instill actors with a sense of *"... what they can or might wish to do"* (Ford, Gadde, Håkansson & Snehota, 2002, p. 7). As such, the actions of each actor, as well as their reactions to those of others, depend on their unique network pictures. It is suggested that each business actor has an idiosyncratic picture of the extent and characteristics of the network; of who does and should do what; of what works and does not work, and of which actors to integrate or to exclude from their view of the network. A network picture portrays a snapshot of a network at a particular point in time. Companies' perceptions of the structure of the network are, therefore, likely to change as they interact and their views of the network's scale may contract or expand through the exclusion or inclusion of other actors (Roseira et al., 2012).

2.5.2 Individual vs. Company Network Pictures

Studies of network pictures have been conducted using different aggregations of actors. For example, Ford and Redwood (2005) and Henneberg et al. (2006) investigated network pictures at the company level, Leek and Mason (2009, 2010) compared network pictures of individuals, and Kragh and Andersen (2009) compared network pictures across units in one company. Examining business interaction at the level of individuals enables researchers to highlight differences between those individuals and subgroups in their views of interaction and to use those individuals as representatives of the approach to interaction of organizations. Each company is made up of individuals with idiosyncratic and probably contradictory network pictures (Ford et al., 2003; Mattsson, 2002). These different pictures may emerge because individuals in different functional areas have access to network information that is quantitatively and qualitatively different. In their study of dispersed cognitive pictures of individual managers, Mouzas et al. (2008) suggest that the more interaction – whether with individuals within the same unit or with individuals in other units or levels inside the organizational boundaries, or with individuals from other organizations – the more amalgamated, collective and, hence, better network insight is produced. While recognizing the

importance of managers' individual network pictures, this thesis considers network pictures at the company level.

2.5.3 Network Pictures Related to Suppliers

Despite the acknowledged significance of network pictures, there is still a paucity of empirical studies describing the range of network pictures held by actors and the interplay between those pictures and business interaction, particularly in the context of supplier networks (Ford & Mouzas, 2010). A recent study by Roseira et al. (2012) has contributed to theory in this area with an analysis of how variations in companies' network pictures relate to their strategies and to their interactions with suppliers and with those suppliers' other counterparts. They suggest that scanning supplier networks strictly on the basis of current pictures may limit the exploration of supplier networks' potential, and they call for further research to further explore the interconnections between customer and supplier network pictures.

Based on earlier studies on network pictures and the acknowledged importance of managing suppliers in their network context, a central theme of the thesis is therefore buying companies' awareness of how the capabilities of their suppliers develop and how opportunities can be found in suppliers' networks if one looks at how network pictures vary between buyers and suppliers. Furthermore, the thesis focuses on how a buying firm can proceed to acquire new insights, which may lead to revision of supplier network pictures, and spur new actions and reactions toward suppliers.

2.6 Conceptual Framework

As presented in Chapter 1, the aim of the thesis is to explore supplier management in a network context by focusing on innovation and capability development involving suppliers as well as supplier-related network pictures.

In Chapter 2, the theoretical foundation for the thesis has been discussed. Based on the formulated aim, the discussion has centred on the necessity to look beyond the dyad when managing suppliers because the context surrounding a buyer and a supplier plays a significant role. In accordance with this, the importance of taking the network into account when involving suppliers for innovation and capability development is discussed, as well as how a buying company's supplier-related network pictures may have an impact on how suppliers are managed. The preceding discussions in this chapter have led to the development of a conceptual framework that captures all the elements of the formulated aim; see Figure 3.
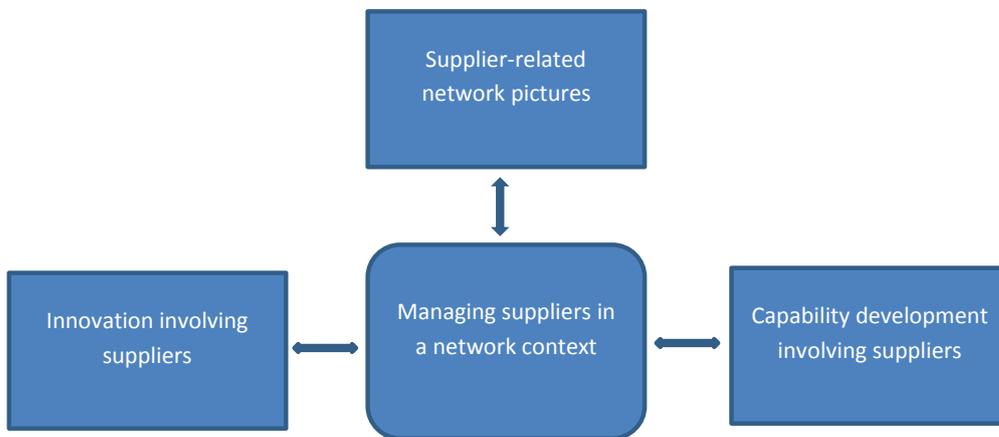
Figure 3: Conceptual framework

This framework has been developed to investigate supplier management in a network context. Three areas are explored because they are assumed to be important for the way suppliers are managed in a network context: innovation involving suppliers; capability development involving suppliers; and supplier-related network pictures. Following the logic of the conceptual framework, three research questions are identified:

1. How can innovation involving suppliers be important for the way suppliers are managed in a network context?

2. How can capability development involving suppliers be important for the way suppliers are managed in a network context?

3. How can supplier-related network pictures be important for the way suppliers are managed in a network context?

This set of research questions forms the basis for the empirical data collection. Overall, the industrial network approach has been used as a conceptual ground for approaching these research questions, as the focus is on managing suppliers in a network context. As will be discussed later, the research questions were not clearly identified in the early phases of this study; however, they were developed during the study in interaction with the empirical data and theory. This chapter has outlined the theoretical framework and presented three research questions; Chapter 3 presents the method used in the study.

Chapter 3
Methods

This chapter presents and discusses the method used in the thesis. First, the chapter presents and discusses philosophical and epistemological perspectives and identifies realism as the orientation underlying the study. Given the initial theoretical interest in the industrial network approach, a case study research method is adopted. Section 3.2 presents case study research in general, including why it is particularly useful for studies of industrial networks. The empirical material and the theoretical basis were refined through 'systematic combining'. Sections 3.3 and 3.4 provide a justification for adopting systematic combining as a way of working with an abductive approach and the process of 'casing' in industrial network studies. Sections 3.5 and 3.6 offers a description of how cases were selected and the research process for the three case studies A, B, and C. Section 3.7 provides an overview of the cases of the thesis and Section 3.8 presents considerations on how data has been analysed. The chapter concludes by evaluating the trustworthiness of the thesis in Section 3.9 and some of the challenges, strengths and weaknesses of the study in Section 3.10.

3.1 Research Philosophy and Epistemology

Research in the field of social science involves explicit or implicit assumptions about the nature of the social world. These assumptions may be threefold – ontological, epistemological and methodological. Ontology refers to the basic assumptions about what reality is and how it works (Denzin & Lincoln, 1994). Assumptions of ontological nature concern whether the 'reality' under investigation can be viewed as objective or the product of individual comprehension. Epistemology refers to how knowledge can be created on the basis of ontology. Assumptions of an epistemological nature relate to the philosophical basis of knowledge and concern how one may develop knowledge of the social world and communicate that knowledge to others. According to Easton (1995) epistemological issues provide the framework for methodological decisions. Several epistemological orientations exist within social research (Burrell & Morgan, 1979; Easton, 1995; Guba & Lincoln, 1994), e.g. positivism, constructivism and realism.

3.1.1 Positivism and Constructivism

Positivism represents an epistemological orientation where an objective truth is assumed to exist and assumes that social reality is independent, objective and external to the researcher (Burns, 2000). Classical positivist thinking holds that the researcher is *"independent of and neither effects nor is affected by the subject of the research"* (Remenyi, Williams, Money & Swartz, 1998, p. 33). The paradigm builds on research in the physical sciences and follows a pattern of formulating and testing hypotheses in which assumptions of the nature of social

reality are made. *Constructivism* represents an epistemological orientation that is at odds with positivism where a subjective rather than an objective truth is assumed to exist (e.g. Burrell & Morgan, 1979). According to Berger and Luckman (1967) it then becomes important to address how the truth is viewed, or constructed, by social actors. In the constructivist paradigm all knowledge is unique in the sense that it is connected to particular situations and individuals, and according to Remenyi et al. (1998) this results in the researcher becoming an intrinsic part of what is being researched and not independent as with the case of positivism.

3.1.2 Realism as the Epistemological Perspective Adopted in the Thesis

While positivism and constructivism are seen as the two dominating epistemological orientations, other orientations also exist. *Realism*, also referred to as transcendental realism or critical realism, is one of these. In line with other researchers within the industrial network approach that have explicitly indicated realism as the orientation they use (e.g. Gressetvold, 2004; Hagberg-Andersson, 2007; Holmen, 2001; Pedersen, 1996), realism is identified as the orientation underlying this thesis.

Realism is based on the belief that a reality exists that may be discovered and understood by the researcher (Easton, 1998, 2002). Realism primarily concerns ontology, but has important epistemological and methodological implications – if we accept that a reality exists that can be discovered, a key consideration must be how one can ultimately learn, or know about, the real world. According to Easton (1995, p. 437) *"Realism describes the belief that there is a reality 'out there' that exists and can be discovered and ultimately understood."* An objective truth exists, even though it is never fully discovered nor understood; *"We see through a glass darkly but there is something there to be seen. Or using another metaphor, there is a land below the aircraft but we get only occasional glimpses of it"* (Easton, 2000, p. 207). Realists believe that there are cases (more or less empirically verifiable as such) "out there" and see cases as either given or empirically discoverable (Ragin & Becker, 1992). For the thesis this means that a reality that is independent of the researcher exists with respect to how suppliers are managed in a network context, and the researcher will only be able to observe fractions of this reality.

Realism and positivism both involve a belief in the existence of an objective truth. In this respect, realism differs from constructivism, which rejects the existence of an objective truth. Realism, however, differs from positivism with respect to causality (Easton, 1995). Whereas positivists view the social and natural worlds as being bound by certain fixed laws in a sequence of cause and effect, processes are essential within realism (Collis & Hussey, 2003). Causality from a realist perspective thus concerns not a relationship between discrete events, but rather the 'causal powers' or 'liabilities' of objects and relations, or, more generally, their 'ways-of-acting' mechanisms (Sayer, 2000). At the core of realism is thus the assumption that the actual events in the world are related to but separate from the interacting objects possessing causal powers and liabilities, which produce the events. Therefore, it is inadequate to search for and identify regularities of events when trying to generate general

explanatory knowledge. Instead, general explanatory knowledge is related to identifying the underlying causal powers or liabilities of objects in the world involved in producing phenomena and events (Bhaskar, 1975) and the possible reasons why objects have those causal powers.

3.1.3 The Impact of the Theoretical Framework

The philosophy subscribed to and the methodology used by the researcher will often be strongly influenced by the theoretical frameworks guiding the researcher; certain philosophical assumptions and methodological approaches will most often be embedded in the theoretical frameworks. In a similar vein, Abbot (2001) argues that any methodology parses the social world in particular ways and thus contains elements of an implicit theory. According to Håkansson and Waluszewski (2002), it is only possible to get hold of *fragments* of business/organizational life. However, which fragments we are focusing on, as well as how we try to catch them, recombine them and analyse them, are issues that are coloured by our research tools. If we had started out with a different theoretical assumption, we would have ended up with other fragments, combined with other research results.

A general principle in research is, therefore, that the methodological perspective should follow from the purpose of the study, the theoretical perspective that informs the study, and the research questions that one wants to answer (Manstead & Semin, 1988). Since the present study is deeply rooted in the IMP tradition and the aim of the research involved studying supplier management in a network context, there was a need to collect multiple forms of data that cannot be easily standardized or aggregated on both sides of buyer-supplier dyads. A decision was therefore made to employ a qualitative methodological approach, because this is particularly suited to capture the meaning and not the frequency of phenomena (Easton, 1998). Furthermore, a *case study method* has been chosen for this study as it is often identified as a suitable approach for the study of business relationships and networks, since it provides the basis for in-depth insight about a phenomenon (Easton, 1998).

3.2 Case Study Research

According to Easton (2010, p. 119), *"Case research can […] be defined as a research method that involves investigating one or a small number of social entities or situations about which data are collected using multiple sources of data and developing a holistic description through an iterative research process"*. A key opportunity with a case study is to understand a phenomenon in depth and comprehensively. Furthermore, case research allows the researcher the opportunity to tease out and disentangle a complex set of factors and relationships, albeit in one or a small number of instances (Easton, 2010). Case studies are also useful for research where more needs to be known about a phenomenon and where existing theory seems to be inadequate (Eisenhardt, 1989). Case studies are further suitable for finding answers to *how* and *why* questions, since these deal with operational links to be

traced over time rather than with frequency or incidence (Yin, 1989). The purpose of the thesis is to find answers to the following research questions:

1. *How* can innovation involving suppliers be important for the way suppliers are managed in a network context?

2. *How* can capability development involving suppliers be important for the way suppliers are managed in a network context?

3. *How* can supplier-related network pictures be important for the way suppliers are managed in a network context?

Gaining in-depth insight into these phenomena has been the primary motivation for conducting case studies. Furthermore, existing theories on innovation and capability development as well as literature on network pictures need to be broadened. Previous research within the innovation and capability development literatures has mainly focused on an internal perspective and the dyadic approach to involving suppliers in innovation and capability development. Literature on network pictures is relatively new, and a need has been expressed to enrich the concept of network pictures especially related to supplier networks. The thesis has the industrial network approach as the main theoretical foundation. Ideas and concepts developed within a managing-in-networks perspective have been used as a point of departure for building on and extending existing knowledge within the above-mentioned research traditions. The theoretical implications for literature on supplier involvement in innovation, supplier development and network pictures are discussed in Section 5.4.

The suitability of applying case study research is also strongly supported by the theoretical perspective of the thesis. Case research has played an important role in the development of theoretical notions on inter-organizational relationships, interaction and industrial networks, and it has been the research method preferred by many researchers in this area (e.g. Gressetvold, 2004; Hagberg-Andersson, 2007; Holmen, 2001; Lind, 2006). Furthermore, several articles and special issues on methods in management research highlight the extensive use of case studies in business-to-business studies and the challenges of case study research. Examples include the special issues "Case study research in industrial marketing" (2010) and "Time and process in business network research" (2012) in Industrial Marketing Management and "Methods" (2007) in the Journal of Purchasing and Supply Management. Even though case studies have a number of advantages in relation to studies of industrial networks and it may be argued that they represent *the* method, there are some challenges for case research in a network context, e.g. the problem of network boundaries, decisions related to case study designs and defining the units of analysis. These challenges are discussed below.

3.2.1 Boundaries in Time and Space in Case Studies

According to Yin (1994, p. 13), a case study is *"an empirical enquiry that investigates a contemporary phenomenon within its real life context, especially when the boundaries between the phenomenon and context are not clearly evident"*. Industrial networks present researchers with particular challenges because they do not constitute closed, bounded or clearly defined systems and the distinction between the phenomenon and the context is problematic. As a network is without boundaries, one challenge in this study has concerned boundaries in *space*, i.e. the context within which an event occurs and how it influences the event (Tidström & Hagberg-Andersson, 2012). In this study, the challenge has been related to delimiting the relationships to consider as relevant in the case studies; i.e. how many relationships should be studied and how far out in the network we should go to be able to analyse the specific research questions.

Dubois and Araujo (2004, p. 210) identify the problem of boundaries and suggest a solution for how to handle it: *"The task of the analyst is often to progressively construct the context and boundaries of the phenomenon, as theory interacts with the method and empirical observations. The research object, its boundaries, context and horizon are thus emergent and unfolding outcomes of the research process"*. This resembles the way in which the boundary issue was treated in the present study. In interaction with theory, what is the focus for a particular case and what is not emerged over time. With a buyer-supplier dyad or a network of companies as the point of departure in the different case studies, the focus of the case studies and the number of companies involved emerged in interplay with theoretical ideas of what the different cases were cases of. The boundaries in space of the different case studies were therefore shaped over time in interaction with theory and the research questions. The study firstly focuses on the relationship level, which includes the nature of the relationship between the focal companies. This delimitation in space can be referred to as "inner space" as identified by Juho, Mainela and Pernu (2010) and Tidström and Hagberg-Andersson (2012). Secondly, the study focuses on the context that is external to the focal business relationships, including third parties connected with the focal business relationships. This delimitation in space can be referred to as "outer space" (ibid.).

The *time* aspect in case studies of industrial networks is another important issue that needs to be addressed, since networks are subject to constant change (Halinen & Törnroos, 2005; Tidström & Hagberg-Andersson, 2012). The cases presented in this thesis have been focused on gaining insight into how companies have cooperated from the time the relationships were established until the time of the interviews. Even though the case studies capture a very long period, the specific papers deal with particular *episodes* during this time. For example, Paper 1 deals with four innovation processes that have taken place between a buyer and a supplier that cover different episodes in the relationship of which they form a part. Paper 2 studies the involvement of buying companies in developing a supplier's capabilities, also as episodes in long-lasting relationships. Paper 4 focuses on the supplier development strategies of buying companies', which also focus on episodes in relationships. Paper 3, however, focus on capturing supplier-related network pictures at the time of the interviews.

According to Easton (2010, p. 118), challenges related to boundaries in time and space as well as 'the nature of the subject' of industrial marketing researchers are the very reason for conducting case research: *"The main units of analysis are organisations and relationships which are difficult to access and complex in structure in comparison with, for example, consumer markets. As a result a case study of single, or small number, of such entities can provide a great deal of, largely qualitative, data which can be written up as a case study, offering insights into the nature of the phenomena"*. This study has benefited from the strength of the case study method, which allows the choice of temporal frames and boundaries to emerge in the course of the research process as the understanding of the phenomenon and its context develops (Dubois & Araujo, 2004). Decisions on which companies to include and the periods to cover were made as the study progressed based on interaction between empirical findings, theory and the research questions.

3.2.2 Basic Case Study Designs

Case study research can primarily be divided into *single* and *multiple* cases (Yin, 1994). When one conducts a study with multiple cases, the cases and their boundaries are determined at the outset to enable some form of case comparison (Aaboen, Dubois & Lind, 2012). When conducting a single case study, however, the boundaries of the case evolve during the study (Dubois & Gadde, 2002). What the case is a case of will be subject to continuous reconsideration. For this thesis, *three single case studies* have been conducted. The initial plan was to conduct two case studies and search for similarities and differences; however, as the research progressed we ended up with two quite different cases due to the unique character of the cases as a result of context specificity. After completion of the first two case studies, there was also a need to acquire some additional insights – which led to the involvement of a third case study. The reasons underlying the case selection processes are discussed further in Section 3.5 Case selection.

Conducting three single case studies has made it possible to gain in-depth knowledge on the specific research questions raised in this study. And, as mentioned earlier, the boundaries of the different cases were not decided prior to starting the case studies; they evolved as theory interacted with empirical observations. The advantage of single case designs in relation to multiple cases is that single case studies permit inductive or abductive approaches in which the theoretical framework can be adapted and developed in interaction with the empirical case (Dubois & Gadde, 2002). The disadvantage may be that the single case becomes too context specific, which limits the possibilities of generalizing to other settings. However, as the aim of the thesis is to build on and extend existing knowledge and theories within established research traditions and not to make generalizations, a single case study design is seen as suitable. Furthermore, Yin (1994) suggests that analytical generalizations can be made from single case study research. When making analytical generalization, the researcher may generalize concepts and theories, thereby generalizing a particular set of results to some broader theory. An attempt is made in this thesis at making analytical generalizations.

3.2.3 Units of Analysis

The definition of a research project's unit of analysis is considered a key aspect of the research design. The unit of analysis defines what is being studied; according to Yin (1994, p. 22) *"no issue is more important than defining the unit of analysis"*. A case contains either a single unit or multiple units of analysis (Yin, 1994). Whereas a case with a single unit of analysis is referred to as holistic, a case with multiple units of analysis is referred to as embedded. The case studies of the thesis contain multiple units of analysis, and they can therefore be classified as single emdedded case studies. The different units of analysis in the case studies A, B, and C are presented in Table 1.

Table 1: Units of analysis in the case studies

	Context				
	Relationship	Network	Innovation projects	Capability development	Network pictures
Case A	✓	✓	✓	✓	
Case B	✓	✓		✓	✓
Case C	✓	✓		✓	

The three case studies are studied across two levels of analysis: business relationship and business network. This has provided the context in which innovation projects, capability development and network pictures have been explored. Case A focuses on innovation projects and capability development in the context of buyer-supplier relationships and networks. Case B focuses on capability development in the context of buyer-supplier relationships and networks. In addition, the focus is on network pictures – particularly supplier-related network pictures. Case C focuses on capability development in the context of buyer-supplier relationships and networks.

These units of analysis were not clearly identified before the case studies were conducted, but emerged over time as data were collected and combined with theory and the research questions. This process can be identified as 'systematic combining' or 'casing', discussed in Sections 3.3 and 3.4.

3.3 Systematic Combining

There tend to be two main approaches for building theories, the *deductive* and the *inductive* approaches, both greatly influenced by the research paradigm adopted, and the nature of the research. Gummeson (2000) points out that a deductive approach focuses on testing existing theory, whereas an inductive approach primarily generates new theory. A deductive approach, mainly associated with positivism, is implemented when a theoretical framework and hypothesis are developed from existing literature. The hypothesis is tested in the research context in order to prove or disprove it (Ghauri, Grønhaug & Kristianlund, 1995). Induction, on the other hand, describes a research process that takes its point of departure from empirical data, thus avoiding theoretical preconceptions, and then relates the empirical findings to theory.

In addition to these two approaches, a third approach has been suggested, where theoretical frameworks evolve simultaneously and interactively with empirical observations and the analysis. This approach, called *abduction*, is identified by Dubois and Gadde (2002) as 'systematic combining' of theoretical and empirical findings, enabling the researcher to move between the two at different stages. Systematic combining implies continuous interpretation of the conceptual structure as well as the crucial role of theory in interpretation of empirical observations. In making abductive inferences, researchers depend on previous knowledge that provides them with the necessary categorical framework for the interpretation, description and explanation of the empirical world under study. It becomes a matter of going 'back and forth' (Dubois & Gadde, 2002, p. 555) through the literature and findings in order to attempt to draw rich insights.

On the one hand, there are similarities between induction and abduction in terms of taking the empirical field as the point of departure. On the other hand, there are similarities between deduction and abduction, since both acknowledge the theoretical assumptions as vital starting points. However, abduction is to be considered as different from a mixture of induction and deduction (Alvesson & Sköldberg, 2000; Dubois & Gadde, 2002) because alternating between the theory and the empirical world has unique effects. An abductive approach take advantage of the flexibility of the case method by permitting reconsideration in both the theoretical and empirical domains, and consequently by allowing changes of the boundaries of the case based on theoretical and/or empirical choices (Dubois & Gibbert, 2010).

For this thesis, the *abductive* approach provides the most accurate reflection of the perceived process experienced by the researcher. Basic theoretical assumptions regarding relationships and networks have been used as guidance helping the researcher to know what to look for in the empirical world. Furthermore, the theoretical assumptions have been developed and articulated through empirical insights. At the same time, the background of the supervisors and the research network of which I have become part during the study have influenced the research process by providing a context for my research. My involvement in the research network has influenced the thesis in terms of the emerging research questions of the different papers, the literature that has been read and the methodology used.

3.4 Casing

As mentioned above, the cases have evolved over time as more and more data have been gathered and combined with theory. Ragin (1992, p. 218) refers to this process as 'casing': *"... making something into a case or "casing" it can bring operational closure to some problematic relationship between ideas and evidence, between theory and data. Casing, viewed as a methodological step, can occur at any phase of the research process, but occurs especially at the beginning and at the end. Usually, a problematic relation between theory and data is involved when a case is declared."* To know what the case is a case of is not to be regarded as the starting point but rather as one of the final steps in the research process (Dubois & Araujo, 2004). *"What constitutes the phenomenon of interest and its boundaries is often the outcome of the study rather than a decision that can be firmed up prior to conducting the study"* (Dubois & Araujo, 2004, p. 225). It means that when it is clear how to draw the boundaries around a case, it is also known what the case is a case of, implying the final phases of the research process.

Parts of the casing process in this thesis took place through interaction with practitioners in the companies studied. The practitioners (particularly the key contact people) have been highly involved in framing the case studies and finding interesting areas of research, from both a practitioner's and a researcher's point of view. Particularly in Case A and B, the key contact people have influenced decisions regarding which companies to include in the studies and which themes to address.

Sections 3.5 and 3.6 present considerations regarding case selection and the research process. These considerations have been important for the 'casing' of the different case studies.

3.5 Case Selection

As argued by Robson (1997), case selection is an important consideration, as each case is uniquely valuable for study in its own right, not a sample from a population. For the thesis, three single, embedded case studies have been conducted. On an overall level, these cases have been selected because they were perceived as useful for gaining in-depth understanding and insights into innovation and capability development involving suppliers. The starting point for the case studies has been technological companies believed to interact with suppliers in order to make improvements in their products and processes. The aim of the first two case studies that were conducted initially was to study buyer-supplier relationships and the impact of the surrounding business network for innovation and capability development. The original plan was to find similarities and differences based on the two case studies. However, while the case studies evolved in interaction with the data, the theory and the research questions, and because the studies were pulled in different directions by the practitioners involved, we ended up with two quite different cases due to the unique character of the two case studies. This finding is in line with processes of systematic combining and casing where the process of

direction and redirection of single case designs means that each case will be distinct and unique.

Case A evolved into a case of innovation and capability development involving suppliers and third parties. Case B evolved into a case of network pictures related to suppliers. Case C was initiated to acquire additional insight into capability development in buyer-supplier relationships and to complement the two case studies already conducted. This case study evolved into a case of capability development in buyer-supplier relationships involving third parties. How the empirical investigation was carried out in each of the three cases is described below.

3.6 Research Process for Case Study A, B and C

This section presents the research process for the three case studies in the thesis. The aim of this section is to give the reader insight into decisions that were taken during the research process leading up to the research issues of interest.

3.6.1 Case A: Innovation and Capability Development Involving NSS, ABB and Third Parties

The decision to study Norske Skog Skogn (NSS) and ABB was heavily influenced by one of my supervisors, and by discussions with key informants in the two companies. In the discussions about which firm(s) might be possible to use in relation to my research, NSS was suggested as an interesting company because of its size and its need for continuous improvements as an important actor in the pulp and paper industry. I was interested in finding a company that focused on innovation, that spent time looking for development potentials, and that involved suppliers in such processes. Media reports about NSS indicated that NSS was a company with high needs for improving efficiency in its paper machines. The pulp and paper industry has seen tough times and a number of companies have been forced to cut costs and improve efficiency in order to ensure their further existence. Some of these improvements were believed to result from finding new and better ways of working with suppliers. NSS therefore seemed an interesting company for further research.

In February 2006, we approached NSS and set up a meeting with the Maintenance Manager. During this meeting, we became acquainted with the company and the process of papermaking. As we were mostly interested in discussing NSS's need for improvements and the importance of suppliers in this process, this was raised as a specific issue during the meeting. We were informed about different types of suppliers, for example suppliers of chemicals to be used in the pulp as well as suppliers of paper machine parts, and the relative importance of these in making improvements at NSS. We learned that purchasing comprised 60-70% of the company's turnover and that a small number of suppliers were very important for the total amount purchased. The global engineering company ABB was highlighted as a

supplier with which NSS had a long-lasting, extensive relationship. Over the years, ABB had been an important supplier for both small-scale incremental improvements as well as large rebuilding projects. We were informed that NSS had invested a great deal in its relationship with ABB, and that in many ways NSS could be referred to as an "ABB factory" due to the different ways in which ABB is involved. Based on the discussions in this meeting as well as some refinement of the theoretical framework, it was decided to start a research project with NSS and ABB as the main point of departure. The research questions were not clear at this point; however, it was decided to investigate how ABB was involved in making improvements at NSS, related to both innovation and efficiency. To provide access to the most relevant informants in NSS and ABB, the Maintenance Manager gave us suggestions for people who could be relevant for interviews and made sure that these informants were willing to participate.

During spring 2006 we started conducting face-to-face, semi-structured interviews with NSS and ABB. Five interviews were conducted with informants in NSS and one interview with ABB. We were also given an extensive guided tour of the plant at NSS to give us a better understanding of the papermaking process. The interviews gave us a solid foundation for understanding the two companies and their relationship. The focus of the interviews was on how efficiency improvements are achieved at NSS, both internally and in cooperation with suppliers, especially ABB. We were informed about specific projects in which ABB has been involved in making improvements. Interacting with the informants functioned as a way to stimulate new questions and to investigate issues in more depth. During the interviews, the informants also referred us to other employees at NSS and ABB whom we might be able to interview in order to gain further insight into the cooperation between NSS and ABB. Using the snowballing method, we were therefore introduced to new people in the two companies and more detailed information was acquired.

After these initial interviews, the interview transcripts were thoroughly examined. Certain themes seemed to be more important than others; the focus had been on some large rebuilding projects and some smaller projects where ABB and NSS had cooperated extensively. After the reading of more literature related to supplier involvement in innovation projects, it was decided to conduct additional interviews in order to gain greater insight into how NSS has involved ABB in innovation processes. Another interesting issue that came up was NSS's role in developing ABB's capabilities. It was therefore decided to acquire deeper insight into ABB's capability development.

At this stage, we lacked information from ABB's perspective. Four interviews to address the more specific issues were therefore conducted at ABB. To find ABB informants who worked specifically with NSS and had detailed insight into their relationship, interviews had to be conducted with ABB employees in Stockholm and Oslo. These interviews gave us a good platform for understanding the history of ABB, specific projects at NSS where ABB has played an important role and how ABB develops its capabilities, internally and with other actors.

Following these interviews, the total amount of information was extensive, and an attempt was made to write down the most important aspects of the case. During autumn 2007, we arranged a workshop at NSS where preliminary findings were presented and discussed. Three researchers and six people from NSS's maintenance and engineering departments participated in this workshop. Based on the workshop and the empirical material as well as the theory, two interesting issues for research began to crystallize:

1. How is ABB involved in innovation processes at NSS? – Is it by working with NSS in a dyadic relationship during the innovation processes and/or by involving third parties?

2. How are ABB's capabilities developed? – Is it mostly internally or are NSS and other actors important in this process?

To provide even more insight into these questions, five more interviews were conducted at NSS and ABB.

To sum up, multiple informants were interviewed in both companies. This has been vital in understanding the complex business relationship and in gaining detailed insight into the innovation and capability development taking place. Following all the interviews, interview transcripts were made and sent to the interviewees for approval and corrections. This also provided an opportunity to ask additional questions to obtain more detailed information. In addition to the interviews, we were given a great deal of secondary material, such as brochures and annual reports, which has added to the case study. An overview of the interviews conducted in the NSS-ABB case is presented in Table 2.

Table 2: Overview of interviews Case A

Company	Informant	No. of interviews	Total no. of hours
NSS	Maintenance Manager	1	1,5
	Purchasing Manager	1	2,5
	Department Manager el/auto	1	2
	Machine Supervisor PM1+2	2	3
	Machine Supervisor PM3	1	1,5
	Engineering Manager	1	1,5
	Maintenance Manager PM3	1	1,5
	Manager Recycled fibre	1	1
ABB	Department Manager	2	4
	Service Manager QCS	1	1,5
	Project Leader QCS	1	1,5
	Technical manager DCS	1	2
	Project leader paper/metal	1	1,5
Total no. of firms: 2	Total no. of informants: 13	Total no. of interviews: 15	Total no. of interview hours: 25

3.6.2 Case B: Supplier-Related Network Pictures Involving Alpha, Four Suppliers and Third Parties

The decision to study Alpha was similar to the decision to study NSS. I was looking for a company that was continuously working to improve its products and processes and that involved suppliers to achieve this. Furthermore, Alpha is a well-known company in the region and some of my supervisors had some previous knowledge about the company. The company was therefore seen as an interesting starting point for studying innovation and capability development involving suppliers. In March 2006, we approached Alpha and set up a meeting with the purchasing manager. During the meeting, several issues around Alpha's development in recent years as well as Alpha's relationships with its suppliers were discussed. Four suppliers (Beta, Gamma, Delta and Epsilon) – delivering different parts for the final product – were mentioned as particularly important for Alpha. In agreement with the purchasing manager, Alpha's relationships with these four suppliers were chosen for further

investigation. The purchasing manager referred us to people in Alpha and at the suppliers that had particular knowledge of and interest in the relationships of the study.

The first interviews at Alpha (face-to-face and semi-structured) were conducted during the spring of 2006 and helped us understand the present situation of the company and the main characteristics of its most important supplier relationships, especially the four suppliers in focus. The four suppliers have been large and important suppliers for a long period. However, we did not find many examples of innovation projects or capability development processes where Alpha and the suppliers had cooperated in recent years. We also discovered that the managers at Alpha were mainly preoccupied with their own tasks and spent little time on discussing the suppliers' concerns. It also seemed that informants at Alpha had fairly limited knowledge regarding its suppliers beyond the actual deliveries. The suppliers had been partners of Alpha for a long time and maintaining "business as usual" without any changes seemed to be the dominating perspective. Furthermore, it seemed that knowledge regarding other actors connected to the suppliers was lacking and that such knowledge was deemed irrelevant. The impression given by Alpha was that the company looked upon itself as a large and significant customer and therefore it was not necessary to acquire knowledge about aspects such as the suppliers' other customers. This finding led to a redirection of the case study. Instead of a focus on innovation and capability development involving suppliers, it was seen as more interesting to pursue a study of insight into important suppliers' network contexts.

Inspired by theory on managing key suppliers in their surrounding network context and theory on network pictures, we set out to investigate what the informants from Alpha knew about the networks surrounding its key suppliers. The second round of interviews at Alpha during the autumn 2006 thus focused on studying how Alpha works with these suppliers and on identifying the relevant actors that the Alpha informants included in their network pictures related to the key suppliers.

Following these interviews at Alpha, interviews were conducted at the suppliers Beta, Gamma, Delta and Epsilon during the autumn of 2006. These interviews provided an opportunity to understand the relationship between Alpha and the four suppliers in more detail, as well as to gather information on the suppliers' most important customer relationships.

After transcription and review of the interviews, a workshop was held at Alpha to discuss and reflect on the preliminary results of the study. The workshop focused on central aspects of the investigation of Alpha and the four supplier relationships. Themes that were discussed were centred on Alpha's role in developing its suppliers and on how the suppliers perceived their development. Network pictures for the four suppliers were presented to Alpha, and the subsequent discussion concentrated on how development of each of the suppliers is driven by Alpha versus other customers. Following the workshop, we carried out further interviews with the purchasing manager and the senior purchaser, primarily regarding how Alpha could gain more insight into how their key suppliers cooperated with other counterparts.

To sum up, multiple informants have been interviewed in most companies in order to capture the variety of perceptions and meanings. This has been important for understanding the business relationships and for enabling amalgamation of the individual network pictures into a 'company network picture'. Following all the interviews, interview transcripts were made and sent to the interviewees for approval and corrections. This made it possible to clarify certain issues and to ask some follow-up questions. In addition to the interviews, secondary material in the form of brochures and annual reports has added to the case study. A guided tour of the production units at all the companies involved has also been given. An overview of the interviews conducted in the case of Alpha and four suppliers is presented in Table 3.

Table 3: Overview of interviews Case B

Company	Informant	No. of interviews	Total no. of hours
Alpha	Purchasing manager	3	3
	Senior purchaser	2	2,5
	Prod. dev. manager	2	3,5
	Warehouse manager	1	2,5
Beta	Production coordinator	1	1,5
	Managing director	1	1
	Logistics manager	1	1,5
Gamma	Department manager	1	1,5
Delta	Documentation manager	1	2
	Marketing manager	1	2,5
Epsilon	Production manager	1	2
Total no. of firms: 5	Total no. of informants: 11	Total no. of interviews: 15	Total no. of interview hours: 23,5

3.6.3 Case C: Capability Development Involving Electra, Six Buyers and Third Parties

After having conducted case studies A and B we saw a need for acquiring additional insight into capability development in buyer-supplier relationships and for complementing the two case studies already conducted. Case A was a case of innovation and capability development involving a supplier and third parties and Case B was a case of network pictures related to suppliers. To be able to comply with the aim of the study, it was therefore seen as beneficial to investigate capability development in buyer-supplier relationships further. After a search for interesting companies to study, we ended up with the company Electra and six of its customers.

The decision to study Electra and six of its most important customers was initially based on a large project by my supervisors of a local industrial cluster in central Norway in 2008. This project focused on studying the companies participating in this cluster (which at the time consisted of ten member companies) and their surrounding business networks. Mapping of the networks of these companies had indicated that the companies had some relationships with common buyers, suppliers or horizontal actors. Most of the common relationships were found on the supplier side. A supplier that many (six) of the companies had in common, and that was also mentioned as very important, was an electronics subcontractor named Electra. As I had an interest in researching capability development with suppliers, this context seemed a promising starting point for further study. Further, this provided a good context for studying different strategies for capability development involving the same supplier.

In the summer of 2010, Electra was approached and interviews with the managing director and the marketing manager were arranged. During these interviews and a tour of the production facilities, we became well acquainted with Electra and its production as well as how the company works with important customers. The customers' strategies for supplier development, the customers' level of involvement and the "thickness" of the relationships were discussed. From the discussions, it was agreed that a further study of Electra's six most important customers should be conducted. These six customers are named Ramo, Micro, Sensoil, Subsic, Seacro and Transpo.

Following the interview with Electra, different streams of literature were reviewed, including literature on the customer active paradigm (CAP), literature on supplier involvement in product development and literature on supplier development. Inspired by the literature, face-to-face, semi-structured interviews with the six buying companies were conducted in the autumn of 2010. These interviews focused on the six buying companies' purchasing strategies in general and specifically on their supplier development strategy and management of Electra. With the interviewees' consent, these interviews were audio recorded to prevent missing essential information. The interviewees are key decision makers for purchasing in relation to Electra. They were identified from earlier studies of these companies and from discussions with different people in the companies.

As in the other case studies, interviews were transcribed following each interview and sent to the interviewee for further comments, corrections, and potential removal of sensitive

information. Follow-up discussions over the telephone and emails were also held with some of the companies in order to clear up a few details and provide additional insight. An overview of the interviews conducted in the case of Electra and six buying companies is presented in Table 4.

Table 4: Overview of interviews Case C

Company	Informant	No. of interviews	Total no. of hours
Electra	Managing director	1	2
	Marketing manager	1	2
Ramo	Production manager	2	2,5
Micro	Operations manager	1	1,5
Sensoil	Senior purchase engineer	1	1,5
Subsic	Operations manager	1	1,5
Seacro	Engineer prod.dept.	1	2
Transpo	Logistics manager	1 Group interview	2
	Production manager		
	Production manager		
Total no. of firms: 7	Total no. of informants: 10	Total no. of interviews: 9	Total no. of interview hours: 15

3.7 Overview of Cases

In total, the thesis contains three single embedded case studies. Fourteen companies have been interviewed (eight buying companies and six suppliers), amounting to 39 interviews in total. Table 5 provides an overview of the companies involved and the method used in the case studies.

Table 5: Overview of cases

| Case | Theme | Involved companies | | | Method | No of interviews |
		Buyers	Suppliers	Others		
A	Innovation and capability development	NSS	ABB	Third parties	Single embedded case study	15
B	Network pictures related to suppliers	Alpha	Beta Gamma Delta Epsilon	Third parties	Single embedded case study	15
C	Capability development	Ramo Micro Sensoil Subsic Seacro Transpo	Electra	Third parties	Single embedded case study	9

3.8 Analysis

In finding an appropriate technique to analyse qualitative data, the issues relating to how to reduce, structure and detextualize the data are a critical concern (Hussey & Hussey, 1997). This section will focus on some aspects related to the data analysis in this thesis. In many ways, the data analysis started when the interviews were carried out and as new interview guides were made. However, the data analysis became more structured during the months when the case descriptions were written, because writing a case description involves choosing which elements to include and leave out, and how to structure the elements included. The early interviews in all three cases were quite broad in terms of issues discussed. However, as the interviews progressed, the interviews became more focused. This reflects the process of 'casing', as discussed in Section 3.4, where the focus of the case study is reconsidered during the case study. During the process of analysing the data, the data from the interviews were supplemented by any relevant secondary data obtained. Furthermore, in line with the process

of systematic combining, literature was extensively used. Different streams of literature were reviewed, for example, supply management literature, innovation literature, literature on capability development, sensemaking and network picture literature and literature on supplier development. The main part of the literature used, however, stems from the industrial network approach. The literature I read enabled me to look at the empirical material from somewhat different angles; however, the empirical material also led me to search for literature in particular directions. For example, searching for literature on network pictures was a result of findings in Case B and searching for literature on supplier development was a result of findings in Case C.

The boundaries of the studies were relatively malleable throughout the investigation, but became clearer and more fixed as the study progressed. During the writing of the case descriptions for the particular papers, there was also a continuous matching of the case and the specific research questions. The total amount of data in the three case studies is therefore much larger than what is included in the different papers. Certain elements of the cases have therefore been highlighted to obtain a clearer picture of "What the case is a case of". As noted by Ragin (1992, p. 6): "What *it* is a case *of* will coalesce gradually, sometimes catalytically, and the final realisation of the case's nature may be the most important part of the interaction between ideas and evidence".

Whereas the previous sections in Chapter 3 have focused on presenting choices made in the research process, an evaluation of the trustworthiness of the thesis and challenges, strengths and weaknesses is presented in Section 3.9 and Section 3.10.

3.9 Trustworthiness

Ensuring trustworthiness in the thesis requires an evaluation of the thesis according to principles that are recognized among researchers. The basic issue is to persuade the audience that the findings of the study are worth paying attention to and worth taking into account. In case study research, the criteria for trustworthiness that are often used are credibility, transferability, dependability and confirmability (Lincoln & Guba, 1985). According to Dubois and Gibbert (2010), a case study relying on an abductive approach resulting in a case used both as inspiration and illustration to develop a theoretical idea, should not be judged based on Yin's or Lincoln and Guba's deductive quality criteria. However, the criteria for trustworthiness as presented by Lincoln and Guba (1985) are widely recognized among researchers doing single case studies relying on an abductive approach (e.g. Bankvall, 2011; Gressetvold, 2004; Holmen, 2001; Hulthén, 2002; Minde, 2007; Pedersen, 1996). In line with these researchers, the thesis is also evaluated based on these criteria and addressed in the following sections.

3.9.1 Credibility

The credibility of a study concerns the establishment of confidence in the truth of the findings (Lincoln & Guba, 1985). To evaluate the credibility, this section looks into data triangulation, the use of member checks and peer debriefing through continuously maintaining a dialogue with other academics.

The use of multiple sources of evidence, also referred to as data triangulation, provides opportunities for verifying the empirical material, and in this way for strengthening the credibility (Eisenhardt, 1989). The main sources of data in the case studies conducted in this thesis are the interviews. In addition to the interviews, other available sources have been pursued. These sources include the companies' websites, annual reports, product brochures and project reports. Another type of triangulation is "informant triangulation" (Kvale, 1997), which refers to whether the interviewed people give a uniform picture of the phenomena in focus. For most of the involved companies in this study, a number of people have been interviewed and the same questions have been asked many times. This was done to obtain different perspectives of a certain theme or to have a certain issue clarified. For example, in order to understand the different innovation projects at NSS, involving many technical details, it was very beneficial to have this explained by a number of interviewees.

Whenever the interviews provide the main source of data, the importance of "raw data" in the form of actual quotations is often stressed (e.g. Patton, 1990). In line with this argument, the audio recorder is often represented as an indispensable item of equipment, as it does not "tune out" or make interpretations. For some of the interviews in this study, an audio recorder has been used in addition to taking notes. This was deemed appropriate when only one researcher was involved doing the interviews. However, for most of the interviews, two researchers participated and for these interviews, it was deemed most appropriate to take notes. There are a number of advantages involved when two researchers conduct an interview. Firstly, it helped greatly for ensuring that all the key areas of interest were covered, as "two heads think better than one". Secondly, the involvement of two researchers also provided a good interview setting, as grasping what the interviewee is saying and taking notes and preparing the next question simultaneously is a challenging task. Thirdly, a more relaxed atmosphere in which a natural dialogue could take place was created with two researchers present. Fourthly, it paid dividends for transcription of the interviews, as each transcript could be cross-referenced with the other's notes to ensure consistency.

In member checks, the empirical material is tested with the informants to investigate whether the data has been correctly understood and interpreted; the ones in the best position to tell are the people who have been interviewed. According to Lincoln and Guba (1985, p. 314) member checks are central: *"The member check, whereby data, analytic categories, interpretations, and conclusions are tested with members of those stakeholding groups from whom the data were originally collected, is the most critical technique for establishing credibility"*. A first round of member checks took place during each interview, as clarifying questions were asked continually. Another round of member checks followed in the weeks after each interview, when the interview transcript was sent to the interviewee. This allowed

the interviewee to provide suggestions for changes, to add information and to remove errors or sensitive information. This procedure was explained to the interviewee at the start of the interview and it is likely to have increased the interviewee's willingness to share information. In addition, follow-up conversations over email or telephone ensured that certain subjects were correctly understood. In Case A, a case description was sent to the main contact person in NSS in order to obtain comments. This was not done for the other two cases, which may be considered a shortcoming. However, workshops have been organized for two companies (NSS and Alpha), involving two of the three case studies. The workshops gave the involved actors a good opportunity to respond to the findings and to respond to our suggestions for research questions.

Another means of ensuring credibility of the study is the continuous reviews and elucidation that the research proposal and article drafts have undergone during the process of presenting them to, and gaining feedback from, other researchers. This is referred to as "peer debriefing" (Lincoln & Guba, 1985). Early versions of articles have been presented to a research group familiar with the industrial network approach at NTNU, Department of Industrial Economics and Technology Management, as well as during internal seminars at Trondheim Business School.

In addition, taking part in conferences has been important for presenting and gaining feedback on article drafts. Two conferences have been particularly important in this respect: the annual Nordic Workshop on Interorganizational Research and the annual Industrial Marketing and Purchasing (IMP) Conference. Taking part in doctoral consortiums prior to the IMP Conferences in 2005 and 2006 has also been very beneficial for obtaining feedback on research proposals and article drafts. Earlier versions of Paper 1 "Supplier involvement in innovation processes: a taxonomy" have been presented at the IMP Conferences in 2005, 2006 and 2007 as well as at the Nordic Workshop in 2005. Earlier versions of Paper 2 "The house of supplier capabilities: a tool for scrutinising the ways in which different customers deploy and develop the capabilities of a key supplier" have been presented at the Nordic Workshops in 2007 and 2008 as well as at the IMP Journal Seminar in 2007. Earlier versions of Paper 3 "Network pictures for managing key supplier relationships" have been presented at the IMP Conference in 2008 as well as at the Johan Arndt Conference in 2009. Finally, an earlier version of Paper 4 "Beyond dyadic supplier development efforts: the multiple roles of the network in bringing about supplier development" has been presented at the IMP Journal Seminar in 2012. In addition, reviews from anonymous reviewers in the journals where the papers have been submitted have provided valuable contributions and strengthen the credibility of the study.

3.9.2 Transferability

A criticism of case studies has been the lack of possibilities for making statistical generalizations from the findings (Yin, 1994). However, following the notion of transferability as a replacement for the concept of generalization, it may still be argued that

the findings and/or interpretations being made could be relevant and resonate well with companies that are familiar with the phenomenon being researched or that operate in similar contexts. In addition, Yin (1994) suggests that analytical generalizations can be made from single case study research. In analytical generalization, the researcher is attempting to generalize concepts and theories, thereby generalizing a particular set of results to some broader theory.

In this thesis, the knowledge generated should be taken to a more abstract level, beyond the individual events that take place for the involved case companies. The findings are taken to a more abstract level by introducing theoretical concepts and different conceptual approaches to undertaking innovation with suppliers, supplier development, capability development and mapping of congruence between network pictures.

The empirical material has also been applied for a purpose that differed from the one in the thesis and has thereby proven transferable to other settings. Three book chapters have been written based on the empirical material from case studies A and B (see Aune & Gressetvold, 2012; Aune, Holmen & Pedersen, 2009; and Gressetvold & Aune, 2013).

3.9.3 Dependability

Dependability concerns the research process itself – would other researchers be able to follow the same procedure and discover the same underlying mechanisms? For this thesis, this question is difficult to answer, as the case studies, the theoretical foundation and the research questions have emerged interactively rather than as a sequential and well-defined process. As realism is the epistemological perspective adopted in the thesis, it is believed that a reality exists that may be discovered and understood by the researcher. Other researchers should therefore be able to find the same underlying mechanisms. However, data in qualitative research on the same real life situation can be collected by different researchers, who use differing methods, and at different times. Hence, the different data sets may not come together into one conforming picture (Neuman, 1994).

In line with reflections made by Gressetvold (2004), I further recognize that researchers not making use of the industrial network approach could have arrived at other conclusions. In addition, if these researchers did not use the same theoretical foundation as in this thesis, they would probably not collect the same empirical material, nor necessarily follow a 'systematic combining' procedure to refine the research questions. Consequently, the research tradition to which these other researchers belong becomes important in an assessment of the dependability of the thesis.

To achieve dependability in case study research demands the enactment of case study procedures to identify a documentation trail. Chapter 3 represents an effort at providing an open and transparent approach towards the research process. The description of the process of going back and forth between the conceptual and empirical world and the process of casing is presented in Sections 3.3 and 3.4. Description of the research process for the case studies is

presented in Section 3.6. By outlining these processes in some detail, I hope to have provided enough information for the reader to be able to get a sense of the nature of the research process underlying this thesis.

3.9.4 Confirmability

Confirmability generally seems to concern ensuring (a) that findings are solidly grounded in events and data that can be traced back to "raw data", (b) that there is consistency between the data, concepts and findings, and (c) that a priori theoretical concepts have not been imposed on the data in an unreflective manner. The "raw data" (interview notes, audio files and interview transcripts) have been archived, making it possible to trace all the empirical findings back to the sources. As the analysis involves an extensive number of empirical examples, I hope to have shown that the data and the concepts and findings have a high degree of consistency. Regarding a priori theoretical concepts imposing on the data in an unreflective manner, this has been discussed previously under Section 3.3 Systematic combining. The theoretical concepts have had some influence on what type of data has been collected. However, I have continuously reflected on this issue during the research process and have allowed the data to evolve "on their own" in line with the increased theoretical insight and refinement of the research questions.

3.10 Challenges, Strengths and Weaknesses

In this chapter, the methodological choices of the thesis have been discussed and the criteria for trustworthiness have been addressed. I have also tried to describe the research and casing process with a sufficient level of detail. I hope that this chapter, together with the rest of the thesis, has provided enough information to claim the trustworthiness of this study and its findings. In this concluding section, I will highlight some of the challenges, weaknesses and strengths of the study.

Firstly, a number of challenges emerged during the research process. As we were dependent on carrying out interviews in companies, it was challenging to gain access to the right people at the right time. Some of the interviewees were managers with busy schedules and certain interviews were postponed a number of times. This was frustrating, as I was dependent on gaining more insight into certain issues to continue with the study. During the interviews, it was also at times challenging to get the interviewees to provide detailed descriptions of aspects such as innovation projects without digging too deeply into technical issues. Another challenge relates to the lack of clear research questions when entering the field. This lack of focus was somewhat frustrating in the early phase, as I did not know exactly what to look for and I was concerned that the data being gathered were too "wide" and did not provide enough detail. It was also challenging to keep the balance between the research question of the thesis and the more specific research questions of the articles when doing the case studies. Doing two of the case studies almost simultaneously was also

somewhat challenging. Finally, I have experienced it as a challenge to obtain a clear idea of "what the cases were cases of". This was especially true for Case B: *Supplier-related network pictures involving Alpha, four suppliers and third parties* and Case C: *Capability development involving Electra, six buyers and third parties*. These case studies took directions that were quite different from those anticipated in the early phases, and several rounds of writing down the case studies were therefore required to enable understanding what the cases were cases of.

A weakness that can be identified in the study involves the number of interviewees in some of the companies involved. For example, more interviews could have been conducted with ABB (Case A) to get a more comprehensive overview of how its capabilities were developed. In addition, interviews with the companies involved in developing ABB's capabilities could have been conducted. As the study is now, this insight is only based on a one-sided perspective and we have to rely on the information from informants in ABB on which actors are involved in developing its capabilities. Furthermore, conducting only one interview with each of the six buying companies of Electra (Case C) can also be seen as a weakness. More interviews in this case study could have provided deeper insight into how the companies are involved in developing Electra. Finally, it can also be considered a weakness that a final case description was only sent to NSS (Case A) and not the other companies.

A strength of the thesis involves the close dialogue with key contact people in the companies. These contact people were central in finding a research area that was seen as interesting both from a practitioner's and from a researcher's perspective. These contact people were also important for gaining access to the companies and their business relationships and in finding relevant informants. The workshops that were conducted for two of the case studies (Case A and B) are also a strength of the study. These workshops were important parts of the casing process and for increasing the credibility of the studies. Another important strength of the study is the comprehensive processes of interaction between my supervisors and colleagues and me, as well as the participation in academic conferences. Finally, I consider it an important strength that the papers in the thesis have undergone several review processes in academic journals.

Chapter 4
Presentation of Cases

Case study A, B and C form the empirical material of the four papers in this thesis. Parts of Case A are the empirical foundation for Paper 1 and 2. Parts of Case B are the empirical foundation for Paper 3. Parts of Case C are the empirical foundation for Paper 4. During the process of writing the case descriptions (which were much more detailed than those presented here) and of analysing the data, it became clear that not all the companies and relationships involved in the study were needed in order to answer the specific research questions of the articles. If the analysis indicated that adding extra companies/relationships did not lead to conceptual developments that were not already covered, a decision was made to include the companies and relationships that made it possible to describe a particular phenomenon. This selection followed a similar logic to that of 'theoretical saturation' (Glaser & Strauss, 1967), regarding the selection of case studies. Therefore, adding new companies/relationships stopped when the categories under study were already densified and saturated, as adding new companies/relationships merely resulted in redundant data, and thus in minimal incremental learning (Glaser & Strauss, 1967).

As a result, Papers 1 and 2 involve the relationship between NSS, ABB and third parties as the main point of departure. Paper 3 involves the relationship between Alpha, Beta and third parties. Paper 4 involves the relationships between Electra and four of the buying companies: Ramo, Micro, Sensoil and Subsic. For an overview of the cases and the empirical material used in the different papers, see Table 4.1 at the end of this chapter. In the following sections, the three case studies of the thesis are presented.

4.1 Case A: Innovation and Capability Development Involving NSS, ABB and Third Parties

This case discusses innovation and capability development involving the buying company NSS, its supplier ABB and third parties. The case contains four units of analysis (as also discussed in Section 3.2.3 Units of analysis):

- Buyer-Supplier relationship
- Network (especially relationships with third parties)
- Innovation projects
- Capability development

The case presentation is structured as follows: the buying company NSS is presented first, followed by a presentation of the supplier ABB. The focus is then on the relationship between the two companies and innovation projects and capability development taking place in this relationship as well as the involvement of third parties.

4.1.1 NSS

NSS (Norske Skog Skogn), founded in 1962, is one of 19 paper mills owned by the Norske Skog Group, which is a leading producer of newsprint and magazine paper. NSS is the second largest of these 19 paper mills, producing more than 600 000 tonnes of newsprint per year, and employing some 515 people. More than 90% of the newsprint is exported to customers worldwide from NSS's own port facilities, which operate a twice-a-week regular line to the UK and Continental Europe. NSS has produced newsprint and flyers since 1966. Today, NSS produces newsprint on three paper machines: PM1, PM2, and PM3, built in 1966, 1968, and 1982 respectively. As PM3 was built more than a decade after the other two, it differs substantially with respect to technological solutions. It also produces about half of NSS's total output.

NSS is a fully integrated mill, which means that whole forest logs (or wood chips) are received and processed down to the individual fibre level and into a pulp slurry (a mixture of fibre and water) and further processed into paper. Even though the basic structure of the three paper machines at NSS has remained unchanged since their establishment, the machines have all been substantially rebuilt and modernized over the years. This has led to considerable increases in productivity as well as improvements in the paper quality. These improvements are partly implemented internally by engineers within the organization. However, in addition to top-class internal expertise, NSS is dependent on cooperation with specialized suppliers. Assisted by its suppliers, NSS can find solutions that will make the paper machines produce at desired speeds and with the right quality as well as to reduce unwanted production stops.

4.1.2 ABB

ABB is a global engineering company that operates in 100 countries and employs around 110 000 people. Its full name, Asea Brown Boveri, stems from the merger between Asea and Brown Boveri in 1987. This merger meant that ABB formed one of the largest electrical engineering companies in the world. ABB's business comprises five divisions, which are in turn organized in relation to the customers and industries they serve. This thesis focuses on the division "Process Automation", and the business unit that focuses on process automation in Norway in particular, hereafter referred to as ABB.

Process automation involves products and solutions for instrumentation, automation and optimization of industrial processes for customers in different industries. ABB largely makes a distinction between two industries: oil and gas, and land-based industry. Customers in the oil and gas industry represent a large share of ABB's turnover and are important for driving capability development and innovation in ABB. Customers in land-based industry are, however, also very important because much of ABB was developed to serve customers in this industry. The majority of the empirical material in the thesis relates to the land-based industry, particularly the pulp and paper industry. ABB has about ten customers in the pulp and paper industry in Norway, of which NSS is a large and important customer.

4.1.3 Innovation Projects at NSS Involving ABB and Third Parties

ABB has been a supplier of NSS ever since the establishment of the paper mill in 1962 and has installed a majority of the process control systems at the three paper machines at NSS. ABB is a large supplier of NSS and strongly involved in both incremental improvements and large rebuilding projects. Hence, both companies have invested a great deal in this relationship. Since the paper machines are quite similar and since the changes being made require some prior knowledge of the "history" of the machines, NSS finds it beneficial to use the same supplier over time. Over more than 30 years, ABB has been involved in a number of technological innovations aimed at improving NSS's paper machines. Three large rebuilding projects where ABB has played a major role involved upgrading and renewal of the automation system of the three paper machines at NSS (PM1, PM2, and PM3). In periods where such large rebuilding projects are conducted, ABB and NSS cooperate intensively involving many people in both companies. Between projects, the intensity of the interaction between the two companies can be quite low, and ABB is only involved in doing service on the machinery. Through cooperating on different innovation processes as well as other joint activities, ABB and NSS have developed a comprehensive and well-functioning business relationship. This relationship is characterized by a high degree of trust and close personal contact across several organizational layers.

For some innovation projects, NSS also relies on the involvement of other companies in addition to the involvement of ABB. This is particularly relevant for innovation processes involving compound and complex products that are made up of several technologies and that therefore require a high degree of cooperation between NSS, ABB and third parties. Typical third parties that are involved are other suppliers of NSS as well as sub-suppliers. A supplier of NSS that has been involved in many joint innovation processes with NSS and ABB is the company Metso, a world-leading manufacturer of paper machines with headquarters in Finland. Metso has supplied all three paper machines at NSS and therefore has a comprehensive relationship with NSS. Some projects require that Metso and ABB handle the development of technical solutions without much involvement from ABB, whereas in other projects it is imperative that all three companies cooperate throughout the innovation process. The level of involvement of the different companies is dependent on the complexity of the technologies involved and the need for joint problem solving.

4.1.4 Capability Development at ABB Involving NSS and Third Parties

Capability development in ABB is predominantly achieved through internal activities in the large corporation. Such activities can be organized (e.g. regular meetings among employees from different units working with pulp and paper all over the world), or occur on a more ad hoc basis (e.g. transfer of knowledge from sister units working mainly with other industries). To make sure that it offers its customers updated knowledge, ABB has a sister unit in Ireland that focuses on developing solutions for the pulp and paper industry, which is consulted frequently during projects with customers. Technological solutions that are produced in the

different countries are gathered in this business unit so that this can work as a "knowledge bank" for future pulp and paper projects.

In addition to the internal development of capabilities, ABB is significantly developing its capabilities through its relationships with other companies, especially its customers. Due to their long-lasting relationship, NSS has contributed to building ABB's capabilities in various ways. Examples can be through early involvement in projects and by joining ABB and other suppliers (e.g. Metso) in projects in order to facilitate learning between the suppliers. By involving ABB in large innovation projects, NSS has contributed to build ABB's capabilities in open control systems. Furthermore, by joining ABB with other suppliers in innovation processes, NSS has contributed to build ABB's capabilities in cooperative project management.

In addition to NSS, other customers of ABB have also been important for developing ABB's capabilities. In the pulp and paper industry, this includes NSS's sister units as well as some other paper mills. However, the customers that are reported to influence ABB's capability development the most are customers in other industries, especially the oil and gas industry. Through its customer relationships, ABB develops capabilities that are important for single relationships as well as a range of customer relationships. Thus, ABB is able to deal with a variety of customer relationships based on the capabilities it develops in cooperation with its customers.

4.1.5 NSS's Knowledge of ABB's Capability Development

NSS has quite good knowledge of which other actors contribute to developing ABB's capabilities in some areas. For example, through participating in a forum with ABB and its other customers using a particular quality control system, NSS has good insight into how other customers influence ABB's capabilities in this area. In other areas, particularly when it comes to the impact that customers in the oil and gas industry have on ABB's capability development, NSS has less detailed insight. According to ABB, this lack of insight has implications for how NSS makes use of ABB's capabilities. From ABB's perspective, NSS could have benefited from having more detailed knowledge of ABB's capabilities and how they are developed.

In sum, Case A involves insights into the paper mill NSS and one of its largest suppliers, ABB. Over 50 years, NSS and ABB have built a comprehensive and trusting relationship in which both companies have invested significant time and resources. The case covers different innovation projects where NSS and ABB have cooperated and it refers to projects where the involvement of third parties has been appropriate. The case further explores how the capabilities of ABB have been developed through interaction with its customers. Whereas Case A focuses on innovation and capabilities being developed in interaction between companies, Case B focuses on capability development and network pictures of the suppliers' contexts.

4.2 Case B: Supplier-Related Network Pictures Involving Alpha, Four Suppliers and Third Parties

This case discusses the buying company Alpha's network pictures of four suppliers as well as the four suppliers' own network pictures. The units of analysis in this case include:

- Four buyer-supplier relationships
- Networks (especially relationships with third parties)
- Capability development
- Supplier-related network pictures

The case description is structured in the following way: the buying company Alpha is presented first, followed by presentations of the four suppliers and their relationships with Alpha, the involvement of third parties in developing the suppliers' capabilities and the network pictures related to the respective suppliers.

4.2.1 Alpha

Alpha is a medium-sized manufacturer of safety equipment and control systems and is part of a US-based conglomerate. The company has about 320 employees. Alpha offers a comprehensive range of products for maritime, offshore and industrial purposes. Alpha's core capability is the production of complete systems and total solutions of control systems. Over the past 20 years, Alpha has outsourced many of its activities and is dependent on having suppliers with manufacturing capabilities as well as the ability to meet demanding cost, quality, and delivery targets. Today, Alpha develops and assembles most of its products in-house, mainly because of strict regulations regarding certifications and approvals for safety-controlling systems installed at complex operation sites.

Alpha's supplier base contains 300–400 active suppliers. The suppliers are classified according to purchasing spend and criticality for the end product, in the categories A, B, C, and D. The study in this thesis is based on an investigation of four A-suppliers, which Alpha identified as its key suppliers.

4.2.2 Relationship I: Alpha-Beta

Beta is Alpha's largest supplier in terms of purchasing spend and volume. In 1980, Alpha outsourced the production of thick film and Printed Circuit Boards (PCBs), and established the operation that is now the company Beta, a large microelectronics manufacturer. Since the time of the outsourcing, Beta has been a part of different industrial corporations. The company has about 60 employees. The relationship between Alpha and Beta can be identified as close and well-established. Even though Beta is interested in becoming more deeply involved in the development of the PCBs in order to make them more efficient to produce, Alpha handles the development of the thick film and PCBs internally without any

involvement from Beta. Alpha's policy is to keep product development in-house. Alpha states that it was Beta's largest customer for many years, and it is still Beta's largest customer for thick film products.

The largest and most influential customer of Beta is company QF, a supplier of intelligent transport systems and automatic toll collection systems. QF continuously involves Beta in the technical development of the PCBs to enable more efficient, automated production. Another large customer that cooperates closely with Beta is KA, a company that manufactures systems for gearshift, clutch actuation, and seat comfort. KA involves Beta from the specification stage when developing circuit boards and ensures that Beta cooperates with some of KA's other suppliers. In addition to these two buying companies, Beta views its relationships with the buying companies N, EP, and E as especially important for developing its capabilities.

Alpha finds it important that Beta has other large customers, as Alpha believes that Beta would be too vulnerable if Alpha were its only customer. Alpha also believes that having other large customers will make it easier for Beta to obtain better purchasing deals and discounts. Alpha identifies the companies NO, VC, QF and TD as large customers of Beta. In addition, Alpha knows that Beta has large customers using thick film as well as other large customers in other industries; however, they do not know the identity of these customers. The network pictures relating to Beta are shown in Figure 4. Alpha's network picture of Beta's most important customers is shown on the left-hand side and Beta's own network picture is depicted on the right-hand side.
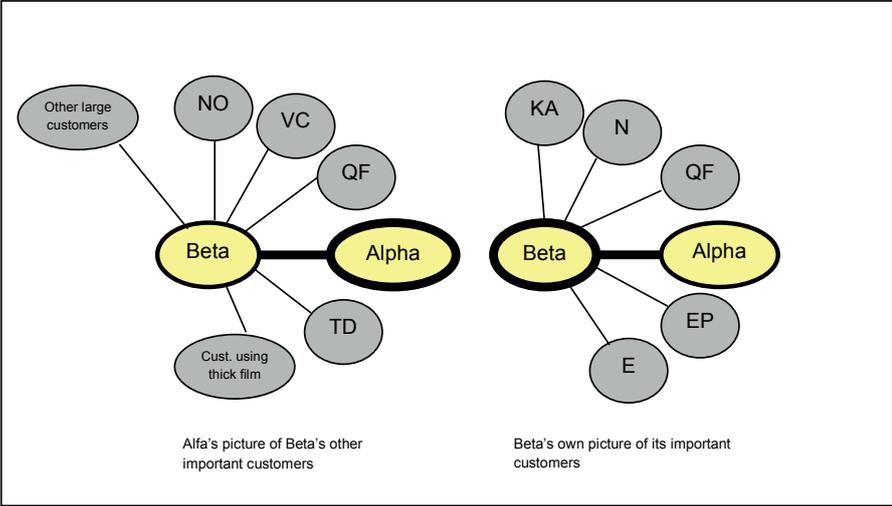
Figure 4: Network pictures relating to Beta

4.2.3 Relationship II: Alpha-Gamma

Alpha is Gamma's fourth or fifth largest customer, representing 7–8% of Gamma's turnover. Gamma is a developer of products and applications manufactured in plastics, and it has about 40 employees. Gamma has been a supplier of Alpha for eight years, producing the plastic cover for Alpha's main product. An injection-moulding machine is producing the plastic covers 24 hours a day throughout the week for Alpha. The plastic covers that Gamma produces for Alpha have remained unchanged since 1999; in other words, the innovation rate has been very slow. Due to Alpha's requirements for dependable deliveries, Gamma holds consignment stock at Alpha's facilities. This enables Gamma to adjust its deliveries based on prognoses and available stock.

Gamma has customers in many different industries that impact its capabilities. A customer that has been particularly important due to its impact on Gamma's turnover and capability development is the company TD, a company focused on data storage products. When developing and designing new products, buying company TD cooperates closely with Gamma. From its relationship with TD, Gamma has developed capabilities in complex product development, cooperating with a group of suppliers developing new products and in working in close cooperation with a large, demanding customer.

Alpha considers it important that Gamma also produces complex products for other customers because this may have positive effects for Gamma's capability development. However, Alpha does not have very good insight into who these customers are. From Alpha's perspective it is not necessary to have this kind of overview, as it believes that Gamma's other customers operate in industries very different from itself. The network pictures relating to Gamma are shown in Figure 5. Alpha's network picture of Gamma's most important customers is shown on the left-hand side and Gamma's own network picture is depicted on the right-hand side.
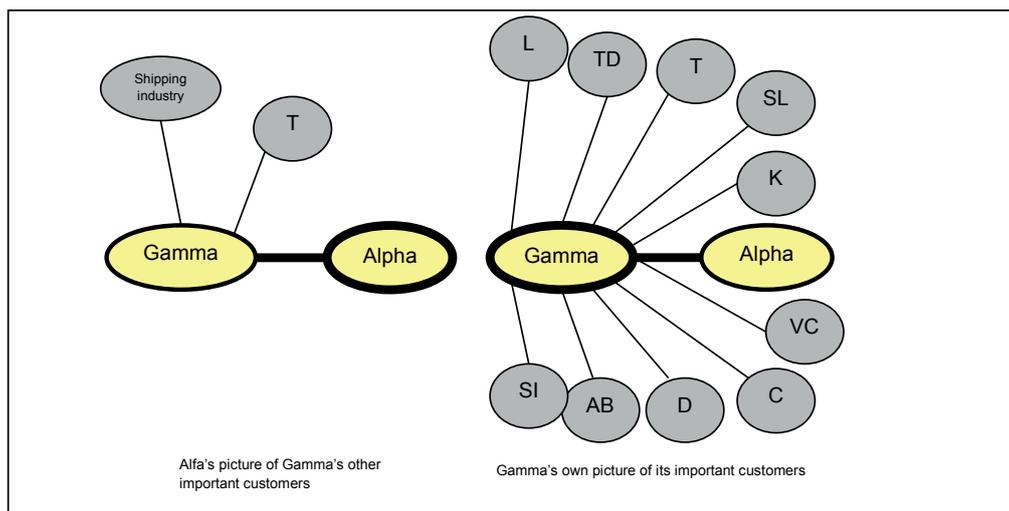
Figure 5: Network pictures relating to Gamma

4.2.4 Relationship III: Alpha-Delta

Delta produces and assembles electronic components and has about 60 employees. In total, Delta produces around 500 different products and has around 60 active customers. Delta has been a supplier of Alpha for about 20 years, producing around 15 different circuit boards of quite large sizes. Alpha does most of the development of the circuit boards in-house, involving Delta in the prototype stage only. Delta has extensive knowledge about the production of circuit boards that it shares with Alpha. Apart from that, however, Delta produces circuit boards from technical specifications that have already been prepared.

The largest and most influential customer of Delta is company FB, a manufacturer of biomedical test and simulation products for the healthcare industry. Delta produces PCBs for this customer as well as assembling complete products. The close cooperation with this customer has been very important for the development of Delta's capabilities regarding complete products as well as how to cooperate with a demanding global customer. According to Delta, much of the learning that has taken place in the relationship with FB is used in Delta's other customer relationships. Another important customer of Delta is company S, a large independent research organization. This organization develops very complex circuit boards and is innovative when it comes to developing and using new technology. Having a close relationship with this organization is therefore important for creating new knowledge regarding the functionality and production of PCBs at Delta.

Alpha considers it important that Delta also produces complex products for other customers because this may have positive effects for Delta's capability development. However, Alpha does not have much insight regarding who these customers are. From Alpha's perspective it is not necessary to have this kind of overview as it believes that Delta's other customers operate in industries very different from itself. The network pictures relating to Delta are shown in Figure 6. Alpha's network picture of Delta's most important customers is shown on the left-hand side and Delta's own network picture is depicted on the right-hand side.
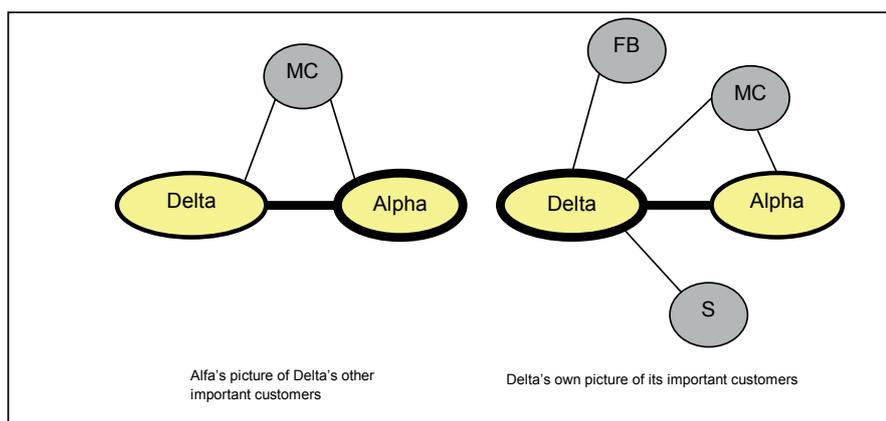

Figure 6: Network pictures relating to Delta

4.2.5 Relationship IV: Alpha-Epsilon

Epsilon is a mechanical company specializing in creating products based on thin steel plates. The company has 15 employees, most of them working with production. Epsilon was earlier a part of Alpha, but was outsourced in 1995 as a part of Alpha's strategy to become a more focused company. Since then, Epsilon has been a large and significant supplier of Alpha. Epsilon produces a number of different products for Alpha; however, these are mainly large steel cabinets. Due to their long-lasting relationship, Epsilon has extensive insight and knowledge of Alpha's requirements and can often give suggestions for adjustments to Alpha's R&D department. Design and how to find the most economical and production-friendly solution are the issues most frequently discussed.

Epsilon has some 200-250 customers of relatively small size. The customers that Epsilon highlights as most important for its capability development, in addition to Alpha, are KM, D and TS.

Many of the people who worked at Alpha and Epsilon before Epsilon was outsourced are still employed there. These "senior" employees in Alpha have broad insight into the customer base of Epsilon. However, this knowledge is somewhat outdated, and especially reflects the customer relationships Epsilon had some years ago. The network pictures relating to Epsilon are shown in Figure 7. Alpha's network picture of Epsilon's most important customers is shown on the left-hand side and Epsilon's own network picture is depicted on the right-hand side.
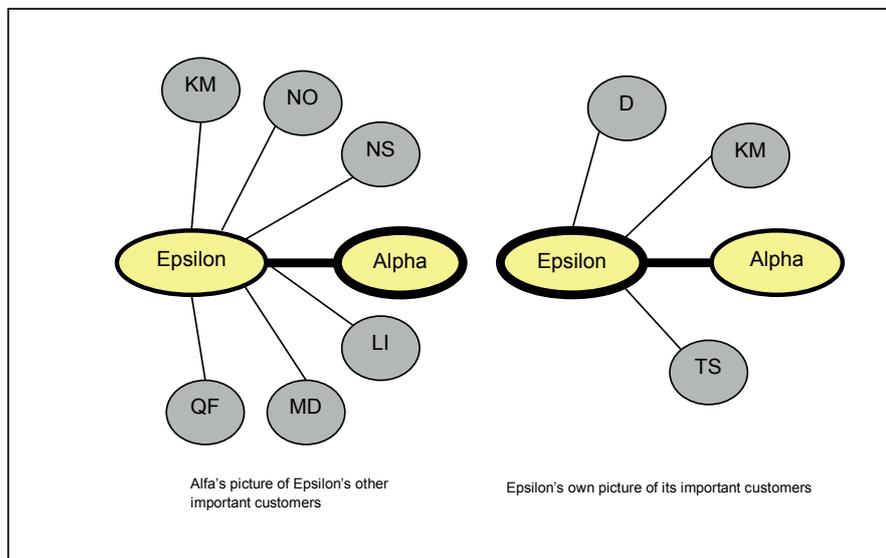

Figure 7: Network pictures relating to Epsilon

In sum, Case B involves four buyer-supplier relationships between the buying company Alpha and four of its most important suppliers. The case focuses on describing the relationship between Alpha and each of the four suppliers, the involvement of third parties for developing the suppliers' capabilities as well as the supplier-related network pictures. Case C further emphasizes the involvement of third parties for developing a supplier's capabilities.

4.3 Case C: Capability Development Involving Electra, Six Buying Companies and Third Parties

This case discusses capability development involving the supplier company Electra and six of its customers (Ramo, Micro, Sensoil, Subsic, Seacro and Transpo) as well as third parties' role in capability development. The units of analysis in this case are as follows:

- Relationships between the buying companies and Electra
- Networks (especially relationships with third parties)
- Capability development

The case description is organized as follows: the supplier company Electra is presented first, followed by a presentation of six relationships involving Electra and the respective buying companies as well as the involvement of third parties for developing Electra's capabilities.

4.3.1 Electra

Electra is located in central Norway and has around 30 employees. Being specialized in wireless products in the electronics industry, Electra provides a variety of circuit boards and other products related to remote control and monitoring equipment. Electra's competences range from purchasing and production to making prototypes and industrializing them for serial production. Through a 50% ownership in a development house, Electra also offers product development services. The four main segments to which Electra delivers circuit board assemblies are offshore/marine, defence, industrial, and medical. About 90% of the sales are related to local customers. Traditionally, Electra has had a small number of customers that have constituted a very large share of the turnover. A handful of customers may therefore account for 90-95% of the turnover.

4.3.2 Relationship I: Ramo – Electra

Ramo develops and produces radio remote control systems for the offshore, mining, maritime and process industries. Ramo has 48 employees and is part of a larger corporate group. Custom-made electronics are among the most critical products for Ramo and cannot simply

be "shopped from the market". Such electronic parts would mainly consist of different types of circuit boards.

Ramo's largest supplier of circuit boards is Electra, which mainly provides Ramo with circuit boards related to radio units. The relationship between Ramo and Electra has lasted for about 14 years. The two companies have a very good relationship and refer to each other as "cooperating partners". Ramo is dependent on a number of Electra's capabilities. The most important of these capabilities would include knowledge in radiotechnology, high flexibility and short delivery time, ability and interest in doing new things, production in line with the ISO-standard, the ability to ask critical questions, and testing capabilities. Electra's competence regarding components is also important for Ramo.

Ramo has contributed to developing Electra's competences in various ways. As Ramo appreciates Electra's competence regarding components, Ramo encourages Electra to build relationships with wholesalers because they possess important component knowledge that contributes to building Electra's competence in this area. Ramo also contributes to building Electra's competences more directly. As Ramo's core competence is in radiotechnology, this is the area where Ramo has influenced Electra the most. Further, Ramo has contributed to building Electra's capabilities in producing products for the oil and gas industry, where safety requirements are very high. Ramo was an important influence when Electra decided to invest in equipment to produce products that are safe to use in potentially hazardous environments ("Ex-products"), and therefore very relevant for the oil and gas industry. Another way in which Ramo contributes to Electra's development is by transferring knowledge acquired in its other supplier relationships. Another circuit board supplier of Ramo has been important in this respect. By learning from the two different circuit board suppliers, Ramo is able to transfer knowledge acquired in one supplier relationship to the other. Ramo finds it very beneficial to be able to control the type of knowledge being transferred instead of letting the two suppliers have a direct relationship.

4.3.3 Relationship II: Micro - Electra

Micro develops industrial electronics for a wide range of industries, for example offshore and defence, and has 28 employees. Micro's main competence is Original Design Manufacturing (ODM) focused on radio-related products and microwave technology.

Custom-made electronics are very important parts of Micro's products and Electra has been Micro's main supplier for these electronic parts for about 15 years. The relationship between the two companies has become so interconnected over the years with such a high degree of involvement and established routines that they compare their relationship to a marriage. Capabilities of Electra that are important for Micro include knowledge in radiotechnology and flexibility. Micro emphasizes Electra's ability to make rapid changes and find suitable solutions. Important production capabilities that Micro appreciates include the ability to do final assembly and the ability to switch quickly from prototyping to full production. Micro contributes to building Electra's competences in various ways. Especially

through involvement with one of its largest customers, Micro has been able to influence the development of Electra.

4.3.4 Relationship III: Sensoil – Electra

Sensoil develops and produces sensors for production optimization in the oil industry. Sensoil has 70 employees and is part of a large American corporation.

Sensoil uses Electra as a single source of circuit boards and the two have had a close relationship for 20 years. The two companies have developed many products together. Electra produces single circuit boards and performs final assembly for Sensoil. Capabilities of Electra that are important for Sensoil include having short delivery times, high flexibility and the ability to be involved in product development at an early stage. In addition, being able to do final assembly, producing Ex-approved products and the ability to do ESS testing (Environmental Stress Screening) are important capabilities.

Sensoil has been involved in developing some of these capabilities at Electra, but has left other capabilities to others to develop. One example where Sensoil has been directly involved in developing Electra's capabilities involves situations where Sensoil encourages Electra to work with one of Sensoil's hardware suppliers. The cooperation between the three companies has been central to developing Electra's competences in working with hardware suppliers and finalizing products for end-users.

4.3.5 Relationship IV: Subsic – Electra

Subsic develops subsea instrumentation, communication and control systems. The company is part of a large American corporation and has 20 employees.

Electra is a very important supplier of electronic parts for Subsic and the relationship between the two has lasted for about 15 years. Most of the products that Electra produces for Subsic are assembled at Electra, tested, and sent directly to Subsic's customers. Electra has adapted some of its testing equipment to match Subsic's needs. The capabilities of Electra that are most important for Subsic include radio capabilities, short delivery times, flexibility, and the ability to handle requirements for high quality. Subsic also depends on Electra's ability to do final assembly of products and complete testing, and to deliver products with ESS approval. One way in which Subsic contributes to developing Electra's capabilities is through the joint relationship Electra and Subsic shares with one of Electra's other customers (Micro). Subsic and Micro have coordinated some supplier development efforts with regard to Electra, both in terms of encouraging an expansion of the production volume and in improving routines for early involvement in product development.

4.3.6 Relationship V: Seacro – Electra

Seacro is an electronics manufacturer specializing in the development and production of precision positioning and motion sensing systems in the maritime industry. Seacro is part of a larger corporation and has about 100 employees.

Electronic components are essential parts of Seacro's products, and Electra has been one of the main suppliers of circuit boards for about 10 years. The relationship between the two is close and well developed. According to employees in Seacro, Electra *"understand how we want it without having to explain everything in a detailed, formal way"*. Capabilities of Electra that are most important for Seacro are radio capabilities, flexibility, short delivery times, ability and interest in doing new things, ability to produce Ex-products and the ability to be involved in product development at an early stage. Seacro contributes to developing Electra's capabilities by encouraging Electra's relationships with wholesalers because they possess important component knowledge that contributes to building Electra's competence in this area. Furthermore, Seacro has contributed to building Electra's capabilities in producing Ex-approved products.

4.3.7 Relationship VI: Transpo - Electra

Transpo delivers solutions to operators of transport systems world-wide and has about 270 employees around the world. The head office in Norway employs some 100 people. Circuit boards are a major part of all of Transpo's products. Electra has been one of Transpo's largest suppliers of circuit boards for about 20 years.

Transpo is dependent on many of Electra's capabilities. The most important of these capabilities include radio capability, flexibility, short delivery time, and ability to do final assembly of products. Transpo contributes to developing Electra's capabilities in various ways. By having a long-term and close relationship, Transpo has contributed to building Electra's capabilities through different projects. By encouraging Electra to cooperate with wholesalers, Transpo also hopes this will contribute to building Electra's capabilities.

In sum, Case C involves the buyer-supplier relationships between the supplier Electra and six of its most important customers. The focus is the buying companies' involvement in developing Electra's capabilities as well as the involvement of third parties for Electra's capability development.

4.4 Final Comments on the Case Presentations

This chapter has presented the empirical material on which this thesis is based. Three cases have been presented in which the focus has been on buyer-supplier relationships, business networks, innovation, capability development and network pictures. As discussed in the introductory part of this chapter, it was not seen as necessary to include all the involved

companies and relationships in the three cases to answer the specific research questions of the different papers. Table 4.1 shows for which paper a specific case has been used and the companies that have been included in the papers.

Table 6: Companies involved in the papers

Case	Theme	Empirical material used in paper no.	Companies involved in papers		
			Buyers	Suppliers	Others
A	Innovation and capability development	1 & 2	NSS	ABB	Third parties
B	Supplier-related network pictures	3	Alpha	Beta	Third parties
C	Capability development	4	Ramo Micro Sensoil Subsic	Electra	Third parties

Chapter 5
Findings

This final chapter presents the main findings of the thesis. Section 5.1 provides a summary of the four appended papers, focusing on the central findings from the papers. Section 5.2 discusses the findings from the different papers in light of the aim of the thesis. Section 5.3 discusses the contributions to existing literature and Section 5.4 presents the main implications. The chapter concludes in Section 5.5 by providing suggestions for further research.

5.1. The Four Papers

This section presents the four papers of the thesis. The focus is on the main findings and contributions as well as a brief presentation of the empirical material. Section 5.1.1 presents Paper 1, Section 5.1.2 presents Paper 2, Section 5.1.3 presents Paper 3, and Section 5.1.4 presents Paper 4. Section 5.1.5 gives an overview of the empirical material and the status of the papers.

5.1.1 Paper 1: Supplier Involvement in Innovation Processes: A Taxonomy

This paper directs attention towards a variety of approaches to organizing supplier involvement in innovation processes. The literature review highlights two dimensions that may be relevant to consider when involving suppliers in innovation processes: the *degree of cooperation between the customer and the supplier* throughout the innovation process, and the *scope of company involvement on the supply side*. The degree of cooperation may be high or low, implying that the supplier is involved either as a *problem solver* or as a *partner*. The scope of company involvement on the supply side may be single or multiple, implying that the supplier is referred to as performing either a *dyadic* or a *networking* role.

The empirical material involves a case study of the paper mill NSS and its main supplier, ABB, as the point of departure (Case A). The two companies have a long-lasting relationship and they have conducted many innovation processes in cooperation. Even so, the variety with respect to how the innovation processes have been organized is striking.

Findings from the literature indicated a need for conceptualizing the variety of approaches to supplier involvement in innovation processes. Even though there are studies focusing on different supplier interfaces related to innovation in literature on interorganizational relationships, there has not been much focus on the organization of single innovation processes involving suppliers. Inspired by both the empirical data and the literature, the paper proposes a taxonomy that addresses the variety related to supplier involvement in innovation processes by exploring the *degree of customer-supplier*

cooperation and the *scope of company involvement* on the supply side. The purpose of the paper is thus to classify and analyse different approaches to supplier involvement in innovation processes, as well as to explore the organization of such processes.

Based on the literature and analysis of innovation processes involving the companies NSS, ABB and third parties, the taxonomy introduces four approaches to supplier involvement in innovation processes. The first approach refers to involving a *supplier as a dyadic problem solver*. Here, a single supplier is involved with a low degree of cooperation in relation to the innovation process. The second approach refers to involving a *supplier as a dyadic partner*. Here, a single supplier is involved with a high degree of cooperation in relation to the innovation process. The third approach refers to involving a *supplier as a networking problem solver*. Here, the supplier is regarded as one of multiple companies participating, and the degree of cooperation between the customer and the supplier in relation to the innovation process is regarded as low. The fourth approach refers to involving a *supplier as a networking partner*. Here, the supplier is regarded as one of multiple companies participating and the degree of cooperation between the customer and the supplier in relation to the innovation process is regarded as high.

The taxonomy presented in the paper focuses strongly on business relationships. It introduces two dimensions that are central in literature on business research in general, and in relation to suppliers and innovation processes. The main contribution to theory is, however, the combination of the two dimensions, thus identifying and comparing four distinctly different approaches to organizing supplier involvement in innovation processes. Another important contribution is the finding that a well-established relationship may enable four different ways of involving the same supplier in innovation processes. The taxonomy may thus be a useful tool for both researchers and practitioners for analysing and organizing the complex task of involving suppliers in innovation processes.

5.1.2 Paper 2: The House of Supplier Capabilities: A Tool for Scrutinising the ways in which Different Customers Deploy and Develop the Capabilities of a Key Supplier

The paper focuses on the development of suppliers' capabilities and particularly the importance of customers for the development and deployment of the capabilities of their key suppliers. The literature review discusses the inward-looking tendency of the resource-based view and highlight that the evolution of capabilities should be studied from a network and interaction perspective. It is argued that buying companies develop and deploy suppliers' capabilities through deliberate supplier development initiatives and through repeated interactions in longer-term buyer-supplier relationships. Acknowledging that the relationships a supplier has with customers in its surrounding network will influence the deployment and development of the supplier's capabilities, buying firms' insight in suppliers' capability development and deployment network context is discussed.

Based on the theory on capability development, supplier development, capability development in repeated interactions, and managing-in-network contexts, the paper *firstly*

seek to investigate if and how the capabilities of a key supplier are differentially deployed and developed by its customers, operating in the same or in different industries. *Secondly*, the paper seek to explore how a buying firm may gain an overview of, and reflect on, how the buying firm as well as other customers differentially deploy and develop the capabilities of a key supplier, in order to improve its supply management practice.

The empirical material involves a case study of the relationship between the focal customer unit Norske Skog Skogn (NSS) and the focal supplier unit, ABB (Case A). The findings indicated that ABB's capabilities to a large degree are developed by NSS and ABB's other customers. In order to establish an overview of ABB's capabilities and of how they are differentially deployed and developed by its most important customers, a matrix is developed. This matrix enables analysis of the impact each of the customer units has on the individual capabilities of the focal supplier unit as well as analysis of differences between the overall impact of 1) the focal customer unit versus each of the other customer units, 2) the corporation to which the focal customer unit and its sister units belong versus the corporations to which non-sister customer units belong, and 3) the industry setting in which the focal customer unit operates in versus customer units operating in other industry settings.

Based on the study, it is firstly suggested that a key supplier's capabilities are differentially deployed and developed by different customers. There are differences regarding the capabilities that the customers deploy and develop, as well as the extent to which the capabilities are deployed and developed. Furthermore, there are differences in the pattern of deployment and development of the supplier's capabilities within units belonging to the same corporation as well as customers operating in different industries. Related to the second aim of the study, a matrix which can be used for systematising and scrutinising the differential deployment and development of the supplier's capabilities by different customers is developed. This matrix is coined "The House of Supplier Capabilities". By using this method it is argued that a buying firm can get an overview of and analyse who influences the capabilities of a key supplier, and how the influence of other customers differ from its own influence on the supplier's capabilities.

5.1.3 Paper 3: Network Pictures for Managing Key Supplier Relationships

This paper deals with the use of network pictures for managing key suppliers in their wider network context. The literature review highlights the context that network pictures provide and their function as framing and sense-making devices as well as possible triggers for managerial activities. It is argued that if managers have incomplete knowledge of the context to which their company belongs, this may lead to undesirable action. Examining their own network pictures and those of the companies around them may therefore be beneficial for companies because this may improve their understanding of the dynamics of the network and reduce the danger of missing significant changes. Furthermore, it is highlighted that business networks are dynamic and ever evolving. There is therefore a need for updating and revising network pictures in order to avoid basing managerial actions on outdated network pictures.

The empirical material involves a case study of the company Alpha – a manufacturer of safety equipment and control systems – and four of its most important supplier relationships (Case B). In the paper, however, data related to only one supplier are presented, because analysis of the other three supplier relationships revealed only conceptual developments that were already covered by the relationship between Alpha and Beta. Investigation of the network pictures relating to Beta revealed that Alpha's and Beta's network pictures were very different. In the network picture related to Beta, Alpha included customers that were no longer customers, customers that had never been customers and customers that Alpha could not identify, other than the industry they are in. In addition, Alpha was not aware of a number of important customers of Beta.

Based on the literature and the empirical data, this paper *firstly* seeks to explore how a buying company can consider whether its present key supplier network picture is in line with the key supplier's network context. *Second*, it seeks to explore how a buying company can become aware that its key supplier network pictures may benefit from being revised. *Thirdly*, the paper seeks to explore how a buying firm can proceed to acquire new insights, which may lead to revision of key supplier network pictures, and spur new actions and reactions toward key suppliers.

First, to explore how a buying company can consider whether its present key supplier network picture is in line with the key supplier's network context, it is suggested that the congruence between the network pictures should be assessed. In particular, it is proposed that a buying company may consider whether elements in its key supplier network picture are *obsolete*, *incorrect*, *incomplete*, or *generic*, as well as reflecting on the usefulness of the generic categories used in the network picture. Elements in a buyer's key supplier network picture may be *obsolete* in the sense that they are no longer correct, although they were correct earlier. Elements may be *incorrect* in the sense that they are incorrect now and have always been incorrect. Elements may be *incomplete* in the sense that the buyer's key supplier network picture is less comprehensive and detailed than the key supplier's network picture is. Finally, elements may appear as *generic categories*, aggregating specific counterparts or other items into groups at a higher level.

Second, to explore how a buying company can become aware that its key supplier network pictures may benefit from being revised, it is suggested that a buyer can benefit from developing *a rule* related to each of the four types of elements (obsolete, incorrect, incomplete and generic). The rules connected to each of the four types of elements are first, "how often should we update the network picture?", second, "which elements in the network picture are critical for us to have corroborated or refuted?", third, "when and in which direction should we widen the network picture", and fourth, "should we break up some of the aggregate categories into concrete identities of counterparts?" and "should we change the type of aggregate categories we use?"

Third, to explore how a buying firm can proceed to acquire new insights, which may lead to revision of key supplier network pictures, and spur new actions and reactions toward key suppliers it is suggested that a buyer can uncover new opportunities in key suppliers'

networks by pursuing four strategies: *systematic search*, *systematic discovery*, *chance search*, and *chance discovery*. *Systematic search* involves searching systematically for opportunities in key supplier networks, i.e. making an organized effort to find more information and gain more insight into particular themes that are viewed as relevant for the buyer. In *Systematic discovery*, while the objects of discovery are relatively unknown, the buyer has an idea of where to find them. *Chance search* involves being alert to issues and themes of importance, without continuously and/or recurrently making systematic efforts to acquire new insights related to these. *Chance discovery* involves neither organizing systematic efforts to acquire new insight, nor specifying themes of interest in advance. However, themes may arise in ongoing interactions that may catch the attention of the buying company. A major task for supply managers is to ensure that a useful mix of strategies is practised in relation to suppliers.

5.1.4 Paper 4: Beyond Dyadic Supplier Development Efforts: The Multiple Roles of the Network in Bringing about Supplier Development

This paper deals with supplier development and the influence of the business network in which the supplier development efforts are embedded. The literature review highlights that relationships with suppliers possessing strong capabilities represent a key to success and that many firms are focusing on supplier development to assist suppliers in developing their capabilities. Previous literature on supplier development has focused on a dyadic relationship between a buyer and a supplier. However, in a network perspective, it is assumed that the network plays a role in supplier development. Furthermore, it is discussed how the concept of a triad can be used to introduce third parties to a focal buyer-supplier relationship.

The empirical material involves a case study of the supplier Electra and six of its most important customers (Case C). In the paper, however, data related to only four buyer-supplier relationships are presented, since analysis of the other two relationships did not reveal conceptual developments that were not covered by the four relationships. The empirical findings pointed at the importance of a supplier's capabilities and showed different strategies employed by the buying companies in order to build the capabilities of the supplier. These strategies involved third parties to a large degree.

Based on the literature and the empirical data this paper *firstly* seeks to explore how companies activate third parties in the wider network in order to bring about supplier development. *Secondly*, the paper seeks to explore what the managerial implications are for the buying company, the supplier, and the third parties, which are or become involved in supplier development efforts embedded in a network context.

Firstly, the analysis of the paper suggests three different strategies a buying company can employ in order to develop its suppliers involving third parties: *indirect and peripheral*, *direct and central*, and *direct and networking*.

Secondly, the analysis of the paper focuses on the managerial implications for the buying company, the supplier, and the third parties. *The buying company* should increase its awareness of the different roles the network can play in bringing about supplier development. Buying companies should consider utilizing the surrounding network in a more structured and systematic manner. Furthermore, buying companies should be aware of the limitations and challenges of relying on the network for supplier development. Pursuing either strategy, the buyer depends on its own relationships with third parties, the supplier and/or the supplier's relationships with third parties. *The supplier company* needs to rely on its own network when being involved in an indirect and peripheral supplier development strategy. The supplier is then dependent on having actors in its network that are able and willing to assist the supplier in making the required improvements. Being involved in a direct and networking strategy may also be challenging for the supplier because it has to rely on a third party appointed by the buyer to develop the suppliers' capabilities. *The third party* must consider the potential constructive and/or deleterious effects, on itself and on its relationship(s) with the focal buying company and/or the supplier, which may result from allowing, encouraging, ordering, or being directly involved in, development of the supplier.

5.1.5 Summary of Empirical Material and Status of the Papers

The four papers of the thesis provide different ways of examining supplier management in a network context. Following the aim of the thesis, the papers focus on innovation involving suppliers, capability development involving suppliers, and supplier-related network pictures. Paper 1 and 2 make use of Case A, Paper 3 makes use of Case B and Paper 4 makes use of Case C. By focusing on central aspects related to supplier management, the papers provide insights into the importance of the network surrounding a buyer-supplier dyad. An overview of the different papers, the case used as empirical material and the status of each paper is provided in Table 7.

Table 7: Summary of empirical material and status of papers

Paper no.	Title of paper	Case	Status
1	Supplier involvement in innovation processes: A Taxonomy	A	Published in *International Journal of Innovation Management.*
2	The house of supplier capabilities: A tool for scrutinising the ways in which different customers deploy and develop the capabilities of a key supplier	A	Submitted to the *Journal of Purchasing & Supply Management.*
3	Network pictures for managing key supplier relationships	B	Published in *Industrial Marketing Management.*
4	Beyond dyadic supplier development efforts: The multiple roles of the network in bringing about supplier development	C	Published in *The IMP Journal.*

5.2 Discussion of the Four Papers

As outlined in Chapter 1, the aim of the thesis is to explore supplier management in a network context by focusing on *innovation and capability development involving suppliers as well as supplier-related network pictures*. The four papers in the thesis provide the grounds for covering different parts of this aim. Innovation involving suppliers is addressed in Paper 1. Capability development involving suppliers is addressed in Papers 2 and 4. Finally, supplier-related network pictures are addressed in Papers 2 and 3. Chapter 2 highlighted three research questions that followed the logic of the conceptual framework. In the following sections, the main findings from the papers are discussed in light of these research questions.

5.2.1 Innovation and Supplier Management in Networks

The first research question posed in Chapter 2 is *How can innovation involving suppliers be important for the way suppliers are managed in a network context?* From the study of many innovation projects involving suppliers, this thesis has demonstrated that involving suppliers and third parties for innovation development is a complex empirical phenomenon. It has been found that innovation projects involving suppliers can be organized in different ways, depending on the complexity of the innovation and the technologies involved. More importantly, it was also found that one supplier can (and should) be involved in different ways when the buying company conducts technological innovation.

A matrix identifying four different ways in which suppliers can be involved in innovation processes is presented in Paper 1. The categories in the matrix are as follows: *supplier as a dyadic problem solver*; *supplier as a dyadic partner*; *supplier as a networking problem solver*; and *supplier as a networking partner*. If we start by looking at supplier involvement using a *dyadic approach,* a large variety in degrees of cooperation is indicated. Some innovation projects are conducted in close cooperation with suppliers, whereas in other innovation projects the degree of cooperation is low.

Another finding relates to the variety in how often a supplier is involved in innovation projects with a buyer. In Paper 1, it was found that the supplier was involved on a continuous basis in innovation projects with the buyer. In Paper 3, however, findings indicated that suppliers were involved in innovation projects on an irregular basis. In some buyer-supplier dyads, it could take years between each time the supplier was involved in an innovation project. It was not the aim of this study to find reasons why some companies involve suppliers more often than others do in innovation projects. However, it seems that the level of internal capabilities and the need for continuous innovations in the industry play a role. Companies possessing a large variety of capabilities across many disciplines, such as company Alpha in Paper 3, may find it cost-efficient to do most technological innovation in-house. Even though a substantial proportion of Alpha's activity has been outsourced in recent years, the company still keeps most of its development in-house. Whether this is due to tradition or to a strategic decision is difficult to say. The industrial setting also seems to play a role in how often innovations happen and the regularity of supplier involvement in such projects. The industry in which Alpha operates has strict quality demands, which means that it takes a long time to get new products approved in the industry. The level of internal capabilities and the industry setting may therefore partly explain the slow innovation rate and the low frequency of supplier involvement in innovation projects identified in Paper 3.

Another finding from the thesis is that the nature of the innovation process may require the involvement of several companies, i.e. supplier involvement by using a *networking approach*. This is in line with findings by researchers such as Håkansson and Eriksson (1993) and O'Sullivan (2006). In such cases, the buying company may benefit from the joint cooperation between itself, the supplier and third parties. Most of the third parties that were identified in this study as involved in innovation projects were other suppliers of the buying company. However, it is acknowledged that other third parties may take part even though they were not identified in this study. The nature of the innovation may further allow the buying company to choose the level of involvement it wishes to pursue with the other actors. As discussed in Paper 1, some innovation projects require a high degree of cooperation between the buying company and the supplier while the supplier cooperates closely with a third party, whereas other innovation projects can be handled with a low degree of cooperation between the buying company and the supplier. Furthermore, third parties can be involved *directly* or *indirectly* by a buying company. Involving third parties directly in innovation development with suppliers means that the buying company directly arranges with a third party to cooperate with a supplier for innovation development. Involving third parties indirectly means that the supplier is encouraged to find a relevant third party for the innovation project. The

buying company then relies on the supplier having actors in its network that can be beneficial for the innovation process.

In Paper 1, it is pointed out that it can be difficult to determine whether an innovation process involves third parties or not, and that this may vary according to who is doing the analysis. For example, a buying company may lack insight into whether the supplier involves third parties, i.e. the network pictures of the buyer and the supplier may differ. Even so, the study may still be important for recognizing the effects that follow from increasing or reducing the number of companies involved in technological innovation.

Innovation involving suppliers is an important element of supplier management. Therefore, the way in which innovation is managed with suppliers has an influence on the buying company's supplier management in general. By realizing that innovation with suppliers can be approached in different ways, a buying company may bring these ways of working with suppliers into the other areas of supplier management. These ideas may be fruitful for discussions in the company regarding with whom to cooperate, and to what degree, in other types of projects and change processes that take place involving suppliers. At the same time, the buying company's ways of managing suppliers may also have an influence on how innovation with suppliers is approached. If the buying company is already thinking in networking terms, this may influence the way in which innovation projects are conducted. Even more important, is the recognition that the same supplier should be involved in different ways. Using the supplier in different combinations (high/low degree of cooperation and dyadic/networking scope of involvement) will therefore also be important in other aspects of supplier management.

5.2.2 Capability Development and Supplier Management in Networks

The second research question posed in Chapter 2 is *How can capability development involving suppliers be important for the way suppliers are managed in a network context?* A central finding in this study is that suppliers' capabilities play a central role for buying companies. The specific capabilities of suppliers are highlighted as one of the most important reasons why the buying companies have continued the relationships with the suppliers for such long periods. Finding new suppliers with similar or better capabilities is seen as a very challenging task. Based on the finding that supplier capabilities have such high importance, the study has in different ways focused on how suppliers develop their capabilities. Taking the buyer-supplier dyad as a starting point suggests that the focal buying companies contribute extensively to the suppliers' capability development. In all three case studies, it was possible to identify specific capabilities of the suppliers that the focal buying companies had contributed to developing. This has been specifically discussed in papers 2 and 4.

Further, the study suggests that to understand the capability development process of suppliers, it is important to look beyond the dyadic relationship between the buyer and supplier. Papers 2 and 4 give detailed descriptions of the *importance of third parties for developing the capabilities of suppliers*. In particular, the suppliers' customers are found to be

important contributors of their capability development. Paper 2 illustrates that it is possible to map a supplier's capabilities, and the customers involved in developing them, in a structured manner. It is found that a key supplier's capabilities are differentially developed and deployed by different customers. Furthermore, the findings indicate the possibility of studying the involvement of customers in developing a supplier's capabilities across different units of analysis, such as the company level, the corporate level or the industry level. Such analysis may allow a buying company to reflect on its role in driving the supplier's capabilities in relation to others. The supplier may also use such insight for strategic decisions regarding which customers, corporations and industries to invest time and resources in.

In this study, much of the capability development seems to take place from ongoing cooperation in long-term relationships. Over time, the buying companies contribute to the supplier's capability development, for example by involving the supplier early in product development, having long-term service agreements, using the supplier as a single source, hiring employees from the supplier for a limited time, and having high quality demands. Other research provides examples of capability development which take place in more systematic ways by involving suppliers in organized supplier development programmes. None of the focal buying companies in this study has supplier development programmes, even though some of their parent companies do. However, the suppliers in the study are involved in supplier development programmes by some of their other customers. Still, some of the focal buying companies in the study have supplier development strategies that are quite systematic and structured. Paper 4 shows that it is possible to develop a supplier's capabilities by utilizing the surrounding network. Different strategies for activating third parties in the network for developing the suppliers' capabilities are highlighted in this paper. Three strategies are specifically introduced: (1) *Indirect and peripheral supplier development strategy*; (2) *Direct and central supplier development strategy*; and (3) *Direct and networking supplier development strategy*. In each case, the buying company is dependent on having in its own network, or in the supplier's network, third parties that are willing and able to take part in developing the supplier.

Developing suppliers' capabilities is an essential part of supplier management. The way in which capability development is approached therefore has a great impact on the management of suppliers. This study shows that capability development involving suppliers takes place in different ways, often involving more actors than the focal buyer and supplier. Seeing that capability development largely takes place in a network requires buying companies to reflect on how suppliers should be managed and how the network ought to be taken into consideration when the aim is to cooperate with highly capable suppliers.

5.2.3 Supplier-Related Network Pictures and Supplier Management in Networks

The third research question posed in Chapter 2 is *How can supplier-related network pictures be important for the way suppliers are managed in a network context?* Buying companies' perceptions of the networks surrounding their suppliers and the impact these have on the way

suppliers are managed have been studied in Paper 2 and 3. These papers highlight that the buying companies seem to have limited knowledge of third parties and the direct impact on suppliers. It is found that elements in the buyers' supplier-related network pictures can be *obsolete*, *incorrect*, *incomplete*, or *generic*. Based on the findings in this thesis, incongruent network pictures between the buying companies and the suppliers can result in missed opportunities. In both Paper 2 and 3, opportunities that could have been utilized by the buying companies if the buying companies had had more insight into their suppliers' network contexts were identified. In Paper 2, the supplier identified capabilities that third parties had contributed to developing and that it believed the focal buying company could have benefited from if it had known about these capabilities. From the supplier's perspective, the focal buying company missed out on a number of opportunities by not having a more comprehensive picture of the supplier's surrounding network context. Similar findings were identified in Paper 3. However, in this paper, the focal buying company was asked to comment on certain parts of the supplier's network picture of which the buying company was not aware. From the buying company's perspective, there were potential opportunities to be found that in turn could have impacted the buying company's innovation and capability development processes with the supplier.

In order to acquire new insights into suppliers' network contexts that may impact the way suppliers are managed, different strategies that a buying company can use are proposed in Paper 3. These strategies include *systematic search*, *systematic discovery*, *chance search* and *chance discovery*. These strategies differ according to the extent to which the buyer deliberately searches for new insights, and the degree to which the buyer can specify in advance what is searched for. As discussed in the paper, the weight assigned to each of the strategies may vary across supplier relationships, as well as within a supplier relationship over time.

In Paper 2, other customers of a supplier were identified as being very important for a supplier's capability development. To gain an overview, and reflect on, how the buying firm, as well as other customers, differentially deploy and develop the capabilities of a supplier, a matrix, which we call "The house of supplier capabilities" was developed in Paper 2. Such a matrix can enable a buying company to get an overview of and analyse who influences the capabilities of a key supplier, and how the influence of other customers differs from its own influence on the supplier's capabilities. Such a matrix can thus help the buying company to gain a more comprehensive picture of the supplier's capability deployment and development network context.

5.3 Theoretical Implications

The thesis relies on the industrial network approach as the main theoretical foundation. Ideas and concepts developed within a managing-in-networks perspective have been used as a point of departure for contributing to literature on supplier involvement in innovation, supplier

development, and network pictures. In the following sections, the contributions for these streams of literature will be discussed.

5.3.1 Implications for Literature on Innovation Involving Suppliers

The thesis has directed attention towards the inter-organizational side of innovation and particularly the involvement of suppliers in such processes. Traditional theories of technological innovation have focused on innovation as a process of managing internal development activities (e.g. Cooper, 1993, 1998, 2001). Only to a very limited degree has research on innovation investigated and conceptualized the impact of the network surrounding the buyer-supplier dyad in bringing about technological innovation.

The current study has addressed the importance of supplier involvement in innovation for the way suppliers are managed in a network context. In accordance with researchers such as Gadde et al. (2010), Johnsen and Ford (2007) and Wynstra (1998), it was found that suppliers play a vital role in innovation projects. Furthermore, it was found that a network approach to supplier involvement for technological innovation is important. This supports the findings by e.g. Dyer and Nobeoka (2000), Håkansson and Eriksson (1993), and O'Sullivan (2006). The main contribution to theory on innovation involving suppliers is, however, related to utilization of the network for technological innovation involving suppliers. This was identified as an area of limited research in Section 2.3.4 Towards a network view on innovation with suppliers.

The thesis indicates *four ways in which innovation involving suppliers can be organized*. A matrix showing four ways in which supplier involvement in innovation processes can be approached is developed in Paper 1 with the following categories: *supplier as a dyadic problem solver*; *supplier as a dyadic partner*; *supplier as a networking problem solver*; and *supplier as a networking partner*. The complexity of the innovation and the technologies involved determines the strategy pursued. Even though the various categories have been discussed in different parts of the literature, the combination of the four categories – identifying and comparing four distinctly different approaches to organizing supplier in innovation processes – is seen to be a contribution to theory. A further contribution to theory is the indication that this variety *can and should take place even in the use of the same customer-supplier relationship*. The study indicated the possibility of involving a specific supplier in different ways depending on the innovation project at hand.

5.3.2 Implications for Literature on Supplier Development

Previous research within the capability development literature has focused on an internal perspective, i.e. how the individual firm controls and manages the development of its own capabilities (e.g. Loasby, 1999; Penrose, 1959; Teece et al., 1997). Acknowledging that capabilities are interactively developed and adapted in business relationships over time

(Håkansson & Snehota, 1995; Rosenbröijer, 1998), an increasing amount of literature has focused on supplier development (Arroyo-López et al., 2012; Krause, 1999; Mallahosseini & Barkhordar, 2010). Literature on supplier development has primarily focused on dyadic relationships between a customer and its suppliers (e.g. Krause, 1999; Krause et al., 2000; Wagner, 2006). The role of the network in developing a supplier's capabilities has received limited attention. The thesis reflects an effort to investigate this further.

This study has highlighted the important role the network plays in developing a supplier's capabilities. The supplier's customers were found to be particularly important in this respect. An important contribution of the study has been the development of a matrix that *in a structured way enables an analysis of how a buying firm as well as other customers differentially deploy and develop the capabilities of a supplier.* This matrix enables discussions regarding companies' development and deployment of single capabilities as well as the development of the supplier's total set of capabilities. Furthermore, it enables discussions regarding the development and deployment of capabilities on a corporation level as well as an industry level.

The study further highlighted that a buying company can contribute to developing a supplier's capabilities by *activating third parties in the wider network.* Another important contribution of this study has thus been the identification of three different supplier development strategies a buying company can pursue – *Indirect and Peripheral, Direct and Central,* and *Direct and Networking* – in order to develop a supplier's capabilities.

Furthermore, a supplier is seen to take a more active part in the development of its capabilities, since the supplier may take the initiative to involve third parties in its network in order to develop its capabilities.

5.3.3 Implications for Literature on Network Pictures

The findings of this thesis extend previous work on network pictures (e.g. Ford & Redwood, 2005; Henneberg et al., 2006; Roseira et al., 2012). According to Ford and Mouzas (2010), there is a paucity of empirical studies describing the range of network pictures held by actors and the interplay between those pictures and business interaction, particularly in the context of supplier networks. This thesis has been an effort to enrich the concept of network pictures related to suppliers' network contexts. Although some previous studies have looked at the incongruence between network pictures both at an individual and at the company level, these previous studies have not specifically studied how these network pictures vary between companies. By *assessing the congruence between the buyer's supplier-related network picture and the supplier's own network picture*, we propose that a buying company may consider whether elements in its supplier network picture are *obsolete, incorrect, incomplete, or generic*. A contribution to theory is therefore the importance of paying attention to these elements when mapping the incongruence between network pictures. Furthermore, a contribution to literature on network pictures is made by developing rules on how a buying company can become aware that its supplier-related network picture is in need of revision as

well as by proposing four strategies (*systematic search*, *systematic discovery*, *chance search* and *chance discovery)* for how a buying company can proceed to acquire new insights.

The matrix developed in Paper 2 may also be regarded as one form of network picture, centring on a supplier's capabilities and their development and deployment in the supplier's wider customer network context. The matrix may thus be a contribution to research on network pictures by providing a different format for mapping network pictures. This study proposes that revision and mapping of network pictures related to suppliers may make it possible to find opportunities in the wider network of suppliers, which may be used by a company to stimulate network actions and consequently affect the performance of the buying company.

5.4 Managerial Implications

The findings in the thesis have practical implications for buying companies and for suppliers. In this section, the managerial implications for the buying firm are addressed first, followed by a discussion of the implications for the supplier.

5.4.1 Implications for Buying Firms

Because this study has been conducted in close cooperation with companies, the insights and outputs of the thesis may help managers in buying companies to deal with supplier involvement in innovation development and capability development with suppliers as well as to improve their understanding of how to manage suppliers in their network contexts. A number of managerial lessons from the study can be identified.

Insight into Suppliers' Network Contexts

An important managerial implication is that a buying company should consider the insight it has into its suppliers' network contexts. Knowledge of suppliers' networks is especially relevant when a company wants its suppliers to perform broader functions and to put into place changes that may involve indirect counterparts. One way of building an increased awareness of the network surrounding a supplier can be to question whether the buying firm's insight into its supplier's network sufficiently reflects the supplier's network context. Acknowledging that elements in the network pictures are, or will become, *obsolete*, *incorrect*, *incomplete* or *generic* is a first step toward ensuring that a buying firm does not adhere to rigid and unquestioned maps of the supplier that may hamper identification of new opportunities related to the supplier.

In Paper 3, we provide supply managers with suggestions for how network pictures related to suppliers can be updated and revised as well as strategies on how to gain insight and

identify opportunities. In Paper 2, we suggest that a buying firm may benefit from applying a matrix in relation to its key suppliers. This may give the company increased insight into and understanding of the priority given by the supplier to the buying company and to the corporation to which it belongs. A stronger awareness of the supplier's network context may imply that buying companies acknowledge that they are not the sole focus of the supplier and that the buying firm needs to make an effort to become a customer of high priority – an attractive customer – for the supplier.

The Importance of Suppliers' External Relationships for Capability Development

An important implication arising from this study is that the developments of suppliers' capabilities are critical for a buying firm's performance. The findings of this study indicate that a supplier's capabilities are developed in interaction with its counterparts, particularly its customers. A buying company should therefore recognize the importance of a supplier's external relationships for the supplier's capability development. Awareness of the supplier's capabilities and of the degree of third-party involvement in developing these capabilities may be important for strategic decisions related to the supplier and may increase the possibilities for identifying new opportunities. Such awareness may also enable the buying company to use the supplier's capabilities more efficiently and to influence the directions in which the supplier's capabilities are developing.

Utilizing the Network when Developing Suppliers' Capabilities

This study revealed that the network could be used in multiple ways for bringing about supplier development. A buying company should therefore consider the possibilities of utilizing the surrounding network in a more systematic and structured manner for developing the supplier's capabilities. Three strategies for supplier development in a network context are presented in Paper 4: *indirect and peripheral*, *direct and central* and *direct and networking*. Buying companies should evaluate which strategies may be useful and possible to pursue. Utilizing third parties in capability development processes means that the buyer depends on its own relationships with third parties, the supplier and/or the supplier's relationships with third parties. All of these play a pivotal role for the ability to employ network-based strategies and the buying company needs to consider and possibly influence the ability and willingness of the involved third parties to play a part in developing the supplier's capabilities.

Involving a Supplier in Different Ways in Innovation Projects

A buying company should reflect on how the network can be used when the company involves suppliers in innovation projects. Certain innovation projects may be of a kind that requires the involvement of several technologies and the competences of several companies, whereas others require the involvement of the buying company and the supplier only. The

taxonomy presented in Paper 1 may form a point of departure for addressing questions related to the degree of supplier involvement and the involvement of third parties in innovation processes. Four different ways of organizing the involvement of a supplier in innovation projects may be: (1) *Supplier as dyadic problem solver*, (2) *Supplier as dyadic partner*, (3) *Supplier as networking problem solver*, and (3) *Supplier as networking partner*. A buying company may use these categories in a search for a suitable way to organize an innovation project.

5.4.2 Implications for Suppliers

Some managerial implications for suppliers can also be identified from the study. These implications relate to buyers' awareness of the supplier's network context as well as the benefits and challenges of active involvement in capability development in networks.

Increasing Buying Companies' Awareness

From the supplier's perspective, it may be very beneficial to have relationships with buyers that have developed an awareness of the different roles the network can play both for innovation and for capability development. First, it may be beneficial for the supplier that the buyer has updated insight on how the supplier develops its *capabilities*. The case studies revealed that the suppliers saw potential opportunities in their surrounding network that the buying companies did not utilize. As also found by Choi and Kim (2008), buying companies with such insight are likely to perform better at supplier management than those without such understanding. Furthermore, the supplier will be in a better position to coordinate its capability development with the buying company and its other customers when the buying company has comprehensive insight. Second, suppliers that are involved by buying companies in *innovation* projects may benefit from the buyer having updated insight on the surrounding network and a plan for how the innovation process should be organized. Clear guidelines from the buyer on the degree of involvement from the buying company as well as the number of companies involved in the innovation project give the supplier a better foundation for planning its involvement.

Based on the finding that increased insight into the supplier's network context is beneficial, an important managerial implication for the supplier is therefore that it could benefit from playing a more active role in increasing the network awareness of buying companies. With a system for updating buying companies on changes that occur in the supplier's bundle of resources, and capabilities developed in cooperation with a certain third party, buying companies' awareness of the supplier's network context could increase considerably. The matrix developed in Paper 2 can serve as a tool for achieving this.

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Challenges Related to Buying Companies' Increased Awareness

Being involved with buying companies that have comprehensive insight into the supplier's network context may not necessarily create a win-win situation. The buying company may become too dominating as the insight into the supplier's situation grows. The supplier may prefer not to share certain aspects of its other relationships and its capability development with the buying company. The supplier may therefore find that it wishes to control its development without the buying company monitoring this and giving directions.

Active Involvement in Capability Development in Networks is Resource Demanding

Being subject to capability development initiatives from the buying company that also involve third parties may provide great benefits for the supplier. In such initiatives, the supplier gains access to knowledge that may be fruitful for building its capabilities related to the focal buyer as well as to its other customer relationships. However, capability development initiatives involving the network may also pose certain challenges for the supplier. Some of the strategies proposed in Paper 4 require the supplier to search within its own network to improve its capabilities or to rely on a third party appointed by the buyer to develop its capabilities. Searching for suitable third parties as well as building a relationship with third parties appointed by the buyer requires substantial resources. Furthermore, there is a risk of being connected to a third party that "drains" knowledge from the supplier and does not contribute to the development.

5.5 Limitations and Suggestions for Further Research

The thesis is not without limitations. The limitations related to method and the empirical material have been discussed in Section 3.10, such as the low number of interviewees in some of the involved companies, the fact that no third parties were interviewed, and that a final case description has only been sent to one of the companies. In addition, the influence of context on the findings should be highlighted. If there were other companies, industries or networks being investigated, some new dimensions could have emerged and some of the proposed elements could turn out to be insignificant.

Furthermore, it could be argued that the study is restricted by the choice of theory. Irrespective of how carefully the theoretical perspectives of a study are selected, they will guide the attention and focus towards some aspects of a phenomenon, while the roles of other aspects are downplayed. The impact of the theoretical framework has also been discussed in Chapter 3. The thesis builds on existing knowledge on innovation involving suppliers, capability development involving suppliers and supplier-related network pictures. With the IMP tradition as the foundation for understanding how these different areas are important for managing suppliers in business networks, the main intention of the study has been to develop theory in these areas.

Based on the results of the thesis, some directions for further research can be identified. One avenue for future research could be to collect more or other empirical material. As the study specifically looks at buyer-supplier relationships in a network context, an option for further research might be to investigate the role of third parties in more depth. Such investigation would be interesting for understanding the role of third parties for innovation and capability development with suppliers as well as understanding why specific network pictures are created. In addition, it could be interesting to collect empirical material from other industries. By doing this, future studies could investigate the transferability of the findings to contexts other than the ones in this study.

Another avenue for future research could be to adjust the method. A longitudinal study could make it possible to study the dynamics of the buyer-supplier relationships and the surrounding networks. This could enable investigation of how buying companies involve suppliers in innovation and capability development over time as well as to see how network pictures change over time.

Future research could also involve changes in the theoretical foundation. Instead of a focus on innovation involving suppliers, capability development involving suppliers and supplier-related network pictures, it could have been interesting to study other areas that might be important for how suppliers are managed in a network context. Such areas might include a focus on outsourcing, ePurchasing and local/global sourcing. These areas have been identified as gaining increasing attention and as having implications for purchasing and supply management.

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Paper I

Supplier Involvement in Innovation Processes: A Taxonomy

Tina Bjørnevik Aune & Espen Gressetvold

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The House of Supplier Capabilities: A Tool for Scrutinising the Ways in which Different Customers Deploy and Develop the Capabilities of a Key Supplier

Elsebeth Holmen & Tina Bjørnevik Aune

The House of Supplier Capabilities: A tool for scrutinising the ways in which different customers deploy and develop the capabilities of a key supplier

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Abstract

According to Schoenherr et al. (2012), supply management has changed from being the purchasing of products and services from suppliers to become the management of the capabilities of suppliers. We contribute to the literature on supply management by focusing on two issues. Firstly, we discuss the importance of customers for the development and deployment of the capabilities of their key suppliers. Secondly, we discuss how a buying firm may get an overview of the contribution it makes, as well as the contributions other customers of a key supplier make, to the deployment and development of the capabilities of that supplier. Basing our work on a single case study, we suggest, test and discuss a tool designed to gain an overview of the customer-related deployment and development of the capabilities of the supplier. We call this tool "The House of Supplier Capabilities". Finally, we offer the potential implications of the tool for a focal customer company: ways in which it can use both the tool, and the reflections it inspires, to improve its supply management practice. We also offer implications for suppliers, and for further research.

Keywords: Supplier capabilities; Capability development; Supplier development; Supplier relationships; Key supplier management; Network insight

1. Introduction

Given the increase in specialisation, outsourcing and supply base reduction, it is not uncommon that inputs from suppliers can account for 60-90% of turnover, and that a small set of suppliers can account for the majority of purchasing costs (Terpend et al., 2008). In line with a company's increasing reliance on its suppliers for the strength of its performance, recent research has emphasised that companies must seek, build and maintain relationships with a smaller set of capable suppliers in order to compete and survive (Dyer, 1996; Lyons et al., 1990; Sarkar and Mohapatra, 2006). Such relationships are sometimes coined 'key supplier relationships', a term defined as "those supplier relationships on which the buying company heavily depends, now or in the future" (Ivens et al., 2013:137). In line with these developments, *"purchasing and supply management has undergone a paradigm shift, away from merely purchasing products and services from suppliers, toward managing suppliers' capabilities, market insight and knowledge"* (Schoenherr et al., 2012:4563). Having relationships with suppliers which have strong or world-class capabilities is seen as a key to success, but it is equally important that the capabilities of such suppliers fit the needs and requirements of the buying firm, in the short-term as well as in the long-term, so that the knowledge, capabilities and innovative abilities of the suppliers translate into improved performance and new business opportunities for the buying firm (Schoenherr et al., 2012). Building, adapting and improving supplier capabilities through buyer practices such as supplier development initiatives, as well as mutual efforts at adaptation, knowledge sharing and joint learning, have therefore become strategically important mechanisms for buying companies (Terpend et al., 2008), intended to ensure a dynamic fit between the capabilities of the supplier and the buying firm's changing needs for, and reliance on, supplier capabilities.

Most of the literature on capability development has opted for an intra-firm perspective. Recent research has, however, highlighted the importance of a company's relationships, and the interaction with counterparts, for its capability development. In particular, customers have been found to have a major impact on the development of suppliers' capabilities. Within the field of purchasing and supply management, two lines of research have addressed this issue in depth. Firstly, research on *supplier development* focuses on how a buying company can deliberately design practices and carry out initiatives explicitly aimed at developing the capabilities of its suppliers, both through direct and indirect approaches (Krause et al., 2007; Wagner, 2006, 2011) and through reactive and strategic approaches (Krause et al., 1998; Sánchez-Rodríguez et al., 2005). Secondly, studies of relationships and networks have shown that *repeated interactions* in substantial buyer-supplier relationships over time, and across different projects and episodes, influence the development of the capabilities of the supplier (as well as those of the buyer) (Ethiraj et al., 2005; Håkansson and Snehota, 1995; Johnsen, 2005; Rosenbröijer, 1998; Skjølsvik et al., 2007).

While customers increasingly reduce their number of suppliers, they often do not opt for single sourcing (Liker and Choi, 2004), but instead choose policies of dual, parallel, network and triadic sourcing (Dubois and Fredriksson, 2008; Hines, 1995, 1996; Richardson, 1993). Furthermore, in order to reduce risk and dependence, and increase learning (Oh and Rhee, 2008), suppliers often prefer situations where no single customer accounts for an excessively large percentage of the supplier's turnover. Similarly, buyers tend to prefer not to account for an excessively large percentage of the supplier's turnover. (However, what is regarded as being an excessively large percentage varies, as well as if the intended strategy is realized.) This implies that a supplier usually has quite substantial relationships with several customers, each of which accounts for a large but not dominant percentage of its turnover (Håkansson, 1990).

When a supplier engages in relationships with several buyers, research has indicated that the capabilities of that supplier are deployed (i.e. used) and developed in different ways by the different buying firms (Weigelt, 2013), making each of the relationships unique (Håkansson and Snehota, 1995). Hence, while some capabilities are quite client-specific, others are more transferable (Anderson et al., 1994; Håkansson and Snehota, 1995; Rosenbröijer, 1998), redeployable (Nobeoka et al., 2002) or fungible (Ethiraj et al., 2005) across the relationships with different customers.

However, few studies systematically investigate how the capabilities of a supplier develop in relation to its set of customer relationships and the differences between the ways in which these customers make use of and influence their development. As a result of this, little attention has been paid to the ways in which a buying company may consider and scrutinise its particular contribution to the deployment and development of the supplier's capabilities in the context of the supplier's other customers and their influence on the supplier's capability development. Gaining insight into the wider network of customer relationships that develop the capabilities of a supplier, relying on the supplier network awareness capability of the buying firm (Choi and Kim, 2008), may improve the buying company's managing in relationships with key suppliers in its supply base.

The purpose of this paper is twofold. Firstly, we aim to investigate the ways in which different customers influence the capabilities of a common supplier. Secondly, we aim to develop a tool which may be used by a focal customer to systematically analyse the influence of different customers of a supplier on the supplier's capability development, in order to support the buying firm's supply management practice.

The paper is structured as follows. In Section Two we present the theoretical background to the article, relying on literature on capability development, supplier development, and capability development in repeated interactions and managing in network contexts. In Section Three, we present the methodology. This is followed in Section Four by the presentation of the single case study on which the article is based. In Section Five, we present a tool for the systematic scrutiny of a supplier's capability development in relation to its key customer relationships, and we discuss the patterns which were found when the tool was tested in the case study, and the ways in which a buying firm may scrutinise such

patterns. In Section Six, we offer the conclusions and implications of our research for managers, for theory and for further research.

2. Theoretical background

2.1 Capabilities and how they evolve

Capabilities are important constituents of the offerings of a firm, as well as being key drivers of organisational performance (Pressey et al., 2009). The concept of capabilities was first developed by Richardson (1972:888), who defines it as a combination of "knowledge, experience and skills". Later, the concept of capabilities was developed further by researchers who subscribe to the resource-based view within the wider field of strategic management. According to the resource-based view, a capability is defined as the "ability to perform a particular task or activity" (Nelson and Winter, 1982; Winter, 2003) and results from repetitive patterns of activity (routines), search processes, and the learning-by-doing which results from these.

Winter (2000) explicitly discusses how we should model 'a capability'. Firstly, he argues that (the possession of) a capability should be modelled as *a continuous variable* rather than a binary one. A binary model of capabilities means that a firm's possession of a capability is either one or zero: either the firm has the capability or it does not. If we apply such a binary model, the consequence is that we overlook how a capability is learned – in a world of binary capability models, nobody exists except absolute beginners or complete experts. Thereby, a binary model leads us to overlook factors which influence the process in which 'beginners' become 'more expert' in performing a capability. Winter (2000) suggests that such factors are important for acquiring insight into how a capability evolves, and consequently that we should model its development and possession as a continuous variable with no limit value. Hence, even if a capability has reached some lower 'threshold level of reliability', it is always possible to improve it and to develop it further.

The view of capabilities as maturing along a continuous scale is similar to the view of resources within the field of quality management, where attention has been paid to specifying and measuring different levels of capabilities, for example in relation to suppliers. The Software Engineering Institute at Carnegie Mellon has proposed a model of contractor capability which specifies five levels of maturity, dependent on the degree to which key processes are defined and managed (Ethiraj et al., 2005; Paulk et al., 1993). Similarly, Walker (1997) has developed a software model for the assessment of supplier capabilities, which relies on the ISO/IEC 15504 standard and suggests that capabilities progress through six levels. Walker gives these levels the following labels: incomplete, performed, managed, established, predictable and optimising.

A few researchers within the resource-based view have scrutinised the issues of *evolution of capabilities* in more detail. Building on Winter's ideas (2000), Helfat and Peteraf (2003) suggest a model of capability development which they coin 'the capability lifecycle'. This consists of two stages: founding and development, followed by maturity. They suggest

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that this model applies to all types of capabilities, operational as well as dynamic. In the 'founding and development' stage, a team searches locally for viable alternatives for capability development, and chooses which of this limited set it should pursue. Having made a choice of a capability to develop, the team tries to accumulate experiences with the capability over time, through on-line trials and off-line evaluations. While the capability is continuously improving, and thus becoming more mature, the performance which relies on the capability becomes increasingly robust and predictable.

The capability enters the 'maturity stage' when capability development ceases and the focus shifts to capability maintenance. The extent to which a company maintains its capability is assumed to depend on how often and how consistently it makes use of the capability. However, when a capability has reached the maturity stage, it may still undergo transformation, and Helfat and Peteraf (2003) propose six different ways in which 'capability branching' can occur: these are retirement, retrenchment, renewal, replication, redeployment and recombination of the capability.

In discussions of the birth and evolution of capabilities, a distinction is sometimes made between the *deployment* and the *development* of capabilities; whereas deployment of capabilities has a strong element of routine, development of capabilities is more clearly marked by intent and deliberation (Helfat and Lieberman, 2002). A more managerial view of capability development suggests that, while capability development relies on more emergent and tacit accumulation of experience, it is important to stress and attend to the more deliberate efforts and investments in the institutionalisation of the lessons learnt (Kale et al., 2002; Zollo and Winter, 2002).

If we relate these insights to the capability life-cycle discussed above, the founding stage of a capability is characterised more by development, and, as a result, by elements of intent and deliberation, than by routine. When the capability reaches the level of maturity, its deployment becomes increasingly characterised by routine. If it is further developed, however, being thus transformed according to one of the six types of branching suggested by Helfat and Peteraf (2003), performance tends once again to be characterised more by intent and deliberation and less by routine.

In summary, capabilities evolve over time from the joint effects of "passive learning-by-doing and deliberate firm-level investments in learning" (Ethiraj et al., 2005:28). While both elements may be present at all times, capability deployment tends to be characterised more by the former and capability development more by the latter.

2.2 Factors and actors which influence the evolution of a capability

Due to the traditionally rather inward-looking focus of the resource-based view (cf. Loasby, 1999; Penrose 1959), most explanations of the evolution of capabilities over time have attended primarily to how a firm controls and manages the development and deployment of its own capabilities, largely without the consideration of external influences (Romijn and Albaladejo, 2002). For example, Winter (2000) conceptualises capability evolution as a predominantly *internal* learning process, stressing the knowledge and skills acquired by the

workforce through experience, internal staff training and 'learning-by-doing' inside the firm. Leonard-Barton (1992) discusses how capabilities develop and change over time in relation to four, mainly internally-oriented, dimensions: the skills and knowledge-base of employees, technical systems, managerial systems and the values and norms which are associated with the various types of embodied and embedded knowledge within the organisation. Other studies within the resource-based view have shown that capability development is increasingly inspired by, and depends on, external sources. For example, Lane and Lubatkin (1998) argue that firms may acquire articulable knowledge about technical and managerial processes from sources such as journals, seminars and consultants; and the firm may get a broader view of other firms' capabilities through bench-marking and initiatives aimed at developing competitor intelligence. All of these external sources can influence how the firm chooses to develop its capabilities. Helfat and Peteraf (2003) suggest that the choice of development path for a capability is based on factors in the *internal* as well as the *external selection environments*. While the internal selection environment is comprised mainly of internal processes and managerial decisions, the main factors in the external selection environment include "changes in demand, science and technology, availability of raw materials, and government policy" (Helfat and Peteraf, 2003:1004). As such, external (also coined environmental) factors that affect the evolution of a firm's capabilities, and hence their deployment and development, are generally discussed at an aggregate, industry or (factor) market level.

Teece (2009:16) criticises the conceptualisation of 'environmental context' as being that of the industry, and suggests that the *business ecosystem* offers a superior framework, as it comprises the concrete customers and suppliers of the firm, as well as all other organisations, institutions and individuals that complement and influence the firm and its customers and suppliers. Furthermore, he argues that in dynamic settings, the main tasks of an enterprising firm are to sense and shape opportunities and threats, and to seize opportunities in both the core and the periphery of its ecosystem. Such sensing, shaping and seizing may be done in established, close relationships with various counterparts as well as in relationships with more distant parties with which the firm is less familiar.

Mahmood et al. (2011:842) also criticise the inward-looking tendency of the resource-based view, stating that the *"extant literature on capabilities has typically emphasized capabilities as being internally generated, with heterogeneity primarily arising from imperfections in factor markets [...], distinct organizational skills and routines [...], causal ambiguity and uncertain imitability [...], and deliberate investment in learning and making improvements [...] While we do not deny internal sources of capability acquisition, we do challenge the implicit assumption that firms are autonomous and atomistic in their pursuit of capabilities. This atomistic approach, with its focus on the characteristics of firms, neglects the importance of the network in which firms are embedded"*. They claim, therefore, that the evolution of capabilities should be studied from a *network embeddedness* perspective, and that alternative forms of ties to different types of actors (e.g. customers, suppliers, partners etc.) may differentially impact the acquisition and building of a firm's capabilities.

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The need for a network and interaction perspective on capability development within the field of supply management was early on discussed by Croom and Batchelor (1997:301), who claim that *"capabilities are not elemental, but in fact "reveal themselves", are specific and particular to the conditions under which a firm operates, and therefore the analysis of capabilities demand recognition of the context within resources become strategic"*, this context being networks of buyer-supplier relationships. They rely on the claim by Ford et al. (1986) that the source of an organisation's capabilities is the activation of resources through interaction between buyers and suppliers. In particular, such activation takes place in idiosyncratic relationships, implying that *"what is useful and of competitive value for one customer, may not be so for another customer. Likewise, what makes one supplier a "good" supplier, may not provide the same advantage for another"* (301). In short, the distinctive capabilities of an organisation develop through its interactions within the relationships it maintains with other parties (Anderson et al., 1994; Croom, 2001).

Hence, the capabilities of a firm evolve in relation to the pattern in which they are deployed and developed in relation to actors in the wider network or ecosystem.

2.2.1 The importance of customers for the evolution of a firm's capabilities

The capabilities of a firm may evolve in relation to every type of actor (e.g. Mahmood et al., 2011). However; customers, and interaction with buyers in buyer-supplier relationships, have, in particular, been emphasised as key drivers of the evolution of a firm's capabilities. For example, Danneels (2002) stresses the importance of product innovation related to customers for the evolution of a firm's capabilities, as well as the impact of customer linkages on the evolution of the firm's capabilities. Ethiraj et al. (2005) also address the issue of where and how capabilities emerge. They suggest that there are two broad classes of capabilities: client-specific capabilities and project-management capabilities. The former emerge from repeated interactions with clients over time and across projects, the latter through deliberate and persistent investments in infrastructure and systems intended to improve the firms' development process. Similarly, Schüssler et al. (2012) claim that in project-based settings, continuity of customer demand is an important driver of capability development. The importance of clients for the development of a supplier's knowledge development has also been stressed by Bettencourt, et al., (2002) and by Skjølsvik et al., (2007), who argue that knowledge-intensive business service firms co-create value through interaction with knowledgeable clients in challenging project settings.

Thereby, the capabilities of a firm evolve in relation to the pattern in which they are deployed and developed in the relationships with their customers.

Within the literature focusing on capabilities and external actors, an increasing amount of attention is paid to (dynamic) capabilities for handling and managing relationships and networks. Early on, Day (1994) argued that externally-oriented processes, such as market sensing, customer linking, channel bonding and technology monitoring, are important distinctive capabilities for market-driven organisations; and therefore he stressed the need for customer-relationship capabilities. Weng and Huang (2012) also stress the importance of

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such capabilities, since they enable a firm to sense opportunities, develop services and increase their performance. More generally, both Dyer and Singh (1998) and Dyer and Kale (2007:66) suggest that a relational, resource-based view of the firm is required which stresses relational capabilities comprising *"the capacity to purposefully create, extend, or modify the firm's resource base, augmented to include the resources of its alliance partner"*. Ritter et al. (2004) argue that, in order to manage in a network, companies need networking capabilities which require them to handle both relationship-specific and cross-relational tasks. However, in this paper, we do not address relational and network capabilities as such; we are interested instead in how a firm's capabilities evolve by being deployed and developed in relation to customers, regardless of whether the evolving capabilities in question belong to the category of (dynamic) relationship and network capabilities.

2.3 How buyers develop and deploy suppliers' capabilities

Taking a purchasing and supply management perspective on the matter implies that buying firms influence the evolution of their suppliers' capabilities through the pattern in which they deploy and develop these capabilities. The literature on purchasing and supply management discusses the issue mainly in relation to two topics. Firstly, the topic of *supplier development* explicitly addresses the ways in which a buying firm can develop the capabilities of its suppliers. Secondly, research into the wider topic of *repeated interactions in longer-term buyer-supplier relationships* also discusses issues related to the deployment and development of supplier capabilities.

2.3.1 Supplier development

Acknowledging that relationships with suppliers that possess strong capabilities represent a key to success, many firms focus on supplier development in order to help suppliers to develop their capabilities (Hahn et al., 1990; Krause and Ellram, 1997; Reed and Walsh, 2002; Watts and Hahn, 1993). Much of the literature on supplier development focuses on the ways in which large companies and global corporations develop the capabilities of smaller suppliers (Krause, 1997; Watts and Hahn, 1993); and several studies report on the supplier-development activities of large international client firms aimed at improving the capabilities of small and medium-sized suppliers in less favoured regions (Wouters et al., 2007). However, the suppliers whose capabilities are developed may be both small and large firms, located in both developing and developed regions and countries.

According to Krause, supplier development broadly refers to *"any effort by a buying firm to improve a supplier's performance and/or capabilities to meet the buying firm's short- and/or long-term supply needs"* (1999:206). The purpose of supplier development is to improve the capabilities of the supplier and enable it to provide better quality and delivery, lower-cost products and services on time, and to bring in innovations to support the customer's sourcing and procurement targets and sustainable development objectives,

while at the same time increasing supplier profitability as an extension of the benefits delivered to its customers.

A distinction is often made between direct and indirect supplier development practices Wagner (2006), which corresponds to the distinction between a steady approach and heavy involvement (Nagati and Rebolledo, 2013). Much of the literature focuses on the first of these, the direct and systematic supplier development practices, and emphasises the active role which a buying firm plays in dedicating human and/or capital resources to a specific supplier (e.g. Hartley and Jones, 1997; Krause, 1997, 1999; Krause et al., 2000). Direct supplier development can include activities such as on-site consultation, education and training programmes, temporary personnel transfer, involving the supplier's personnel, and the provision of equipment and capital (Krause, 1997; Krause and Scannel, 2002; Monczka et al., 1993). Toyota is a frequently cited example of a company with a direct, systematic and standardised way of working with its suppliers and building supplier capabilities which have long-term benefits both to itself and to its suppliers (Dyer and Nobeoka, 2000; Nobeoka et al., 2002). Conversely, indirect supplier development occurs when a buying firm commits either no resources or limited resources to a specific supplier, but instead offers incentives or enforces supplier development (Wagner, 2006). Indirect supplier development can be produced through the assessment of suppliers, the communication of supplier evaluation results and performance goals or the promise of future business to suppliers (Krause, 1997; Krause et al., 2000). These activities are used by buying firms to encourage suppliers to improve, with little involvement from the buying firm itself. According to Prahinski and Benton (2004), and Wagner (2006), indirect supplier development can be associated with improved product and delivery performance, as well as with an improvement of the buyer-supplier relationship.

While various studies have found that both direct and indirect approaches have a positive impact on the development of suppliers' capabilities, other studies stress that buying firms which have a proactive philosophy towards the performance of their suppliers, which put more effort and resources into their supplier development activities, and which exhibit a greater willingness to share information with their suppliers, tend to be more satisfied with the results of supplier development than those buying firms which are less proactive and spend less resources and efforts on supplier development (Krause and Ellram, 1997). This was confirmed by later studies, which suggested that buyer-supplier relationships are doomed to failure if clients are not willing to use interaction-oriented capabilities (Moreira, 2009); that indirect supplier development efforts are less effective than direct ones (Arroyo-López et al., 2012); and that the direct involvement of the buying firm is a critical factor for the success of supplier development activities (Ghijsen et al., 2010; Routroy and Pradhan, 2013).

Buyers may therefore develop the capabilities of their suppliers through deliberate investment in supplier development initiatives and practices, (mostly) with the intention to deploy the capabilities.

2.3.2 Repeated interactions in buyer-supplier relationships over time

The capabilities of a supplier, however, also evolve from being deployed and developed by a buyer, even if the latter has no planned scheme in place for developing the capabilities of the former. Such effects have been studied, in particular, in literature which addresses substantial longer-term buyer-supplier relationships, and proposes that repeated interactions over time between buyers and suppliers influence the creation and development of capabilities through the long-term intertwining of their resources and activities, implying that the directions in which the capabilities of two firms develop will converge (Håkansson and Snehota, 1995) through mutual adaptations (Brennan and Turnbull, 1999; Hagberg-Andersson, 2007) and interaction in different types of interfaces (Araujo et al., 1999), in order to meet some specific need of the partner, or to nurture and develop the relationship itself. Thereby, the capabilities of the supplier evolve by being used (i.e. deployed) by the buyer, as well as by becoming adapted to the buyer's needs (and thus developed) over time.

From the supplier's perspective, a buyer can be considered important and prioritised for different reasons (Håkansson and Eriksson, 1993; Gadde and Håkansson, 2001; Håkansson and Snehota, 1995). Firstly, a buyer can be important because it purchases large volumes and accounts for a large percentage of the supplier's turnover, hence allowing for continuous learning and improvements, and for day-to-day rationalisations. Secondly, a buyer can be considered important because it places challenging demands on the supplier, and influences the supplier's innovation and capability development, functioning as a valuable premise provider. Finally, a buyer can be prioritised (or not) because of its reputation and position in the wider network, which stems from its relationships with other parties. Hence, a customer can influence the evolution of a supplier's capability by deploying as well as by developing that capability. Furthermore, the identity of the customer matters: some customers are more knowledgeable and more influential than others, and may have a role as premise providers for the wider industry setting, implying that their deployment and development of the supplier's capabilities are more worthy of notice.

Within the field of buyer-supplier relationships, the topic of supplier capabilities has also received particular attention from Möller and Törrönen (2003), who suggest that the potential value of a supplier is related to its various capabilities, since the quality of a company's products is ultimately determined by the capabilities of its suppliers (Watts and Hahn, 1993). More specifically, Möller and Törrönen (2003) propose that suppliers can potentially provide their customers with value propositions in a number of generic areas based on distinct capabilities: production, delivery, process improvement, incremental innovation, relational, networking, radical innovation and mastering the customer's business. Consequently, buying companies would benefit from paying close attention to the management and development of their suppliers and those suppliers' capabilities.

Hence, in a business relationship a buyer both deploys and develops the capabilities of the supplier. Repeated interactions related to the deployment of the supplier's capabilities give rise to adaptations of those capabilities. Furthermore, the buyer may make deliberate

attempts at managing and developing the capabilities of the suppliers, in order to complement the adaptations that emerge from the interactions over time.

2.3.4 The evolution of supplier capabilities in the context of multiple customers

So far, the evolution of a supplier's capabilities has been discussed in the context of a single buyer, and a single (dyadic) buyer-supplier relationship. However, if a supplier has more than one customer, then the capabilities of that supplier can be assumed to evolve in relation to its set (or portfolio) of customers. Hence, a supplier's other customers may be the most important drivers or "catalysts" of the supplier's capability development (Hartley and Choi, 1996).

Within the field of *supplier development*, this issue has not been extensively investigated or discussed, as the supplier development literature most often takes the perspective of a single buyer and rarely investigates whether a supplier is exposed to several supplier development initiatives, driven by different customers, either in parallel or consecutively. One exception is the work of MacDuffie and Helper (1997), who suggest that when developing a supplier, a focal company may benefit from the prior supplier development initiatives of other customers, since these may have improved the supplier's capabilities and thus raised the supplier's capacity to absorb the focal customer's subsequent initiative. Furthermore, they conclude that when undertaking supplier development, there is little need to worry about spillovers of knowledge to competing customers via the shared supplier – since overall improvement of the suppliers' capabilities will improve the self-reliance of the supplier, something which, in turn, benefits the focal customer. However, MacDuffie and Helper (1997) also state that a buyer needs to consider how responsive the supplier can be to the needs of the buyer, in the face of competing demands from multiple customers. As such, the supplier's other customers may pose a challenge to the extent that they compete for the supplier's attention and for the allocation of its capacity to carry out work for different customers. Koufteros et al. (2012) also briefly discuss the undesirable effects by suggesting that "buyers who do not invest in supplier development can "free ride" or "cream off" supplier knowledge acquired from other sources", in particular other customers. In short, scant attention has been paid to the issue of a supplier being involved in supplier development initiatives from multiple customers. However, when the issue is examined, the initiatives of other customers may prove to have positive and/or negative effects on a focal customer.

In the literature on *repeated interactions in buyer-supplier relationships* over time, some attention has been paid to the impact on suppliers from engaging in substantial relationships with several customers. For example, Nobeoka et al. (2002) discuss the importance for a supplier of having several knowledgeable customers which operate within the same industry, since this can lead the supplier to capture benefits from redeploying what has been learnt in one relationship and using it in other relationships. They conclude that the performance of a supplier will be superior when it has a "broad customer scope", consisting of a set of "related customers" with similar or complementary needs or requirements, due

to their operating within the same industry. Similarly, Schilling et al. (2003) state that in cases of related customers, what the supplier learns can be leveraged across its multiple customer relationships. Moreover, von Corswant and Tunälv (2002) emphasise that when a buying firm uses suppliers which also work with customers that are competitors of the buying firm, the benefits for the buying firm from having more knowledgeable and innovative suppliers offset the costs of knowledge spillovers. Based on similar observations, Oh and Rhee (2008) stress the importance of suppliers having a customer proliferation capability, since having several customers enables the supplier to enjoy customer-scope economies and increased learning and, consequently, to improve its performance. While the contributions mentioned so far focus mainly on the benefits of a supplier having multiple customers operating in the same industry, others have stressed the effects of a supplier having customers in different industries. For example, both Hargadon and Sutton (1997) and Mahmood et al. (2011:826) suggest that suppliers with customers in several industries are able to come up with more novel business concepts by taking advantage of their access to knowledge derived from various industries.

In the literature on business networks, capability development is seen as being about coping with the effects of multiple relationships on the development potential of the company (Håkansson and Snehota, 1995). Hence, capabilities develop through connections across relationships. Attention is paid to two types of connections (also coined network effects): deleterious and constructive. Deleterious effects may occur, for example, when scarce resources used in one relationship cannot simultaneously be used in another relationship; when adaptations made in one relationship are detrimental to other relationships; when capacity used in one relationship is prohibited from use in other relationships; and when the identity of one counterpart is repulsive to, and hence incompatible with, other counterparts with whom the company has relations. Constructive effects, on the other hand, may occur, for example, when resources and knowledge used in one relationship can be transferred to or from other relationships; when adaptations made in one relationship are useful and valuable in other relationships; when more of the available capacity is used and scale effects are achieved by combining volumes across relationships; and when the identity of one counterpart is in harmony with, and attractive to, other counterparts with whom one has a relationship. As such, one relationship may have neutral, positive and/or negative effects on another relationship (Ritter, 2000).

Only a small amount of research on connected relationships in business networks, however, has focused on the issue of the deployment and development of capabilities across relationships. One exception is Rosenbröijer (1998) who discusses the company's function as a connector of capabilities. However, more importantly for the present paper, Mota and de Castro (2005) show the development of capabilities deemed important for being a good supplier for one particular customer to be contingent on some of its other customer relationships, and hence on the mix of customers and customer relationships in its portfolio. Similarly, because of the impact that its counterparts have on a company's development and capabilities, Corsaro et al. (2013) advise companies to take a value perspective on their

portfolios of interdependent, dynamic relationships, and, in particular, on their customer portfolio.

To sum up, the capabilities of a supplier evolve as a function of its set of relationships to customers, operating in the same industry and/or in different industries, and as a consequence of if and how the respective customers' deliberate and emergent development and deployment of the supplier's capabilities become connected, positively and/or negatively, over time, at the supplier.

2.4 Buying firms' insight into the network context of suppliers' capability deployment and development

So far, we have established that the relationships a supplier has with the customers in its surrounding network will influence the deployment and development of the supplier's capabilities. From the perspective of a single buyer, however, being aware of the impact a supplier's surrounding network has on the deployment and development of its capabilities may be key to understand the supplier, its actions (Mota and de Castro, 2005), and how to best manage (in) the relationship to the supplier over time. Buying companies with such insights are likely to have better supplier management compared with those which lack such understanding (Choi and Kim, 2008). Choi and Kim (2008) further argue that a better understanding of the network surrounding its key suppliers will allow a buying company to evaluate its current or potential suppliers with more accuracy. Buying companies should therefore develop their "network awareness" capability, or, in other words, the ability to effectively and efficiently scan the external networks of its key suppliers beyond its direct relationships with them. There has recently been an increase in studies examining a company's insight into its surrounding business network, including studies on network horizons and network pictures (Anderson et al., 1994; Ford et al., 2003; Håkansson and Snehota, 1989; Henneberg et al., 2006; Holmen and Pedersen, 2003; Holmen et al., 2003; Storer et al., 2003). However, to our knowledge, no studies have explicitly investigated customers' knowledge of the ways in which the capabilities of suppliers are differentially developed and deployed by other customers in the suppliers' surrounding network. Such knowledge would form an important input for a firm's key supplier management which fundamentally "deals with the question of how to *analyze*, plan, manage and control interactions with key suppliers" (Ivens et al., 2013:137, *italics added*).

On the basis of the theories on capability development, supplier development, capability development in repeated interactions and managing-in-network contexts, the research questions of this paper are:

(1) Whether, and in which ways, the capabilities of a key supplier are differentially deployed and developed by its various customers, whether these operate in the same industry or in other industries?

and

(2) In order to improve its supply management practice, how may a buying firm gain an overview of, and reflect on, the ways in which it, as well as other customers of a key supplier, differentially deploy and develop the capabilities of that supplier?

3. Methodology

The empirical material consists of a single case study (Dubois and Araujo 2004, 2007; Dubois and Gadde, 2002; Eisenhardt, 1989; Ragin, 1992; Yin, 1994) which focuses on the relationship between Norske Skog Skogn (NSS), a large producer of newsprint, and its supplier, ABB, a global engineering company. The case study method is generally regarded as advantageous when the phenomenon studied is complex and difficult to separate from its environment (Yin, 1989), which is certainly the situation for this study. NSS has cooperated with ABB from its establishment onwards, and it was therefore interesting to study if and how NSS has contributed to the development of ABB's capabilities. Furthermore, our intention was to examine if and how other actors are involved in the development of ABB's capabilities. In addition to systematically studying ABB's capability development, our intention was also to examine NSS's knowledge of ABB's development. ABB is a world-wide conglomerate with departments all over the world, so there was a need to make some decisions about which parts of ABB should be studied. The purpose of this paper made it most appropriate to focus on ABB's division for process automation, based in both Trondheim and Oslo in Norway, as this division has been the most involved with the pulp and paper industry. When the development of ABB's capabilities is referred to in this paper, the focus is therefore on the specific capabilities of this department.

In total, sixteen interviews were conducted, nine of them with NSS employees and seven with employees of ABB. They were conducted over a period of two years, from 2006 to 2008. They were all face-to-face interviews, and were conducted using a semi-structured interview guide. Most of the interviews were carried out with two interviewers, in order to capture more of the information given and to allow for a discussion and joint reflections on each interview. Interviews involving only one interviewer were recorded. Every interview was transcribed and then the transcription was submitted to the interviewee for further comments, corrections, and the potential removal of sensitive information. This part of the procedure was also clearly described to each interviewee prior to their interview, and this is believed to have made them more confident about discussing potentially confidential matters. The interviews with different employees of NSS (the Maintenance Manager, Purchasing Manager, Department Manager, and engineers) focused firstly on the relationship between NSS and ABB, and on NSS's involvement in the development of ABB's capabilities. Secondly, the interviews focused on what these NSS employees know about ABB's capability development in general, and more specifically on their knowledge of the influence of other actors. The interviews with employees of ABB (the Department Manager, Service Manager, Project Leader, and Technical Managers) focused firstly on the relationship between ABB and NSS, and on NSS's involvement in the development of ABB's capabilities.

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The second part of the interviews focused on the involvement of other actors in the development of ABB's capabilities. A matrix listing the most important capabilities of ABB and the actors involved in developing them was generated in cooperation with ABB's department manager of process automation in Norway. The department manager filled out the matrix and then discussed it with the researchers, and this matrix and discussion later formed the foundation of our analysis.

In addition to the interviews, tours of production units, brochures, and annual reports formed part of the case study. A workshop was also held at NSS, in which the preliminary results of the study were discussed. The study has followed the procedure of systematic combining (Dubois and Gadde, 2002), in which the empirical material and the theory influence each other over time. The theoretical foundation and the research question have therefore been shaped, reformulated, and refined throughout the collection of the empirical data.

4. Empirical basis

4.1 Background: NSS and ABB

NSS was founded in 1962, and is one out of nineteen paper mills owned by the Norske Skog Group, a leading producer of newsprint and magazine paper. NSS currently has three paper machines, with a production capacity of 600,000 tons per year. Serving customers world-wide, the mill has its own port facilities, and operates a twice-a-weekly regular line to the UK and continental Europe. To produce high quality newsprint, NSS is dependent on continuous and systematic improvements in the paper machines. These improvements are partly implemented internally by the organisation's own engineers. However, in addition to high-level internal expertise, NSS is dependent on cooperation with specialised suppliers. Assisted by those suppliers, NSS is able to make the paper machines produce paper at the desired speeds and with the right quality, as well as to reduce unwanted breaks in production. ABB is a global provider of power and automation technologies, and, in its role as supplier, has contributed significantly to the success of NSS. The ABB group operates in 100 countries and employs around 110 000 people. ABB's business comprises five divisions, which are in turn organized in relation to the customers and the industries they serve. This paper focuses on the division "Process Automation", and the business unit that focuses on process automation in Norway in particular, hereafter referred to as ABB. ABB and NSS have a long history of working together and have cooperated on both small upgrading projects and large rebuilding projects. The large rebuilding projects involved upgrading and renewing the automation system of the three paper machines at NSS (PM1, PM2, and PM3).

ABB has two primary business areas: oil and gas, and land-based industry. In Norway, its land-based industry is mainly focused around the two divisions: pulp and paper, and metals. ABB offers a wide range of products and solutions; however, this article will focus on the products and systems that ABB offers to NSS, one of its largest customers in the pulp and paper industry. The main products and solutions that ABB offers to NSS are control products and systems intended to meet the automation needs of an entire paper mill. These comprise the following subsystems: the Open Control System, paper machine drive solutions, and the Quality Control System (QCS). The Open Control System is a manufacturing system which controls both the flow of pulp and the variable speed drives and motor control centres throughout the mill. Open Control Systems are not specific to the pulp and paper industry but are offered to a number of customers in different industries, such as oil platforms, dairies, saw mills, and melt shops. The term 'paper machine drive solutions' refers to the smaller motors involved in the papermaking process, while QCS provides measurement of all the sheet parameters in order to maintain paper quality.

4.2 Development of ABB's capabilities

A significant proportion of ABB's capabilities are developed internally in the large corporation. Such activities can be organized (e.g. regular meetings among employees from different units working with pulp and paper all over the world), or occur on a more ad hoc basis (e.g. transfer of knowledge from sister units working mainly with other industries). To make sure that it offers its customers updated knowledge, ABB has a sister unit in Ireland that focuses on developing solutions for the pulp and paper industry, which is consulted frequently during projects with customers. Technical solutions that are produced in the different countries are gathered in this business unit so that this can work as a "knowledge bank" for future pulp and paper projects.

In addition to the internal development of its capabilities, ABB is significantly developing them through its relationships with other companies. ABB's customer relationships have been found to have the strongest impact on its development. Through its customer relationships, ABB develops capabilities that are important for single relationships as well as for a range of customer relationships. In this way, ABB is able to deal with a variety of customer relationships based on the capabilities it develops in cooperation with those customers. In the following sections, we first describe NSS's development and deployment of ABB's capabilities, before presenting the involvement of other customers in the development and use of ABB's capabilities.

4.3 NSS's involvement in the development of ABB's capabilities

NSS is highly dependent on many of ABB's capabilities. The technological capabilities seem to be most important in this relationship. One reason for this is that such capabilities enable technological problems to be identified and dealt with at an early stage; they may also

create opportunities for a more open forum for the exchange of technological expertise between the two firms. ABB is very important to NSS, and many capabilities are developed in the interaction between them. NSS contributes in various ways to the building of ABB's capabilities. The most obvious way is through involving ABB early in innovation projects, which range from small upgrading projects to large rebuilding projects. Examples of large projects conducted in cooperation between NSS and ABB are the rebuilding of the three paper machines, PM1, PM2 and PM3, carried out in 1999, 2003 and 1995 respectively. All three projects involved an upgrading or replacement of the open control system, the paper machine drive solutions and the quality control system. As the two companies have had a relationship for several years and have conducted many projects in cooperation, much of the knowledge developed in previous projects could also be utilised here.

These three large projects shared many similarities; the project to upgrade PM2 in 2003 was rather different, however. In this project NSS wished to integrate a number of control systems in order to provide unique single-point data access. NSS was the first paper mill in Norway to install this new technology, which had been developed by ABB. It was the first time that ABB's department in Norway had installed this solution at a paper mill, and close collaboration with NSS was therefore required to match this new technology to the functions of a paper mill. According to ABB, their capabilities in open control systems are highly influenced by the number of projects they are involved in and the frequency of those projects. ABB undertake large projects with NSS about every three years, and these projects therefore contribute to some extent to the development of ABB's capabilities in open control systems.

ABB's service programmes are developed in order to improve the effectiveness of maintenance by optimising management practices in order to improve mill productivity. The development of ABB's servicing capabilities is dependent on the extent to which the customer wishes to undertake the servicing itself and the amount they want ABB to do. NSS has decided to leave most of the servicing of open control systems, quality control systems and drive solutions to ABB. ABB is extremely familiar with the equipment at NSS, and can often assist NSS by telephone. ABB also has the ability to connect remotely to the NSS plant to carry out the servicing. NSS influences ABB's service capabilities to some extent by demanding a prompt and thorough service when this is required.

NSS is a demanding customer of ABB, an example of which is NSS's repeated request for ABB's best engineers to be involved in its projects, as well as necessary resources being locally available. To ensure that key people in ABB have the necessary knowledge of the current processes at the paper mill, NSS often hires ABB engineers rather than external consultants. These engineers can work at NSS for periods of up to two or three months, making specifications for control systems. Gaining an intimate knowledge of the paper mill enables ABB to lower the engineering costs of its NSS projects, and consequently to offer a more competitive price.

The way in which NSS conducts its projects, together with the close personal relationships between employees in NSS and ABB, influences the development of ABB's capabilities in cooperative project management. Some projects at NSS require several suppliers to be involved in a so-called "Task Force Project". In addition to ABB, NSS often involves Metso, a paper-machine supplier, in the same projects in order to facilitate learning among the suppliers. There must be communication between the equipment installed by ABB and Metso and therefore some coordination between the two suppliers is necessary. During the installation of new equipment, all the three actors (NSS, ABB and Metso) are usually present doing a "Site Acceptance Test"; they also coordinate their work, in order to be as efficient as possible while the machines are shut down.

From the point of view of the department manager at ABB, NSS does not greatly contribute to the development of ABB's QCS capabilities, even though it makes extensive use of such capabilities. NSS, on the other hand, believes that it has considerable influence over ABB's QCS capabilities. This view is also shared by other ABB employees who work with QCS. In the three large projects involving ABB, as well as in a number of smaller projects, NSS have had to address very specific quality-control-related problems, to which ABB have provided solutions. NSS also participates in a QCS forum involving customers of ABB in Norway, Sweden and Denmark who use QCS. The forum was initiated twenty years ago, with NSS as one of the founding members. Around thirty paper mills, as well as approximately five employees from ABB, participate in this annual forum. Many mills experience similar problems, and this forum is an arena for discussions of problems and issues which arise at the plants. The participants share their experiences of solving technical challenges, enabling ABB and the paper mills to prevent any potential problems. Before the forum, each participating paper mill suggests themes for discussion. The forum therefore represents a unique opportunity for the paper mills to influence the key technical areas of ABB. The meetings are usually located near a paper mill owned by one of the participating buying firms, so that guided tours can be arranged. The companies are not concerned about sharing technical knowledge with their competitors because the competition consists of so many different parameters and so is not solely reliant on technical solutions.

4.4 Other customers' involvement in the development of ABB's capabilities

Some of ABB's capabilities have been specifically developed to serve the pulp and paper industry. These include capabilities related to paper-machine drive solutions, web-imaging systems, collaborative production management and quality control systems, which are not applicable to customers in other industries. Some of ABB's other capabilities have not been developed to serve a specific industry but can be useful in relationships with many customers. These include capabilities in open control systems, service and early involvement in innovation, among others. The most important external influence in developing ABB's capabilities is ABB's customers.

NSS is ABB's largest customer in the pulp and paper industry, and the customer in that industry with the greatest influence over ABB's capability development. The company "OneSouth" is ABB's second largest pulp and paper customer, and also has some influence in developing ABB's capabilities. The most influential customers are, however, those from other industries, especially the oil and gas industry. Some examples of capabilities which these customers are involved in developing are listed below:

- Service: unlike its pulp and paper customers, the customers "Metal" and "Oil and Gas" have long-term service agreements with ABB, where they strongly influence the service capabilities which ABB need to develop.
- Frame agreements: companies with frame agreements influence ABB's capabilities of carrying out such agreements, as well as ABB's competence in managing customers for long-term cooperation. Companies in the pulp- and paper industry influence ABB to some extent, but the greatest influence comes from other customers, especially the companies "Metal", "Energy" and "Oil and Gas".
- Early involvement in innovation: projects in the oil and gas industry are usually specified to a lesser extent in their early phases than projects in the pulp and paper industry. By involving ABB early in innovation projects, such customers are helping ABB to become a highly important participant in the search for applicable solutions. Customers within the oil and gas industry have much greater resources than customers in the pulp and paper industry, which allows for greater experimentation in such projects. The customer "Metal" have here been particularly important in developing ABB's innovation capabilities in the early phases of projects.
- Open Control Systems: Customer "Metal" was closely involved in the early phases of the development of ABB's capabilities in a new open control system. Customer "Oil and Gas" is currently contributing even further to this development, mainly by purchasing high volumes of the system from ABB.

There is, of course, a great deal of financial difference between projects in the pulp and paper industry and those in the oil and gas industry. According to the department manager at ABB, this also has an effect on ABB's capability development: "the customer that has the largest orders gets the greatest focus. These customers will also influence the development of ABB's capabilities to a greater extent than customers with small orders". Furthermore, the continuity of a supplier relationship is important: "if a customer has previously said 'No' to ABB, and chosen another supplier, ABB has to consider whether it will spend resources on developing capabilities related to this customer in the future". ABB is therefore very cautious when selecting the companies they want to cooperate with, as they want to develop capabilities related to customers with whom they will have an ongoing relationship.

4.5 NSS's knowledge of ABB's capability development

In some areas, NSS seems to be well aware of ABB's capability development. It seems to have an especially good overview of the development of ABB's QCS capabilities. This is most likely to be the result of the QCS forum in which NSS participates. Even though its Norwegian customers do not appear to contribute much to the development of ABB's QCS capabilities, NSS seems to have a good insight into the ways in which other Scandinavian customers influence those capabilities. This knowledge has been beneficial to NSS on several occasions.

Another area, in which NSS has benefited from having insight into how ABB's capabilities are developed through its customer relationships, is related to open control systems. Through one of the visits to another paper mill, NSS was introduced to a technology, called "light-touch", which had been developed in cooperation between ABB and its customer "OneSouth". NSS became very interested in this technology and initiated a project with ABB which resulted in this "light-touch" technology being installed at NSS. As a result of this new technology, NSS reduced the pressure on the paper and consequently had fewer breakages and interruptions to productions.

NSS knows that it is a major customer of ABB within the land-based industry. However, NSS is also aware that it is quite small compared to ABB's customers in the oil and gas industry. NSS knows that those oil and gas customers have greater resources for experimentation than customers in the more stringent pulp and paper industry. Despite this awareness, the company does not seem to know the extent of those customers' involvement in the development of ABB's capabilities. The oil and gas customers are very focused on the acquisition of as much knowledge as possible from their suppliers and are willing to spend a large amount on the development of those suppliers' capabilities. As a result, ABB is more inclined to spend more time and resources on these customers.

ABB believes that NSS has limited knowledge of its capability development. According to ABB, NSS does not exploit ABB's capabilities as much as it could. In particular, ABB believes that greater knowledge of the ways in which ABB develops its capabilities with NSS's sister units ("NSAlpha" and "NSBeta") would have been beneficial for NSS. According to ABB, it would be quite easy to transfer knowledge from one project to another, and to make use of the same capabilities in several relationships, since the units concerned are associated companies. For example, NSS could have benefited from some of ABB's development projects with NSS's sister units, and could also perhaps have participated in some of them, in order to contribute to their technological development. In ABB's experience, little cooperation takes place between NSS and its sister units, which focus on different areas and do not exploit each other's competences, something which might be due to excessive competition between them.

In ABB's view, it is the outmost importance to have a set of customers who contribute to the development of its capabilities. Capabilities that can be re-deployed to other customers are particularly important, and enable ABB to collaborate in different relationships in which technological capabilities are needed. When one industry is experiencing a difficult financial situation, it is especially important for ABB to have

customers in other industries that are willing to invest time and resources in developing its capabilities. Because of the current difficult financial situation in the pulp and paper industry, ABB is dependent on its customers in other industries. ABB's customers in the pulp and paper industry may suffer in the long term from their lack of involvement in developing its capabilities. ABB see that its capabilities are increasingly being developed by customers in other industries, because they are more predictable in the long-term, and therefore will receive a greater proportion of ABB's technological attention.

5. Analysis and Discussion

5.1 Developing a tool with which to scrutinise the deployment and development of a supplier's capabilities

In order to establish an overview of ABB's capabilities and the different ways in which they are deployed and developed by its most important customers, we devised the matrix shown in Figure 1. The development of the matrix is inspired by work within the field of quality management and, more particularly, by the method known as quality function deployment. The *capabilities* were identified by the manager of ABB's Process Automation department and are listed in the left-hand column of the matrix. They comprise operational as well as managerial capabilities. Furthermore, this manager identified the most important *customers*, which are listed in the top row. Of these pulp and paper customers, the manager chose to distinguish between customers at the level of individual mills, while also considering the corporation they each belong to. As a result, it seemed relevant to our study to discern between some customers at the unit level, on the basis that different units within the same corporate customers may deploy and develop the capabilities of a shared supplier in different ways. For each combination of customer and capability, the inner cells of the matrix contain two numbers (scores). The first score (to the left of the forward slash) refers to the extent to which the customer (unit) *develops* the capability, implying that the capability has originated from, or gone through major planned changes in relation to, that particular customer (unit). The second score (to the right of the forward slash) refers to the extent to which the customer (unit) *deploys* the capability, indicating the extent to which the capability is used in terms of volume and capacity, as well as the minor adaptations of the capability that have been made during its deployment in order to make it fit the needs of that customer (unit). The scale used ranged from 1 (to a small extent) to 6 (to a large extent). The manager filled in the matrix, thus indicating the extent to which each customer contributes to the development and deployment of the supplier's capabilities. In the matrix, not applicable (NA) implies that the capability is not (currently) considered relevant to the customer in question. A question mark (?) indicates that the manager was unsure about the extent to which that particular customer develops and deploys the capability in question.

Furthermore, based on the capability development and deployment scores for the individual customers and capabilities, we have calculated a number of indices, which appear in the nine lower *rows*. These concern the total impact of single customer (units), of single corporations and of single industries, and allow for comparisons between units, corporations and industries.

In the following sections, we will discuss the patterns revealed by the matrix. Firstly, we will discuss the *rows* of the matrix, thus addressing the impact each of the customer units has on the individual capabilities of the focal supplier unit. Secondly, we will discuss the *columns* of the matrix, addressing the differences between the overall impact of: 1) the focal customer unit compared to each of the other customer units; 2) the corporation to which the focal customer unit and its sister customer units belong compared to the corporations to which the non-sister customer units belong; and 3) the industry setting in which the focal customer unit operates compared to the customer units operating in other industry settings.

When discussing each capability (*row*), we start by discussing the customer(s) that have the most influence on the deployment and development of the capability, and then discuss the other customers in decreasing order of their influence. While it is often the direct customers of the key supplier that have the greatest influence on its capabilities, this is instead sometimes true of customers of sister units in the corporation to which the key supplier belongs, due to internal knowledge transfer between the sister units. Although such sister units and customers of the sister units do not appear in the top row of the matrix they are mentioned and discussed in the text accompanying the matrix.

------ Insert figure 1 around here------

5.2 Influence of customer units on ten different capabilities

1) *Paper machine drive solutions*

- Customers within the industry but operating in other countries are the main sources of the supplier's capability development and deployment
- The focal customer unit is the only national customer both developing and using the capability
- Sister unit customers mainly deploy the capability
- Non-sister unit customers mainly deploy the capability

Since the development of the capability is mainly driven by units of the supplier firm in other countries, it is important for the focal customer unit that the focal supplier unit maintains good relationships with relevant sister units in other countries. However, since it is

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customers in other countries that mainly drive the development of the capability in the supplier's units in those other countries, the focal customer unit may not have much influence on that capability. It is mainly a matter of using what the supplier firm is developing for customers operating within the same industry setting but in other countries; in this way, the focal customer unit may be able to benefit from the supplier capability development efforts of these other customers.

The extent to which the focal customer firm experiences competition in the global arena, based on this type of capability, may pose a threat to the focal customer unit, if the direction in which the capability is developing is not a good fit for the focal customer unit and/or if the focal customer unit does not get timely access to the capability, and thus suffers a late-mover disadvantage.

The focal customer unit may also consider the characteristics of the relationships between the focal customer unit and the customers of the supplier's sister units, in particular with regard to the presence of competitive and/or cooperative elements, together with the conditions under which the focal supplier unit and its sister units are allowed to use facets of the capability, which have been developed in the relationships with other customers, in the relationship to the focal customer firm. Depending on the outcome of such considerations, it may be possible to consider whether the focal customer firm could benefit from direct interaction, mediated by the focal supplier unit, between the focal customer unit and the sister units of the focal supplier unit, and also with some of the latter's customers.

In comparison with its sister unit customers, the focal customer unit is more influential in both the development and the deployment of the supplier unit's capability. The focal customer unit may, therefore, (re)consider its role within the corporation and the ways in which it could influence, interact with and transfer to sister unit customers of the supplier with regard to this capability.

In relation to non-sister customer units operating in the national context, the focal customer unit may consider the relative advantages and disadvantages gained from being the customer unit that develops and most heavily deploys a capability of a focal supplier unit, while the others only deploy the capability without contributing to its development. As a consequence of this, the focal customer unit may benefit from reflecting on several issues. Firstly, does the focal customer unit obtain a better fit with the supplier's capability, translating into more effectiveness, efficiency and/or innovation, in comparison to the non-sister units which operate in the focal customer unit's home country? Secondly, does the deployment by the other customer units of the supplier unit's capability enable the focal customer unit to beneficially share the costs of maintaining the supplier's capability with other customer units? Finally, what characterises the relationships between the focal customer unit and the non-sister units in question? This question may in particular be considered with regard to the presence of competitive and/or cooperative elements, and the conditions under which the supplier unit is allowed to make use of facets of the capability, which have developed in cooperation with the focal customer firm, in the non-sister customer units.

2) Web imaging systems

- Customers operating in the same industry setting but in other countries are the major sources of the supplier's capability development
- One other customer unit operating in the same industry and national setting takes the lead in developing and using the supplier unit's capability
- The focal customer unit is less influential when it comes to developing the capability of the supplier unit, but is a heavy user of the capability
- The focal customer unit's sister units exhibit a pattern of development and deployment of the capability similar to that of the focal customer unit
- One non-sister customer unit exhibits a pattern of development and deployment of the capability which is fairly similar to those of the focal customer unit and its sister units

The development of the focal supplier unit's capability is to a large extent driven by the supplier's units based in other countries and by their customers. The considerations discussed in relation to *Paper machine drive solutions* therefore apply equally here, and will not be repeated in this section.

When considering the influential non-sister customer unit which operates in the same industry and the same national context, the focal customer unit may reflect on the advantages and disadvantages gained from its position as a customer unit that mainly deploys the capability of the supplier unit, but only minimally develops it. Firstly, the focal customer unit may consider whether it is able to obtain and sustain a sufficiently good fit with the supplier's capability, given that another non-sister customer unit is playing the lead role in the development of that capability. Secondly, the focal customer unit may consider whether the development and deployment of the supplier unit's capability driven by the non-sister customer unit, will enable the focal customer unit to avoid and/or share the costs of developing and maintaining the supplier's capability. Finally, the focal customer unit may also consider the characteristics of its relationships with the leading non-sister unit in question, in particular with regard to the presence of competitive and/or cooperative elements, and the conditions under which the supplier unit is allowed by the influential non-sister customer unit to make available the facets of the capability, which have been developed in cooperation with the latter, to the focal customer unit. Depending on the outcome of such reflections, it may be possible to consider whether the focal customer firm could potentially benefit from direct interaction between the focal customer unit and the influential non-sister customer unit mediated by the focal supplier unit.

Furthermore, the focal customer firm may reflect on whether its pattern of heavy deployment but little development of the supplier unit's capability presents disadvantages to the focal customer unit in terms of value or costs which result from discounts or other concessions granted to those customer units which are more heavily involved in developing the supplier firm and the capabilities of its units.

The focal customer unit and all of its national sister units heavily deploy the supplier unit's capability but do not do much to develop it. The focal customer unit may therefore consider whether benefits can be gained from cooperation between the sister units within

the focal customer corporation. It may also consider which role the focal customer unit could play inside the corporation with regard to this capability.

In relation to non-sister customer units which operate within the same industry and national setting, which, when compared to the focal customer unit, are similarly or less influential in the development and/or deployment of the supplier unit's capability, the focal customer unit may consider the advantages and disadvantages gained specifically from the sharing of costs related to developing and using the supplier unit's capability.

3) Collaborative production management

- Customers operating in the same industry setting but in other countries are the major sources of the supplier's capability development
- The focal customer unit and its sister units all heavily deploy the supplier unit's capability but only play a minor role in developing the capability
- One other customer has also influenced the development of the supplier unit's capability but only deploys it to a very small extent
- Most of the other customers which operate in the same industry and national setting neither deploy the supplier unit's capability nor influence its development

The development of the focal supplier unit's capability is to a large extent driven by the supplier's units in other countries and by their customers. As a result, the considerations discussed in relation to *Paper machine drive solutions* and *Web imaging systems* apply equally in this context, and will not be repeated here.

The focal customer unit and all of its national sister units heavily deploy the supplier unit's capability but do not do much to develop it. Therefore, the considerations discussed in relation to *Web imaging systems* apply equally in this context, and will not be repeated here.

One non-sister unit operating in the same industry and national context as the focal customer unit has previously exerted some influence on the development of the supplier unit's capability. However, this customer has stopped using the capability (whether temporarily or permanently, remains to be seen). Therefore, the focal customer unit and its sister units need to consider the advantages and disadvantages of being the only current users of the focal supplier unit's capability in their particular national setting; especially since their pooled demand for the capability is imperative for its continued supply by the focal supplier unit. Furthermore, the focal customer unit (and its sister units) may occasionally inquire into whether the focal supplier unit is making efforts at getting other customer units interested in using the capability. The focal customer (and its sister units) may encourage the focal supplier unit to make such efforts, and may even assist it to do so.

4) *Quality Control System*

- Development is entirely driven by customers operating in the same industry in other countries, and by units of the supplier based in these countries
- The focal customer unit and one other non-sister customer firm extensively deploy the capability of the focal supplier unit

The development of the focal supplier unit's capability is entirely driven by the supplier's units in other countries and by customers of theirs which operate in the same industry context as the focal customer unit. Therefore, most of the considerations discussed in relation to *Paper machine drive solution*, *Web imaging systems* and *Collaborative production management* apply equally in this context, and will not be repeated here. However, two points should be made. Firstly, the focal customer unit already engages in direct interaction with the sister units of the focal supplier unit and so the direct interaction with those sister units affects the extent to which the capability is developed at the focal supplier unit. Secondly, the focal customer unit engages annually in direct interaction with customers of the focal supplier unit and of its sister units in other countries, mediated by the focal supplier. It seems that the interaction related to this capability between the focal customer unit and the customers of both the focal supplier unit and its sister units is characterised mainly by cooperation, although elements of competition are present in other dimensions. Furthermore, the focal customer unit and the other customers of the focal supplier unit and of its sister units also engage in direct discussions and attempt to directly pool their requirements concerning the future development of facets of the supplier units' capability.

Whereas the focal customer firm heavily deploys the capability of the supplier unit, without contributing much to the development of the capability, none of its sister units develop or deploy the capability. The focal customer unit may, therefore, consider the possible benefits and drawbacks of interesting its sister units, which are also customers of the focal supplier unit, in deploying (and/or developing) the capability or, alternatively, putting it on the agenda as an issue to discuss with and benchmark among the sister units.

There is only one other user of the supplier unit's capability – a non-sister customer unit which operates in the same industry and national setting. As described above, the focal customer unit already engages in some interaction with this non-sister customer unit. However, this interaction mainly relates to ways of deploying the capability of the focal supplier unit (and of the sister units) as well as the directions in which the capability should be developed. The focal customer firm may, however, also benefit from reflecting on the fact that these two units are the only ones bearing the costs of maintaining the supplier's capability. It may, therefore, be particularly important for the focal customer firm to be alert to possible changes in the extent to which the focal supplier unit's capability is deployed by the non-sister customer unit. Furthermore, the focal customer unit may occasionally inquire into whether the focal supplier unit is attempting to interest other customer units in using the capability, and may encourage the focal supplier unit to do so, possibly even assisting it in this.

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5) Open control systems

> - Customers operating in other industries, but based in the same country as the focal customer unit, are the main contributors to the development and deployment of the focal supplier unit's capability
> - The focal customer unit takes a leading role in developing and deploying the capability of the focal supplier unit within the industry context in which the focal customer unit is operating
> - The focal customer unit's sister units neither develop nor deploy the capability of the supplier unit
> - A few non-sister customer units operating in the same industry context as the focal customer unit also play a role in developing and/or deploying the capability of the focal supplier unit

The development of the focal supplier unit's capability is mainly driven by customers and units which operate in other industry contexts but within the same national context as the focal customer unit. This implies that the customer unit may not be able to strongly influence the focal supplier unit's capability development. Thereby, it is mainly a matter of creating value by deploying what the focal supplier unit is developing for other customers which operate in other industrial contexts but within the same national context, and attempting in this way to transfer and benefit from the supplier capability development activities of these other customers of the focal supplier unit. In cases where these other customers of the supplier have requirements that challenge the supplier unit and are relevant to the focal customer unit, the latter may potentially be among the first units to benefit from transferring the supplier's capability excellence, which has been developed in cooperation with demanding customers in other industry context, to its own particular industry context. It is therefore important for the focal customer unit that the focal supplier unit maintains good relations with such demanding customers in these other industry settings. It may even be possible to consider whether the focal customer firm could potentially benefit from direct interaction between the focal customer unit and these other customers mediated by the focal supplier unit. In any case, since it is mainly customers operating in other industry settings who are responsible for the development of the supplier's capability, the focal customer unit may scrutinise whether the capability and the direction(s) in which it develops remain useful and thus valuable for the focal customer unit, in its own industrial context.

Considering the sister units, the focal customer unit is the only one involved in developing as well as using the supplier's capability. The focal customer firm may, therefore, consider the role it plays within the corporation and whether it could be beneficial to involve, influence and interact with sister unit customers of the supplier with regard to the supplier's capability. If this is the case, it should also consider the ways in which the focal customer unit could develop a role within the corporation to the benefit of the unit itself as well as to that of the sister customer units, in terms of innovation and/or costs.

In relation to non-sister customer units operating within the same industry context and the same national context, one non-sister customer unit exhibits a pattern of development and deployment of the focal supplier unit's capability which bears a close resemblance to that of the focal customer unit. A few other customer units of the focal supplier unit also develop and/or deploy the capability, although less intensively. However, one other non-sister customer unit neither deploys nor develops the capability, thus displaying a pattern

similar to that of the focal customer unit's sister units. The focal customer unit may consider the relative advantages and disadvantages of being one of two customer units that more intensively develop and deploy the focal supplier unit's capability within a wider but still small set of customer units which also develop and deploy it, but to a lesser extent. Hence, the focal customer unit may consider how the capability development of the focal supplier unit is influenced by the mix of demands placed on that supplier by several non-sister customer units. Furthermore, the focal customer unit may reflect on whether its more intensive involvement in developing and deploying the supplier unit's capability enables it to obtain a better fit with the supplier's capability, which translates into greater effectiveness, efficiency and/or innovation for the focal customer unit. In addition, the focal customer unit may consider whether the use of the supplier unit's capability made by the other non-sister customer units enables it to share the costs of maintaining the supplier's capability with those other customer units in a way that benefits (or at least is not detrimental to) the focal customer unit. Finally, the focal customer unit may also consider the characteristics of those relationships between the focal customer unit and the non-sister customer unit which exhibit a pattern of deployment and development similar to that of the focal customer unit, in addition to the characteristics of its relationships with the other non-sister units. In both cases, the focal customer unit may benefit from reflecting on the presence of competitive and/or cooperative elements, and whether benefits could be gained from (re)considering how the focal customer unit interacts with these non-sister customer units in relation to both the particular supplier capability and other dimensions of the relationships.

6) Service and maintenance

- Customers operating in other industries, but based in the same country as the focal customer unit, are the main contributors to the development and deployment of the focal supplier unit's capability
- Most customer units operating in the same industry and national setting develop and deploy the supplier's capability. The focal customer unit and one non-sister customer units, however, influence the development slightly more than the other customer units

The development of the focal supplier unit's capability is to a large extent driven by customers operating in other industries, but which are based in the same country as the focal customer unit. Therefore, the considerations discussed in relation to *Open Control System* apply equally in this context, and will not be repeated here.

In the context of sister unit customers, the focal customer unit is more heavily involved in developing as well as deploying the supplier's capability. This pattern is similar to the one discussed in relation to *Open Control Systems*, which implies that the focal customer firm might benefit from (re)considering the role it plays within the corporation in relation to this supplier capability. For details of the discussion, the reader is referred to the section on Open Control Systems.

In relation to non-sister customer units operating within the same industry context and the same national context, one non-sister customer unit exhibits a pattern of development and deployment of the focal supplier unit's capability which shows a close resemblance to

that played by the focal customer unit. All the remaining customers of the focal supplier unit display a pattern similar to that of the focal customer unit's sister units – less involved in developing the capability, and also less involved in deploying it. The focal customer unit may consider the relative advantages and disadvantages obtained from being one of two customer units that more intensively develop and deploy the focal supplier unit's capability within a wider but still small set of customer units that also develop and deploy the capability, but to a lesser extent. Hence, the focal customer unit may consider how the capability development of the focal supplier unit is influenced by the mix of demands placed on the supplier by several sister, as well as non-sister, customer units. Furthermore, the focal customer unit may reflect on whether its more intensive involvement in developing and deploying the capability of the supplier unit enables it to obtain a better fit with that capability which translates into greater effectiveness, efficiency and/or innovation for the focal customer unit. In addition, the focal customer unit may consider whether the uses which the other non-sister customer units make of the supplier unit's capability enable it to share the costs of maintaining that capability with these other customer units in such a way that is beneficial to (or at least not detrimental to) the focal customer unit. Finally, the focal customer unit may also consider the characteristics of the relationships between the focal customer unit and the non-sister customer unit which exhibit a pattern of deployment and development quite similar to that of the focal customer unit, as well as the characteristics of its relationships to the other non-sister units. In both cases, the focal customer unit may benefit from reflecting on the presence of competitive and/or cooperative elements, and whether benefits could be gained by (re)considering the ways in which the focal customer unit interacts with those non-sister customer units in relation to the particular supplier capability as well as to other dimensions of the relationships.

7) *Frame agreement and long term cooperation*

* Customers operating in other industries but within the same national setting account for the majority of the development and deployment of the supplier's capability
* All customer units operating in the industry and national setting develop and deploy the supplier's capability, but not to a great extent

The development of the focal supplier unit's capability is chiefly driven by customers which operate in other industries, but are based in the same country as the focal customer unit. Therefore, the considerations discussed in relation to *Open Control System* and *Service and maintenance* apply equally in this context, and will not be repeated here.

The focal customer unit, and all other sister and non-sister customer units, operating in the same industry and national setting, exhibit identical patterns with regard to this supplier capability. Based on its cooperation and interaction with these customer units, the experience of the focal supplier unit is that it continuously develops the capability in a step-by-step manner, thus improving its cooperative interaction with the customer units, and responding to small changes in the sourcing and purchasing practices of the customer units, for example by changing the ways in which the customer units handle tendering processes.

However, interaction with customers in other industries has led the supplier to experience extensive, leap-wise capability development, as it has gained insight into a variety of innovative methods which a customer can use when working with its suppliers. These include working with cooperative dual sourcing settings; developing innovative, long-term frame agreements so that the supplier can plan for future years; and enabling coordination and cooperation between different units within the wider corporation which enables coordinated experiments and structured experience transfer to take place between the units in relation to suppliers and their capabilities. When viewed in this light, the contribution made by the focal, sister and non-sister units (operating in the same industry and national setting as the focal customer unit) to the development of the supplier unit's capability appears marginal, and their contribution to deployment as insignificant. The focal customer unit may benefit from reflecting on its competitive multiple sourcing policy and its approach to managing supplier relationships, including the extent to which the continuity of the relationship results from efforts to match plans *ex ante*, or primarily emerge from ad hoc involvement of the supplier over time. In relation to sister units, the focal customer unit may consider the potential advantages and disadvantages, as well as the feasibility, of developing and deploying the focal supplier unit's capability in a different way from that in which the sister units develop and deploy the supplier's capability. Alternatively, the focal customer unit may consider whether it could encourage a corporation-wide change in the ways in which all the sister customer units engage with the supplier's capability. In relation to non-sister units operating in the same industry and national context, the focal customer unit may consider whether a change of sourcing and supplier relationship management policy and practice might give it competitive advantages over and above those achieved by the non-sister units. For example, the supplier unit could potentially give more priority to the focal customer if this customer opted for a supplier capability development and deployment profile which is closer to those of customer units operating in other industries.

8) Early involvement in innovation

- Customers operating in another industry but in the same national setting are the main sources of the supplier's capability development and deployment
- The focal customer firm and one non-sister customer firm take the lead in the development and deployment of capability within the industry and national context
- Sister units also influence the development of the supplier's capability but to a lesser extent

The development of the focal supplier unit's capability is chiefly driven by customers operating in other industries which are based in the same country as the focal customer unit. Therefore, the considerations discussed in relation to *Open Control System*, *Service and maintenance* and *Frame agreement and long term cooperation* apply equally in this context, and will not be repeated here.

The focal customer unit and one other non-sister customer unit operating in the same industry and national setting exhibit identical patterns with regard to this supplier capability, developing it slightly more than its two sister customer units that are marginally involved in

developing the supplier unit's capability. No other non-sister customer units within the industry and national setting contribute to the development and deployment of the supplier unit's capability. This patters bears a strong resemblance to the pattern identified for the *Frame agreement and long term cooperation* capability, and the discussion will therefore not be repeated here. However, there are some differences.

Firstly, the focal customer unit and one non-sister unit have a greater effect on the development of the capability of the supplier unit to involve itself in the early stages of innovation processes, compared to customers in other industries. Hence, the experience of the supplier unit is that it is involved in the early stages of innovation processes at the customer unit(s) and, furthermore, that it learns from this experience and so develops its capability in an ad hoc manner. However, the frequency of processes with early involvement is very low, and the accumulated experience not perceived as particularly additive. In addition, only a few facets of the supplier unit's capability are utilised. As a result, the supplier unit experiences this deployment of the capability as insignificant. The focal customer unit may benefit from considering its approach to early supplier involvement in innovation processes.

In relation to sister units, the focal customer unit may benefit from considering the ways in which it develops and deploys the supplier unit's capability, alongside its sister customer units. While the sister customer units contribute less to the development of the supplier capability than the focal customer unit, the corporation to which the sister and focal unit belong appears to be more involved in developing the supplier unit's capability than the other corporations and their respective sets of non-sister units.

Benefits could potentially arise from systematic efforts at transferring experiences with the capability across the sister units and/or from coordinated change in the patterns of supplier capability development and deployment across units within the corporation.

In relation to non-sister customer units which operate within the same industry context and national context, one non-sister customer unit exhibits a pattern of development and deployment of the focal supplier unit's capability identical to that played by the focal customer unit. No other customer units develop and/or deploy this supplier capability. The focal customer unit may consider the relative advantages and disadvantages gained from being one of two customer units that more intensively develop but more insignificantly deploy the focal supplier unit's capability within a set of customer units where the sister units do not develop the supplier's capability as much. Furthermore, the focal customer unit may also consider the characteristics of the relationships between the focal customer unit and the non-sister customer unit which exhibit a pattern of deployment and development similar to that of the focal customer unit. If the focal customer unit considers changing its approach to early supplier involvement in innovation, and moving towards more development but, in particular, greater deployment of the supplier unit's capability, the focal customer unit may benefit from interacting with this non-sister customer unit in relation to this supplier capability.

9) Cooperative project management

- All customer units which operate in the industry and national context are involved to some extent in developing the supplier unit's capability, but do not deploy it very much
- Customers operating in other industries but within the same national context exhibit a similar pattern of development and non-deployment of the supplier's capability

The development of the focal supplier unit's capability is driven equally by each of its customers. For this capability, no differences can be detected between units within corporations or between units across corporations, regardless of the industry setting in which the customers operate. However, none of the customer units deploy the capability extensively.

By involving the focal supplier unit in various forms of project which involve interaction and cooperation between the customer and the focal supplier, as well as between the focal supplier and complementary suppliers of the customer, the experience of the focal supplier unit is that its cooperative project management capability is continuously developed in a step-by-step manner. It thus improves its ability to interact with the respective customer units and their complementary suppliers in a variety of cooperative ways. However, none of the customers and customer units extensively deploy the attained capability of the focal supplier unit. In most projects, the customer (unit) designs and develops its own project management format and, furthermore, takes the lead in managing collaboration within the project, dividing tasks among the suppliers involved and specifying how they should work. As a result, the experience of the focal supplier unit is primarily that it is seldom given the opportunity to exercise its capability, neither being given the opportunity to (heavily influence the) design of the cooperative project management format, nor being assigned the role of manager of the cooperative project.

The focal customer unit may benefit from reflecting on its approach to cooperative project management, including the extent to which the focal supplier unit could be given further responsibilities in the development of a cooperative project management design and/or could be assigned greater responsibility for managing the project.

In relation to sister units, the focal customer unit may consider the potential benefits from exchanging experiences with their different approaches for project management which involves cooperation with suppliers as well as between them. Furthermore, they may consider whether they could make better use, either individually or jointly, of the focal supplier unit's capability, potentially assigning further responsibilities to the focal supplier unit.

In relation to non-sister units which operate in the same industry and national context, the focal customer unit may consider whether the focal supplier unit has developed capabilities through experiences with other customers which could be relevant to transfer to the management of cooperative projects with the focal customer unit, and whether systematic attempts should therefore be made to elicit the supplier's best practice, gained from collaboration with others.

10) Local resources

- Customers operating in other industries are the main sources of the supplier's capability development and deployment
- The focal customer firm is the only national within-industry customer both developing and using the capability

While the first nine capabilities each focus on a type of capability, the tenth one deals with the location of a subset of the capabilities of the supplier unit, namely those capabilities located in close proximity to the focal customer unit's premises. Furthermore, it shows the extent to which the focal customer unit and other customers develop and deploy the supplier unit's total amount of capabilities.

The focal customer unit is the most active in deploying and developing the locally situated resources, while sharing the total available resources with other customers. However, those other customers are seen as developing the supplier unit's capabilities more extensively, and making heavy use of frame agreements, thereby allowing the supplier to plan its future requirements for capacity and capabilities, and to hire and allocate personnel to work on pre-planned assignments for the customers.

Having discussed the impact of the different customer units on each of the focal supplier unit's capabilities, and therefore addressed the rows in the matrix, we will now address the columns in the matrix.

5.3 Total customer unit impact across ten different capabilities

In order to assess the overall impact of the focal customer unit and to compare it to each of the other customer units, several indices have been calculated. Firstly, the *Cross-capability development and deployment intensity by customer unit* shows the sum total of the impact which the customer unit has on the development of *respectively* the deployment of the focal supplier unit's ten capabilities. Secondly, the *Total impact of customer unit* shows the *sum* of the impact which the customer unit has on the development *and* deployment of the focal supplier unit's ten capabilities. Thirdly, the *Development/deployment ratio of customer unit* is calculated as the total impact which a customer unit has on the capability development of the focal supplier unit, divided by the total impact on the capability deployment of that focal supplier unit, and thus shows whether the main impact of the customer unit is in terms of capability development (X<1) or capability deployment (X>1).

Considering the focal customer unit in relation to other customer units which operate in the *same* industry setting shows that it has the largest *total impact* on the focal supplier's capability development and deployment, as well as being the customer most intensively involved in the development respectively the deployment of the focal supplier unit's capabilities. We may also notice that the relationship between the focal customer unit and the focal supplier unit is characterised by a greater emphasis on capability deployment than on capability development, scoring 0.48 on the *developing/deployment ratio*. However, this is the second highest score, compared to the other customer units, implying that in only one

other relationship is there a greater relative emphasis on capability development than in the focal relationship.

When considering the corporation to which the focal customer unit and its sister customer units belong in comparison to the corporations to which the non-sister customer units belong, the same indices have been calculated at the corporate level. These show a pattern similar to that discussed for the focal customer unit. In other words, the corporation to which the focal customer unit belongs has the largest impact on the focal supplier unit's capability development, its capability deployment, and therefore also on its total capability development and deployment. Furthermore, the development/deployment ratio in this case is the second largest overall, implying that only in relation to one other corporation is there greater relative emphasis on capability development than in the focal corporation. This implies that the focal supplier unit views the focal corporation as its most important corporate customer within the focal industry, although possibly not the customer that, in relative terms, is the most important for the development of its capabilities.

Similar indices have been calculated for the industry to which the focal customer unit, its sister customer and non-sister customer units belong, in comparison to the customers of the focal supplier unit in other industries. We may notice that the industry in which the focal customer unit operates has the principal influence, in terms of development, deployment, as well as total development and deployment of the focal supplier unit's capabilities. However, the development/deployment ratio of the focal industry is less than half the ratio of the (sum of) other industries. This implies that relationships with customer units operating in other industries make a much greater impact on the development of the capabilities they use in the focal supplier unit. Similarly, considering the development and deployment of the focal supplier unit's *local* resources for customer units in the focal industry compared to customers operating in other industries shows that the amount used seems to be quite similar; however, customers operating in other industries have three times the impact on the development of these local resources.

Compared to non-sister customer units which operate in the same focal industry and national setting, the focal customer appears to be a heavy user and developer of the capabilities of the focal supplier unit. However, when compared to customer units which operate in the same industry but other national settings, and which influence the focal supplier unit via sister units which operate in these countries, the importance of both development and deployment is much lower. Furthermore, when compared to customers outside the focal industry but in the same national setting, the focal customer is important in terms of deployment but less so in terms of development. When development by these other customers of the supplier unit's capabilities is useful and transferable to the focal customer unit, this may appear to be advantageous. However, if the capabilities develop in directions which are not valuable to the focal customer unit, it may pose a threat.

Furthermore, given the pattern of deployment and development of local resources, the focal supplier unit may give priority to its other customers, since they appear (collectively) to be more important in terms of capability development. This may be

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exacerbated by the pattern discerned for the capability *Frame agreement and long term cooperation*, indicating that the customers operating in different industries but in the same national setting are much more oriented towards long-term planning, and thus ensure continuity which, in turn, can provide benefits for developments which require continued, systematic experimentation and focus over extended periods. The focal customer unit, and the corporation to which it belongs, may therefore consider whether the advantages gained from its deployment and development of the focal supplier unit's capabilities (which in retrospect show a pattern of continuity, but seem to emerge primarily as a result of a series of disconnected choices of the focal supplier unit, in individual episodes characterised by competitive bidding) outweigh the advantages which could be gained from a more long-term view of the deployment and development of the focal supplier unit and its capabilities across a series of connected episodes planned for the duration of frame agreements lasting several years. Such agreements could in turn increase the possibilities for the focal supplier to make plans in relation to the focal customer unit and, consequently, to give it greater priority.

In any case, the focal customer unit should view the matrix related to the focal supplier unit in the context of its deployment and development of other suppliers (and potential, comparable matrices which might be compiled for these suppliers). In addition, the focal customer unit should consider its potential for effective deployment and development of a supplier in the context of the industry setting in which it operates. It should also consider whether conditions exist which may favour or hinder the transfer of practices from other industries to its particular industry setting.

5.4 The buying firm's insight into the capability development and deployment of the key supplier

In our study, we found that the buying company has great insight into some parts of the matrix but lacked insight into others. The buying firm has some knowledge of the capabilities that are specific to the industry in which it operates. One example of this is the buying company's knowledge of the development of the key supplier's QCS capabilities. The buying firm participates in a forum with other customers of the supplier, where issues related to QCS are discussed. Because of its participation in the forum, the buying firm is well informed about ongoing projects between the supplier and its customers that deploy and develop the QCS capability. As a result, the buying firm gains a deeper insight into the ways in which these customers individually develop the QCS capability. It also gains an insight into the ways in which a group of customers may influence the supplier's capability development by joint efforts at co-strategising and coordination. The buying company has, however, less insight into many of the other capabilities that are developed and deployed by customers which operate in the same industry as the focal buying firm. Furthermore, in the case of some other capabilities, the buying firm seems to have less insight into the ways in which sister customer units deploy and develop a capability than into the ways in which non-sister units deploy and develop it. This finding demonstrates the existence of unused opportunities for coordination, cooperation and co-strategising among sister units which share a common

supplier. At the same time, it suggests that capability-related coordination, cooperation and co-strategising may be performed more beneficially with those customer units of the supplier which are part of other corporations. Such attempts, however, must take into account elements of cooperation and competition both within the relationships between the involved units as well as between the overall corporations to which the units belong. Finally, the buying firm has little insight into other customers that deploy and develop capabilities that are not specific to the pulp and paper industry, and into the benefits which (according to the key supplier) may be reached through a better understanding of the evolution of the key supplier's capabilities in relation to these customers.

6. Conclusions and implications

The purpose of this paper was twofold. Firstly, we aimed to investigate whether, and in which ways, the capabilities of a key supplier are differentially deployed and developed by its customers, operating in the same or in different industries. Our research suggests that the capabilities of a key supplier are deployed and developed in different ways by different customers. This has various implications. Firstly, a single capability is not deployed and developed in the same way by the individual customers of the supplier. Some customers may not deploy and develop a capability at all, and differences exist between the customers that do develop and/or deploy it. Secondly, while some customers may have a similar influence on a single capability of the supplier, the overall patterns in which customers influence the supplier's set of capabilities differ. Some customers may equally deploy and develop one capability, while deploying and developing other capabilities to different extents. Thirdly, different units belonging to the same corporation may differ (widely) in their pattern of deployment and development of the supplier's capabilities, and a single customer's pattern of deployment and development may bear close similarity to those of customer units in other corporations. Fourthly, differences exist between customers which operate in different industries. Some capabilities are mostly or solely used by customers in one industry, while other capabilities are used by customers in a range of industries. The patterns discovered by our study showed that, in particular, the operational capabilities showed more similarities within the set of customers that operate in the same industry when compared to the set of customers operating in other industries. However, this may be particular to the empirical setting investigated. Fifthly, when considering the overall evolution of the supplier's capabilities, thus joining the effects of development and deployment, the overall influences of the different customers, corporations and industries differ – revealing to a large extent the importance of, and priority allocated to, different customers by the key supplier. This is also influenced by the particular identity of individual customers, however, as the customer's wider position and influence in industry, as well as its financial state, will also influence the priority given by the supplier to that customer. For this reason, it is important to include the names of the individual customers, since it would otherwise not be possible to attribute changes in position and financial status to them.

The second aim was to develop a method through which a buying firm could gain an overview of, and reflect on, how it, as well as other customers, differentially deploys and develops the capabilities of a key supplier, in order to improve its supplier management practices. Inspired by quality function deployment, we developed and tested a matrix which can be used to systematise and scrutinise the differential deployment and development of a supplier's capabilities by different customers. We argue that a buying firm can use this method to obtain an overview of, and analyse, who influences a key supplier's capabilities. It can also use it to analyse the ways in which the influence of other customers on the supplier's capabilities differs from its own. Such a systematic overview reveals patterns and enables analyses which, in turn, stimulate reflection. Firstly, a customer may be surprised by its pattern of capability deployment and development and by the manner in which it may differ from patterns of other customers of the supplier. A customer may be more (or less) influential than originally assumed on both individual capabilities and the totality of capabilities. Secondly, a buying firm may consider the advantages and disadvantages that can result from the patterns identified. The buying firm may consider whether it should attempt to change its deployment and development of the supplier's capabilities, and may also consider the positive effects – in terms of costs, efficiency, effectiveness and innovation – which may arise from such changes. Such changes should be considered not only in relation to the buying firm itself, but also in relation to sister units belonging to the same corporation, thus giving rise to ideas for changing the coordination, cooperation and co-strategising between sister units in relation to a common supplier. Thirdly, a buying firm may consider whether benefits could be gained by changing the way in which it relates to other customers of the supplier which are not part of the same corporation and may operate within the same or in other industrial settings. Similarities and differences in the patterns of capability development and deployment of these customer units may prompt the buying firm to consider the possibility of (increased) coordination, cooperation and co-strategizing with one, some or all of the units, in relation to one or several capabilities. In both cases, but particularly in relation to non-sister units, it would be necessary to take into account the stance towards the customer unit(s) in question, as well as the presence of competitive and cooperative elements in the relationships with these other units. Fourthly, by analysing the patterns in the matrix, a buying firm may also gain insights into whether it is the only customer deploying and developing a particular supplier capability, and, if so, may then encourage the supplier to look for additional, complementary customers, thus relying on the supplier's *customer proliferation capability*.

6.1 Managerial implications

More generally, we suggest that a buying firm may benefit from applying the matrix to their key suppliers and the other customers in their respective network contexts. This may give the company increased insight into, and understanding of, the priority given by the supplier to the customer or to the corporation to which it belongs, as well as the directions in which the supplier's capabilities are developing (being influenced by other customers, within or

outside the industry setting in which the buying firm is active). In Figure 2, we depict a "cleansed" version of the matrix, which we call "The House of Supplier Capabilities". Influenced by work on quality function deployment, we have added a "roof" to the table, in which it is possible to insert (+), (0), and (–) signs in order to denote whether the focal buying firm would consider it beneficial to engage in direct interaction with particular other customer units of the supplier (+), undesirable to enter into such interaction (-), or neither beneficial nor undesirable to do so (0). However, the advantages and disadvantages of undertaking more explicit coordination, cooperation and co-strategising with the supplier's other customers may differ across capabilities. Competing firms do not compete on all dimensions of their offerings, activities and capabilities; and for non-competitive dimensions, joint industry initiatives may be suitable.

---------Insert Figure 2 around here ----------

However, this matrix should only be taken as a point of departure, as customising it to suit the particular context of the customer and supplier may be beneficial. Several relevant issues are worth considering.

Firstly, the matrix only takes into account the focal supplier unit and its customer units which operate in one *national setting*. Including the focal supplier unit's sister companies and customer units which operate in the same industry but in other national settings could have demonstrated the influence of these other customer units on the supplier's capabilities compared to that of the focal customer unit and other customer units which operate in the national setting as the focal customer unit. Whether the national settings of the different customers should be an issue at all remains an empirical question.

Secondly, the matrix only considers those capabilities which are deployed and developed by the focal customer unit. Other capabilities of the focal supplier and its sister units are deployed and developed by the other customer units, especially those that operate in other industry settings. These other customers can therefore be expected to have an impact on additional capabilities of the supplier and, as a result, the influence of these other customers can be expected to be greater than appears to be the case from the present matrix and the analyses of it. As a result, *which capabilities to include* in the matrix is a matter of (conscious or unconscious) choice, depending on which supplier capabilities the customer is (or becomes) aware of, and on the increase in complexity as well as the marginal value of including additional capabilities. Overall, the users of the matrix should discuss among themselves "which are relevant capabilities to include?"

Thirdly, the matrix depicts corporations as being present in one industry, through one or several units. However, a corporation may be active in several industries, a logic which could apply to the focal corporation as well as to the non-focal ones. In order to capture such interrelations, the matrix would need to be customised to suit the particular

characteristics of the corporate context of the focal customer, the other customers, and the focal supplier.

Fourthly, the matrix does not show the different priorities which the supplier may assign to its different capabilities, nor the consequences of such priorities. In future research it might be advantageous to weigh the importance of each capability for the supplier and then to incorporate those weights in the calculations made for the columns. This could potentially lead to different results, since one customer unit's greater influence on the development and deployment of a capability to which the supplier gives less weight could be offset by the lesser influence of another customer unit on the development and deployment of a capability to which the supplier gives more weight. Such priorities could also make it possible to reflect on dynamics, as capability priorities could change over time.

Finally, in order to capture changes over time, in the customers of the focal supplier as well as in their respective patterns of development or deployment of the supplier's capabilities, it would be necessary to construct and complete a series of matrices over a period of time. This would enable the detection of changes which could influence the priority given by the focal supplier (unit) to the focal customer (unit), as well as the relevance and value of the available capabilities of the supplier – including new, existing and discontinued ones.

Our research also has implications for suppliers. Firstly, by developing a matrix that systematically identifies which customers influence the development of its different capabilities, a supplier may have a better foundation for its customer relationship strategy. Such analyses may allow a supplier to develop greater capability self-awareness and relationship awareness. The supplier may make better, more informed decisions about which capabilities and which relationships it should prioritise and develop, and which customer relationships it should in the future invest time in, and allocate resources to. The supplier may be able to focus on developing capabilities that presently are weak or underdeveloped, and thus be able to establish a stronger position within its relationships. The matrix could also be used as a tool for evaluating the total set of capabilities of the supplier, in order to consider possible expansion or reduction of the capability base.

Secondly, the supplier must consider the extent to which it is willing to – or feels pressurised to – share customer information, and capability-related information, with its different customers. In the present study, the supplier seemed willing to share information related to the matrix with the focal buying firm. However, this may not always be the case, and it may differ across the supplier's unique customer relationships. It may be beneficial for the supplier to have relationships with customers with insight into the supplier's capability development. In the present study, the supplier saw several opportunities that the buying company did not take advantage of because of its limited understanding of the impact of the supplier's other customer relationships on its capability development. The supplier even encouraged the buying firm to pay attention to the patterns revealed by the matrix. Furthermore, customers with such insight are likely to perform better at supplier management than those without such understanding (Choi and Kim, 2008), and if the

benefits gained by the customer are shared with, and positively affect, the supplier, the latter may be better off, in the future.

6.2 Implications for theory and further research

Our study allows us to offer some implications for theory and for further research. Firstly, we suggest that more research is needed into the ways in which different customers affect the deployment and development of the capabilities of a common supplier. While a few researchers have touched on this issue, few studies explicitly address and systematically investigate differences between patterns of capability deployment and development in multiple customer settings. Furthermore, the few studies in existence seem to stress the importance of industries, claiming that redeployment is mainly possible between customers operating in the same industry (MacDuffie and Helper, 1997; Nobeoka et al., 2002). This may, however, be particular to the (automotive) industry setting in which these authors have carried out their research. In our study, we found that it is possible to redeploy and redevelop some capabilities across relationships to customers in different industries, in particular in relation to managerial capabilities. We would encourage further research into a variety of settings, where the main customers of a supplier operate within different industries or the same industry.

Secondly, since the tool we propose – *The House of Supplier Capabilities* – has only been tested in relation to one key supplier and one of its main customers, we would welcome research on ways in which the tool can be used, modified for particular circumstances and types of firms, and further developed, as well as the benefits which the involved firms may accrue from using it. In particular, this could confirm (or refute) the assertion by Choi and Kim (2008) that buying firms with insight into the network context in which key suppliers are embedded can improve the performance of the firm. In particular, it would allow us to assess the extent to which insight into the supplier's other customer relationships in the wider network result in improved performance, compared with insights into the supplier's other relationships, such as its supplier relationships, and possible differences between firms, and between industrial settings. This would be important for a buying firm in order to assess whether time and other scarce resources are better spent on gaining insights into other customers and/or (sub)suppliers in a key supplier's network context.

Thirdly, building on this line of thought could inspire research on what we might call *supplier empathy*. According to dictionaries, empathy may be defined as "the identification with and understanding of another's situation, feelings, and motives". What may a buying firm gain from having and increasing supplier empathy, and which aspects of a supplier's situation are most important to understand and identify?

Fourthly, the proposed matrix may be regarded as one form of *network picture*, centring on a supplier's capabilities and on their development and deployment in the supplier's wider customer network context, capturing these elements in a matrix-like format. This may trigger further research from students of business relationships and networks on

the variety of formats and shapes of network pictures which may be used by a firm to stimulate network actions and bring about network results.

Fifthly, some attention has been paid within research on business relationships and networks to the concepts of micro and macro position. The matrix we propose acts to reflect the capability-related micro and macro positions of the key supplier, showing its relationship to the focal customer unit (the micro position) in the context of the key supplier unit's wider direct network of relationships (the macro position). In this way, the matrix may assist a company to better assess its micro position in relation to a particular supplier by becoming aware of the supplier's macro position. Building on our work, other researchers might therefore carry out research on capability-related micro and macro positions in networks.

Finally, as discussed above, most research on capabilities and on capability evolution, has been carried out within the field of the resource-based view which has focused primarily on the internal factors that influence how a capability evolves over time. Such researchers may investigate how relationships to customers (and other external parties) in the business ecosystem affect the evolution of a firm's capabilities which, in turn, may give the firm a competitive advantage. Our findings revealed unique (heterogeneous) patterns of supplier capability deployment and development by different customers. Such findings could act as a source of inspiration for further development of the increasing understanding that competitive advantage may derive from the way in which a buying firm relates to its suppliers (Weigelt, 2013). If it is not only a matter of who a firm's suppliers are, but how the suppliers and their capabilities are deployed and developed by the buying firm, then the purchasing and supply management function can (and should) develop unique patterns of deployment and development that fit the needs of the buying firm, and thus contribute strategically to performance and long-term survival of the buying firm.

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Capabilities of ABB Pulp and Paper, Norway		Pulp & Paper industry - Norway								Other industries - Norway		
	Customers	NSS	NSAlpha	NSBeta	OneSouth	OneNorth	FirstHigh	FirstLow	Maxi	Metal	Energy	Oil and Gas
Operational	Paper machine drive solutions	1/5	0/2	0/2	0/4	0/0	0/5	0/2	0/5	NA	NA	NA
	Web imaging systems	1/5	1/5	1/5	3/5	0/0	0/0	0/0	1/3	NA	NA	NA
	Collaborative production management	1/5	1/5	1/5	1/0	0/0	0/0	0/0	0/0	NA	NA	NA
	Quality Control System (QCS)	0/5	0/0	0/0	0/0	0/0	0/0	0/4	0/0	NA	NA	NA
	Open Control System	3/5	0/0	0/0	2/5	0/5	0/0	1/5	1/5	3/5	1/4	4/5
	Service	2/5	1/4	1/4	2/5	1/5	1/4	1/4	1/4	3/4	2/4	4/4
Managerial	Frame agreement/long-term cooperation	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0	4/5	2/2	5/5
	Early involvement in innovation	2/0	1/0	1/0	2/0	0/0	0/0	0/0	0/0	4/4	1/2	?
	Cooperative project management	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	?
	Local resources	3/3	0/0	0/0	0/0	0/0	0/0	0/0	0/0	3/1	3/2	3/0
	Cross-capability development and deployment intensity by customer unit	16/33	7/16	7/16	13/19	4/10	4/9	5/15	6/17	19/19	11/14	16/14
	Total impact of customer unit	49	23	23	32	14	13	20	23	38	25	30
	Development/deployment ratio of customer unit	0,48	0,44	0,44	0,68	0,4	0,44	0,33	0,35	1	0,79	1,14
	Intensity of development and deployment of local resources	3/3									9/3	
	Cross-capability development and deployment intensity by customer corporation	30/65			17/29		9/24		6/17	19/19	11/14	16/14
	Total impact of customer corporation	95			46		33		23	38	25	30
	Development/deployment ratio of customer corporation	0,46			0,59		0,38		0,35	1	0,79	1,14
	Cross-capability development and deployment intensity by focal industry compared to other industries	62/135								46/47		
	Total impact of focal industry compared to other industries	197								93		
	Development/deployment ratio of focal industry compared to other industries	0,46								1		

Figure 1: Key customers and their impact on the development and deployment of the capabilities of ABB Pulp and Paper, Norway

| Capabilities of focal supplier (unit)		Focal corporation		Other corporations			Other industries	
		Focal unit in focal corporation	Sister unit b in focal corporation	Non-sister unit a in corporation x	Non-sister unit b in corporation x	Non-sister unit b in corporation y	(Unit in) other corporation	(Unit in) other corporation
Operational	Capability 1							
	Capability 2							
	Capability 3							
Managerial	Capability 4							
	Capability 5							
	Capability n							
Customer unit impact	Customer unit's cross-capability development/deployment intensity							
	Total impact customer unit							
	Development/deployment ratio of customer unit							
	Intensity of development and deployment of local resources							
Corporation impact	Corporation's cross-capability development/deployment intensity							
	Total impact corporation							
	Development/deployment ratio of corporation							
Industry impact	Cross-capability development and deployment intensity by focal industry vs. other industries							
	Total impact of focal industry versus other industries							
	Development/deployment ratio of focal industry versus other industries							

Customer unit)s

Figure 2: The House of Supplier Capabilities

Network Pictures for Managing Key Supplier Relationships

Elsebeth Holmen, Tina Bjørnevik Aune & Ann-Charlott Pedersen

Paper III
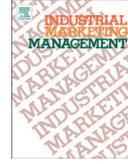
Network pictures for managing key supplier relationships

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A R T I C L E   I N F O

A B S T R A C T

We contribute to key supplier management literature, emphasizing the buyer's insight into key suppliers' surrounding networks. We build on supply network research suggesting that buyers must manage their key suppliers in their network contexts, and research suggesting that managing in networks is based on the interacting parties' network pictures. The theoretical insights were systematically combined with a single-case study of a buyer and four key suppliers. We suggest that a buyer assess the congruence between the buyer's network picture of key suppliers and the key suppliers' own network pictures, paying attention to obsolete, incorrect, incomplete, or generic elements. Second, a buyer may consider five "rules for revision" that can reveal problems arising from the obsolete, incorrect, incomplete, and/or generic elements. Third, the buyer may uncover new opportunities in key suppliers' networks by pursuing four strategies: systematic search, systematic discovery, chance search, and chance discovery. Thereby, the buying company may revise its network picture and contemplate alternative actions and reactions toward key suppliers. Our findings have implications for key supplier managers and others who interact with key suppliers. Further research should investigate how a buyer's insight into key suppliers' networks affects the performance of the buying firm, and the key suppliers.

1. Introduction

According to theories on supplier management, some suppliers are more important than others, and relationships to the strategically most important suppliers – recently coined "key supplier relationships" (Corsten & Felde, 2005; Ivens, Pardo, Salle, & Cova, 2009) – should be managed by dedicated key supplier managers, via a set of specialized key supplier practices (Pardo, Missirilian, Portier, & Salle, 2011). However, key supplier relationships, like all supplier relationships, are embedded in wider networks, and instead of managing a key supplier as if it existed in isolation, a buying firm may develop a network awareness capability in order to manage the key supplier in its wider network context (Choi & Kim, 2008). The question is, however, how a buying firm should manage key suppliers in their network context. In this article, we rely on literature on network pictures and network insight generation (Ford, Gadde, Håkansson, & Snehota, 2003, 2011; Henneberg, Mouzas, & Naudé, 2006; Mouzas, Henneberg, & Naudé, 2008), and suggest that the discussion on how key supplier relationships can (or should be) managed might benefit from cross-fertilization with ideas and concepts developed within a managing-in-networks perspective. We pursue this idea by empirically investigating, conceptualizing and discussing three issues pertaining to how network pictures can be used for managing key supplier relationships. First, how can a buying company consider whether its present key supplier network picture is in line with the key supplier's network context? Second, how can a buying company become aware that its key supplier network pictures may benefit from being revised? Third, how can a buying firm proceed to acquire new insights, which may lead to revision of key supplier network pictures, and spur new actions and reactions toward key suppliers?

The remainder of the article is structured as follows. In Section 2, we discuss the conceptual background of the article, relying on the literature on key supplier management and network pictures, and we present the three research questions. In Section 3, we explain the method and the case study. In Section 4, the findings from the case study are presented. In Section 5, we discuss the findings in light of the three research questions. In Section 6, we offer conclusions and implications of our research.

2. Conceptual background

2.1. Key supplier relationships

Since the 1980s, empirical evidence has mounted that a limited set of suppliers often account for a large proportion of purchasing spend, and that these relationships are characterized by interdependence, a collaborative spirit, and a long-term orientation (Håkansson, 1982, 1990; Håkansson & Snehota, 1995; Lamming, 1993). Further inquiries into supplier relationships, also spurred by management trends

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suggesting that companies should focus on their distinctive competences and outsource activities not relying on these competences, have revealed that such deep and collaborative supplier relationships heavily influence the buying firm's performance, operational efficiency, and innovative capability (Corsten & Felde, 2005; Dyer, 2000; Gadde & Håkansson, 2001; van Echtelt, Wynstra, van Weele, & Duysters, 2008). Given the importance of the supplier relationships, increasing attention has been paid to how such supplier relationships are (or should be) managed in order to create collaborative advantage (Dyer, 2000; Gadde & Håkansson, 1993; Lamming, 1993; Liker & Choi, 2004; van de Vijver, Vos, & Akkermans, 2011). Among the managerial approaches that have been proposed are supplier portfolio approaches (Kraljic, 1983), supplier base configuration and reduction programs (Gadde & Håkansson, 2001; Wagner & Johnson, 2004), and supplier development (Krause, 1997). All of these approaches seem to rely on the idea that, due to scarcity of managerial and other resources, a buying company can (and should) only engage in deep, collaborative relationships with a limited number of suppliers. Therefore, the buying company needs to reduce the number of suppliers and/or single out the subset of its suppliers that matter most for the buying firm's short-term performance and long-term survival, and needs to direct most of its supply management efforts toward this set of suppliers. The practice of giving a limited number of suppliers a specific treatment has been labeled "key supplier management" (KSM), as referred to in the introduction to this special issue.

2.1.1. Identifying key suppliers

Identifying the key suppliers is a central theme in KSM. Miocevic and Crnjak-Karanovic (2012) define key suppliers as those who provide strategic inputs (e.g. raw materials, components or systems) to a buyer's manufacturing process, where most of these inputs become core components of the buying firm's product offering. Wagner and Johnson (2004, p. 723) define key suppliers as "carefully selected and important suppliers that are subject to extremely high demands in terms of management of core skills, market and technological leadership" and for which the buying company applies a policy of "absolute single sourcing". In line with Kraljic (1983), Corsten and Felde (2005, pp. 446–447) define key suppliers as those "who supply strategic products which are high in value, scarce, or contribute considerably to a buyer's performance". Van de Vijver (2009) differentiates between key suppliers and preferred suppliers, suggesting that key suppliers are considered critical to the future success of the buying company, whereas preferred suppliers represent a category of suppliers largely based on their delivery and quality performance. Key suppliers may also contribute to the technical development of a company by playing a scout function (Corsten & Felde, 2005) or in other ways constitute important sources of knowledge and skills (Dyer, Cho, & Chu, 1998; Håkansson & Eriksson, 1993; Lakemond, Berggren, & van Weele, 2006; Wynstra, van Weele, & Weggemann, 2001). The definition provided by Ivens et al. (2009, p. 516) that key suppliers are those that the buying firm has "identified as being of strategic importance" captures the variety of these definitions at a more general level.

2.1.2. Managing key suppliers

Growing attention is paid to how key suppliers, once identified, are (or should be) managed. Pardo et al. (2011) define KSM as a set of practices that allow key suppliers to receive a specific, adapted treatment. In addition to capturing practices, KSM focuses on key supplier management roles (i.e. the practitioners), in particular the role of Key Supplier Manager, which embraces "managing relationships with suppliers that the company has identified as being of strategic importance" (Ivens et al., 2009, p. 516) or the role of Key Supply Purchasers (KSP). However, Pardo et al. (2011) stress that a company may practice KSM without having appointed anyone to the position of key supplier manager, since non-formalized approaches to KSM may exist. Finally, KSM also involves creating a new mission: coordinating the buying company's information and action in time and space in relation to a key supplier in its entirety (Pardo et al., 2011, p. 854).

2.1.3. KSM as an emerging field

KSM has been observed in some (often large or multinational) companies (for an overview see Pardo et al., 2011). However, KSM generally seems to be much less practiced and investigated than key account management (KAM), which aims to serve strategically important customers in a more individual manner than minor accounts (Ivens & Pardo, 2007, 2008; Ivens et al., 2009; Pardo, Henneberg, Mouzas & Naudé, 2006; Workman, Homburg, & Jensen, 2003). Since KSM may be seen as the mirror image of KAM (Ojasalo, 2002), the relative paucity of KSM has stimulated inquiry into possible barriers to "key supplierization" of the firm. Pardo et al. (2011) suggested that such barriers comprise difficulties in implementing supplier portfolio approaches, a narrow view of value co-creation with suppliers, and a persistent lack of integration of the purchasing function with other internal functions.

The emerging status of KSM praxis and research implies that future research needs to be able to capture the possible variety of forms in which KSM may appear (Pardo et al., 2011), including differences between large corporations vs. SMEs, across different industrial and/or national settings, etc. Furthermore, Ivens et al. (2009) emphasize the importance of not only describing existing KSM practices and roles but also giving advice on how to design and implement KSM practices and roles. Finally, Wagner and Johnson (2004) propose that in the long run, results can only be achieved if the management of key supplier relationships takes into account the wider context in which these are embedded, for example additional tiers in the supply chain.

2.2. Wider networks surrounding key suppliers

The literature on supplier management has mainly focused on the buying company's relationships to its direct suppliers. However, all suppliers, whether key or not, are embedded in wider networks (Håkansson & Snehota, 1995). This means that a dyadic buyer–supplier relationship is connected to other relationships of the two respective parties, and that these connected relationships affect the focal relationship positively and/or negatively (Anderson, Håkansson, & Johanson, 1994). Acknowledging such connections, important issues are how a buyer should manage in the wider networks in which key suppliers are embedded, which counterparts in the key suppliers' wider networks are important to consider, which capabilities are required for managing key suppliers in their wider network contexts, and which practices (cf. Ivens et al., 2009) may support this.

2.2.1. Managing the structural embeddedness of key suppliers

Within the field of supply chain management, the importance of interdependencies in the wider chain is acknowledged. However, as noted by Fawcett and Magnan (2002), the practice of supply chain management focuses mainly on practices toward direct (first tier) suppliers. In research on supply networks, which explicitly addresses connections among relationships, most studies center on connections among the direct suppliers of a buyer (see Choi & Wu, 2009; Dyer & Nobeoka, 2000) and pay scant attention to the wider networks of the buyer and the respective, direct suppliers. Nevertheless, there is a growing recognition that in order to understand a supply network and make strategic supplier-related decisions, it is necessary to look beyond the dyad (Axelsson & Easton, 1992; Choi & Kim, 2008, 2009; Dubois & Fredriksson, 2008; Gadde & Håkansson, 2001; Håkansson & Snehota, 1989; Ozcan & Eisenhardt, 2009; Smith & Laage-Hellman, 1992). In particular, Choi and Kim (2008) suggest that instead of managing a key supplier as if that supplier exists in isolation, a buying company also needs to consider the "structural embeddedness of the supplier", since the network surrounding the supplier can affect the buying firm's business decisions, behavioral choices, and economic outcomes. "If structural

embeddedness is not managed well, then the performance of the buying company may ultimately suffer" (Choi & Kim, 2008, p. 6). Since key supplier relationships are strategically important and have a profound impact on the performance of a buying company, it seems particularly useful to consider the wider networks of key suppliers (rather than the wider networks surrounding non-key suppliers). Against this background, we suggest that a buying company should not manage its key supplier relationships in isolation, but should *manage them in their structural network contexts.*

2.2.2. Important counterparts of the key suppliers

Choi and Kim (2008) suggest that it is important for a buying firm to consider several types of counterparts in the wider networks of a supplier, including the supplier's other customers, the supplier's suppliers, and other suppliers of the buyer with whom the supplier is instructed to co-operate. While the latter two categories may fall within the managerial boundary of the buying firm's supply chain and network (as discussed by e.g. Choi & Kim, 2008; Dyer & Nobeoka, 2000), the first category does not. However, the supplier's other customers may be the most important drivers or "catalysts" of the supplier's capability development, efficiency, financial performance, and long-term survival (Hartley & Choi, 1996; Mota & de Castro, 2005). Many suppliers have substantial relationships to several customers, which can be a mixed blessing for a focal buyer, since the supplier's other customer relationships can have negative effects as well as positive effects on the relationship between the supplier and the buyer (cf. Anderson et al., 1994). Focusing on the negative effects, MacDuffie and Helper (1997) state that a buyer needs to consider how responsive the supplier can be toward the needs of the buyer, in the face of competing demands by multiple customers. Having multiple customers, however, may also create constructive effects. Nobeoka, Dyer, and Madhok (2002) conclude that the performance of a supplier will be superior when it has a "broad customer scope" consisting of a set of "related customers" with similar or complementary needs or requirements, e.g. because they operate within the same industry. Due to such relatedness, the supplier's learning can be re-deployed and leveraged across its multiple customer relationships (Nobeoka et al., 2002; Schilling, Vidal, Ployhart, & Marangoni, 2003). In the light of such mixed blessings, it is easy to sympathize with the senior executive who stated that "in the future, when we select a major supplier, we are going to review carefully who its key customers are" (reported in Choi & Kim, 2008, p. 6).

2.2.3. Developing a network awareness capability related to key suppliers

In line with the aforementioned arguments, we suggest that a key supplier's set of customers is vital for its performance and a buying firm should therefore pay particular attention to its key suppliers' other customers, when managing key suppliers in their structural network context. One pertinent question that arises, however, is how a buying firm should approach this task. Choi and Kim (2008, p. 9) propose that "buying companies should develop their capability to measure their suppliers' structural embeddedness or what we may call 'network awareness' capability. This capability refers to a buying company's ability to effectively and efficiently scan the external networks of its key suppliers beyond its direct relationships with them. It entails observing other, indirect relational dynamics that might potentially lead to future concerns and opportunities". Although systematically developing and exercising a network awareness capability is an investment (Choi & Kim, 2008, p. 10) due to the managerial efforts involved, we suggest that it is likely to be worth the efforts in relation to key suppliers.

The claims by Choi and Kim (2008) regarding supplier network awareness capability can be viewed in light of the work by Teece (2007, 2009) on dynamic capabilities. According to Teece (2007, p. 1320), a company requires dynamic capabilities to achieve long-run enterprise success. Important foundations of dynamic capabilities are the abilities to sense, shape and seize opportunities and threats, and to reconfigure the company accordingly. Sensing new opportunities is

very much a scanning, learning, and interpretive activity, where companies must search the core as well as the periphery of their business ecosystem in order to identify and shape opportunities. In particular, a company's search must embrace the "community of organizations, institutions, and individuals that impact the enterprise and the enterprise's customers and suppliers" (Teece, 2007, p. 1325). Although Teece (2007) conceptualizes companies' outer context as an ecosystem, the logic of sensing and searching in ecosystems may be applied to business networks as well. Hence, we propose that one way of being aware, sensing and searching in a key supplier's network is through systematic use of network pictures, and interaction processes that generate network insight, for managing key suppliers' relationships.

Searching in a network to find new opportunities may be a deliberate process. However, as suggested by Kirzner (1973) it is possible to find hitherto unseen opportunities without deliberately searching for them. In his work on entrepreneurs, Kirzner (1973) proposes that there are two types of ignorance that individuals must cope with in the world. The first of these concerns things that we *know* we do not know, and we remain ignorant of them because we do not think it is worth the effort to gain knowledge about them. If we should change our mind and find it worthwhile to acquire knowledge about such elements, we could search *deliberately* for the missing knowledge. The second type of ignorance concerns things that we *do not know* that we do not know, also termed "sheer ignorance". According to Kirzner (1973), such ignorance is dispelled by discovery. That is, we cannot amend sheer ignorance by deliberate search, but only by spontaneously being "alert to new possibilities". Kirzner (1973) connects *search* to known ignorance and *discovery* to sheer ignorance, arguing that alertness is a special ability of an entrepreneur to perceive new opportunities. In summary, the interaction processes that generate insight in the key supplier network in which an "entrepreneurial" buyer engages should cover search for as well as discovery of opportunities.

2.3. Network pictures

Network pictures are a concept developed within the Industrial Marketing and Purchasing (IMP) approach that focuses on interaction in business relationships embedded in networks. The concept of network pictures builds on two lines of research: organizational sense-making theory (Weick, 1969, 1995), which is a particular management field concerned with how people see and position themselves, and focusing on explaining the maps people use; and theory on cognitive maps, which focuses on how maps can be constructed and used for decision-making (Eden, 1988; Eden & Ackerman, 2004). Network pictures are defined as "the views of the network held by participants in that network" (Ford et al., 2003, p. 176); they reveal companies' perceptions of what is happening in the network around them, and provide guidance for assessing the usefulness of various actions and reactions that they may undertake in the network.

Research on network pictures is based on the concept of network horizons, "which concern how extended an actor's view of the network is" (Anderson et al., 1994, p. 4). However, research that puts network horizons and pictures center-stage is quite recent; see Corsaro, Ramos, Henneberg, & Naudé, 2011; Ford & Redwood, 2005; Henneberg et al., 2006; Holmen & Pedersen, 2003; Leek & Mason, 2009, 2010; Mouzas & Naudé, 2007; Mouzas et al., 2008; Öberg, Henneberg, & Mouzas, 2007; Ramos & Ford, 2011.

It is generally agreed that network pictures provide a context, and are framing and sense-making devices as well as possible triggers for managerial activities (Colville & Pye, 2010; Henneberg et al., 2006; Mouzas & Naudé, 2007; Mouzas et al., 2008; Öberg et al., 2007). Network pictures thus act as a reference point for the way in which actors interact with each other and instill actors with a sense of "…what they can or might wish to do" (Ford, Gadde, Håkansson, & Snehota, 2002, p. 7). As such, the actions of each actor, as well as their reactions to those of others, depend on their unique network pictures (Ford & Redwood, 2005).

2.3.1. Network pictures and network insight

A company's network picture is conditioned by its relationships and positions held in the network. Correspondingly, companies can be expected to have distinct, dispersed, and maybe contradictory views of the world (Mouzas et al., 2008). Therefore, managers may benefit from examining their own network pictures and those of the companies around them, as well as the assumptions on which they are based (Ford & Redwood, 2005; Holmen & Pedersen, 2003). By doing so, managers may improve their understanding of the dynamics of the network, and reduce the danger of missing significant changes. Building on these lines of thought, Mouzas et al. (2008, p. 177) argue that "… incomplete knowledge of the context (by managers) may lead to inappropriate action". They advise managers to supplement their network pictures with interaction, in order to amalgamate and "objectify" individual network pictures so that they give rise to what the authors term "network insight".

Mouzas et al. (2008) base their conceptualization of network insight on network pictures being the dispersed cognitive pictures of individual managers. Given that point of departure, they suggest that the individual manager should overcome her (or his) network picture solipsism by amalgamative interaction. Hence, they seem to suggest that network pictures + amalgamative interaction = network insight. They also seem to imply that the more interaction – both with individuals within the same unit or with individuals in other units or levels inside the organizational boundaries, as well as with individuals from other organizations – the more amalgamated, collective and, hence, better network insight is produced. In Table 1, we illustrate their propositions for a buyer and one of its key suppliers.

However, as proposed by Gavetti and Levinthal (2000), cognitive models affect actions, resulting in outcomes that, in turn, shape the cognitive models, thus resulting in an endless loop between intelligence and action. Within the IMP approach, this logic is reflected in the "model for managing in networks" suggested by Ford et al. (2011, p. 193) in which "networking, network pictures, and network outcomes are all interconnected". Following these lines of thought, we argue that network pictures are a function of network insight. Thereby, more collective and amalgamated network insight, in turn, can result in better network pictures of individual managers, if managers internalize (part of) the collective network insight.

This presents a challenge in empirical studies of network pictures, since we cannot know to what extent a network picture expressed by an individual manager is already based on amalgamative interaction with others, inside and/or outside the organization's boundaries, and thus conveys the network insight amalgamated in a team, a unit, a company, a relationship, and/or a network. However, by contrasting the network pictures expressed by individual managers (within or across units and/or companies), we can assess the congruence among network pictures, and gain an indication of the extent to which amalgamation has taken place.

Given the issues discussed above, it is neither surprising that studies of network pictures opt for different aggregations of actors (individuals, units, or companies) nor that many of the studies focus on comparing network pictures at different levels, thus assessing their degree of congruence as a proxy for network insight gained via amalgamative interaction. For example, Ford and Redwood (2005) and Henneberg et al. (2006) investigate network pictures amalgamated at the company level. Leek and Mason (2009) compare network pictures of individuals in two companies; Kragh and Andersen (2009) compare network pictures across units in one company; Leek and Mason (2010) compare network pictures of three individuals in one company; Öberg et al. (2007) use multiple respondents in two companies and assess the congruence between the network pictures

Table 1
Types of amalgamative interactions generating network insight.

		Number of individuals from key supplier engaged in amalgamative interaction to develop network insight				
		0	1	>1, representing the same unit	>1, representing different units	
Number of individuals from buying firm engaged in amalgamative interaction to develop network insight	1	Network picture of individual manager	One-to-one network insight in relationship	One-to-many network insight in relationship, single individual toward single unit	One-to-many network insight in relationship, single individual toward multiple units	
	>1, representing the same unit	Network insight within unit	Many-to-one network insight in relationship, within unit to single individual	Many-to-many network insight in relationship, between two single units	Many-to-many network insight in relationship, single unit toward multiple units	
	>1, representing different units	Network insight across units	Many-to-one network insight in relationship, across units to single individual	Many-to many network insight in relationship, many units toward single unit	Many-to-many network insight in relationship, across multiple units	
						Increasing network insight

expressed by individuals in one company, but also present the empirical data at the company level. Furthermore, the multitude of levels on which the concept of network pictures can be applied is in line with the literature on applied research on cognitive maps, which describes and constructs such maps for decision making and problem solving for individuals, small groups, as well as companies, within the wider field of soft operations research (Eden & Ackerman, 2004).

While recognizing the importance of managers' individual network pictures we shall, in the remainder of the article, only consider network pictures at the *company level*. The company level is the most common level of analysis in IMP research, due to the necessity of conceptually reducing the complexity of companies' internal context when increasing the complexity of companies' outer network context (Axelsson, 1982). Therefore, from this point forward, we shall use the terms *the buyer's key supplier network picture* and *the key supplier's network picture*.

2.3.2. Network horizons and pictures

As mentioned, the literature on network pictures originates from research on network horizons. For a company, the choice of network horizon, beyond which the company has no insight, is a major management decision (Ford et al., 2003). In line with this, Holmen and Pedersen (2003) suggest that all firms can benefit from *reflecting on their current network horizon* and, furthermore, from *discussing internally* if it would be beneficial to *change* the horizon. Reflecting on issues of horizons in network pictures, Geiger and Finch (2010, p. 387) propose that "network pictures help managers select salient elements in their business context, reject others and increase their awareness that there are still others that could be available for selection even if presently perceived as *peripheral to or outside the established network boundaries*" (our emphasis). Hence, combining the concepts of network horizons and pictures in relation to key suppliers gives rise to ideas that a buying firm may *reflect on the boundary of its key supplier network picture*.

2.3.3. Dynamics in key supplier networks

A network picture portrays a snapshot of a network at a particular point in time. Since business networks are ever-evolving (Håkansson & Snehota, 1995), there is a need for updating network pictures (Colville & Pye, 2010; Geiger & Finch, 2010). As emphasized by Geiger & Finch (2010, p. 387), "a significant advantage of network pictures is that they can be revised at little cost, thus encouraging the actor to embrace uncertainty and instability in their sense-making efforts rather than shaping a false sense of stability". Hence, a buyer may consider *revising its key supplier network picture* in order to avoid sense-making efforts, and managerial actions and reactions, based on outdated pictures.

2.4. Key supplier network pictures and network insight

In Section 2.3, we discussed network pictures and the interactions in networks through which network insight is generated. Furthermore, we suggested that new insight can lead to revision of network pictures and, hence, give managers a new sense of what is happening in the network as well as a new view on which actions and reactions they may beneficially undertake in the network. In Section 2.2, we stressed the importance of a buyer managing a key supplier in its structural network context. Combining these lines of reasoning leads us to two concepts we consider useful for managing key suppliers in their network context: key supplier network pictures, and amalgamative interaction with key suppliers that generates network insight.

2.5. Research questions

There are many unanswered questions concerning how a buying company should use network pictures and generate network insight. By means of an empirical study, we shall address three questions. First,

how can a buying company consider whether its present key supplier network picture is in line with the key supplier's network context? Second, how can a buying company become aware that its key supplier network pictures may benefit from being revised? Third, how can a buying firm proceed to acquire new insights, which may lead to revision of key supplier network pictures, and spur new actions and reactions toward key suppliers? These questions can be of relevance to all types of counterparts in a key supplier's wider network. However, in line with the discussion in Sections 2.2.2 and 2.2.3, we shall only focus on the key supplier's other customers.

3. Empirical basis and method

The article is based on an exploratory single, embedded case study (Dubois & Araujo, 2004, 2007; Dubois & Gadde, 2002; Eisenhardt, 1989; Ragin, 1992; Yin, 1994) of the company Alpha and its four most important supplier relationships.

3.1. Case companies

Alpha is a medium-sized manufacturer of safety equipment and control systems and is part of a US-based conglomerate. Alpha has outsourced many of its activities, and is dependent on having suppliers with manufacturing capabilities as well as the ability to meet demanding cost, quality, and delivery targets. Today, Alpha develops and assembles most of its products in-house, mainly because of strict regulations regarding certifications and approvals for safety-controlling systems installed at complex operation sites.

Alpha's supplier base contains 300–400 active suppliers. The suppliers are classified according to purchasing spend and criticality for the end product, in the categories A, B, C, and D. This article is based on an investigation of four A-suppliers, which Alpha identified as its key suppliers. In this article, we only present data on Alpha's relationship to Beta, since analyses of the other three relationships did not reveal conceptual developments that were not covered by the relationship between Alpha and Beta. The relationship dates back to the 1980s, when Alpha outsourced its production of instrumentation modules based on thick film and printed circuit boards (PCBs) to Beta. The components Beta delivers are critical for the functioning of Alpha's systems. Over time, Beta has been part of different industrial electronics corporations. Today, Beta has approximately 60 employees.

3.2. Research method

The empirical basis was built up through several rounds of inquiry. Firstly, the authors had carried out previous studies of both Alpha and Beta. This meant that the authors were familiar with some of the informants and the history of the companies as well as the products and supply-related issues at Alpha. Secondly, the empirical basis for addressing the specific issues in this article was gathered during ten face-to-face interviews and two telephone interviews with Alpha and Beta during one year. The nine interviews in the focal firm were carried out with the purchasing manager, the senior purchaser, and the product development manager. The three interviews in Beta were carried out with the managing director, the logistics manager, and the production manager. The interviewees are considered key informants with particular knowledge of and interest in the issues being researched (Kumar, Stern, & Anderson, 1993; Pardo et al., 2011), and were identified in close cooperation with the participating companies. The key informants from Alpha have specialized knowledge of supplier relationship management and purchasing issues. As they are involved in managing the relationship to Beta, they can be expected to have insight into Beta's surrounding network. The key informants at Beta have specialized knowledge of production issues and how Beta interacts with its customers at different levels within the

organization. Furthermore, they have worked with the relationship to Alpha for several years.

The interviews lasted between 60 and 120 min each and were mostly carried out by two interviewers in order to capture more of the information provided and to allow for discussions and joint reflections on each interview. A semi-structured interview guide was used. The main topics covered in the interviews with Alpha informants were: who the key suppliers are, how they work with these suppliers, how the relationships to these suppliers have developed over time, and who the other important counterparts of the suppliers are, with special attention to other customers of the suppliers. In the interviews with Beta, the main topics were: how the relationship to Alpha has developed, who are Beta's other important counterparts (especially other customers), and what characterizes the relationships with regard to efficiency and innovation. All interviews were transcribed and subsequently sent to interviewees for approval and correction of misunderstandings. Tours of production units, brochures, and annual reports provided further information for the case study. A workshop at Alpha was held to discuss and reflect on the preliminary results of the study. In particular, network pictures for Beta and the other three key suppliers were presented to Alpha, and the subsequent discussion concentrated on how development of each of the key suppliers was driven by Alpha versus by other customers. Following the workshop, we carried out further discussions with the purchasing manager of Alpha, primarily regarding how Alpha could get more insight into how their key suppliers cooperated with other counterparts.

Having performed several rounds of iterations between empirical data and theory, we have followed the process of systematic combining aimed at theory development, which means that the theoretical framework, empirical fieldwork and case analysis evolved in relation to each other, over time (Dubois & Gadde, 2002). As a consequence, the research questions were refined and reformulated during the research process. The first round of interviews with Alpha mainly helped us understand the present situation of the company and the main characteristics of its relationships with key suppliers. We discovered that the managers were fairly preoccupied with their own tasks and spent rather little time on the key suppliers' concerns. Inspired by theory on managing key suppliers in their surrounding network context, and theory on network pictures, we set out to investigate what the informants from Alpha knew about the networks surrounding its key suppliers. The second round of interviews at Alpha thus focused on identifying the relevant actors that the Alpha informants included in their network pictures related to the key suppliers. The following interviews with Beta provided an opportunity to understand the relationship between Alpha and Beta in more detail, as well as to gather information on Beta's most important customer relationships. Subsequently, the interview data were analyzed and compared in light of theory on key supplier management and network pictures. Data analysis involved critical examination, evaluation, categorization, and recombination of the empirical data collected to address the research questions of how network pictures play a role in the management of key suppliers. In particular, we paid attention to the actors that formed part of the respective companies' network pictures and the exchange and interaction characteristics of the important relationships.

The primary goal of the analysis was to link theory on key supplier relationships and network pictures with the empirical observations of the relationship between Alpha and Beta, and their respective views on the wider network surrounding Beta. In this process, we developed two network pictures related to Beta and its most important counterparts. One network picture was based on our interviews with informants from Alpha; the other was based on our interviews with informants from Beta. Each key informant had its own, somewhat idiosyncratic picture of Beta's surrounding network. However, there were many overlaps across the network pictures of the

individuals in Alpha and Beta, respectively. For the purpose of this research we focus on the shared understanding of managers within each company and, as such, we amalgamated the individual pictures to a 'company network picture'. Thus, we present data on a company level, in line with previous studies on network pictures (e.g. Ford & Redwood, 2005; Kragh & Andersen, 2009). While it would have been possible to focus on differences within the set of informants in each company, this was not the key purpose of our study and, furthermore, based on discussions with key informants, it was not seen as the most interesting issue to explore. The compiled network pictures, the workshop at Alpha, and the subsequent discussions with Alpha's purchasing manager inspired us to return to theory and develop concepts addressing how, when and why a buying company can (or should) acquire additional insight into its key suppliers' networks, and revise its network pictures in order to improve its key supplier management.

4. Findings

In this section, we present the material obtained through our empirical study. Firstly, two network pictures relating to Beta's wider network of customers are presented — Alpha's network picture and Beta's network picture. Secondly, based on the workshop and discussions with Alpha's purchasing manager, we present reflections on which opportunities in the network of customers surrounding Beta Alpha could find if it revised its network picture, as well as ideas for how Alpha could go about revising its network picture.

4.1. Pictures of Beta's wider network of customers

The development of the thick film and PCBs is handled internally by Alpha without any involvement from Beta. Alpha is aware that Beta is interested in becoming more deeply involved in the development of the PCBs in order to make them more efficient to produce. Alpha's policy is to keep product development in-house. According to Alpha, they were Beta's largest customer for many years, and they are still Beta's largest customer of thick film products. Around ten years ago, Beta started to sell PCBs to other large customers besides Alpha. Alpha knows that Beta has other large customers, whom they cannot identify, of PCBs as well as other large customers using thick film. It is, however, very important for Alpha that Beta has other large customers, as they believe that Beta would be too vulnerable if Alpha were their only large customer.

Until now, Alpha has not focused much on knowledge development with its suppliers. Regarding knowledge transfer from Beta's other customers, Alpha does not see that there is much knowledge that can be transferred that can be beneficial for Alpha. In Alpha's view, the knowledge required for Alpha's products is very industry-specific, in particular because of the strict demands imposed by regulations, certifications and approvals. However, Alpha finds it imperative that Beta has other

Alpha's network picture of Beta's	Beta's own network picture of its
other important customers	important customers
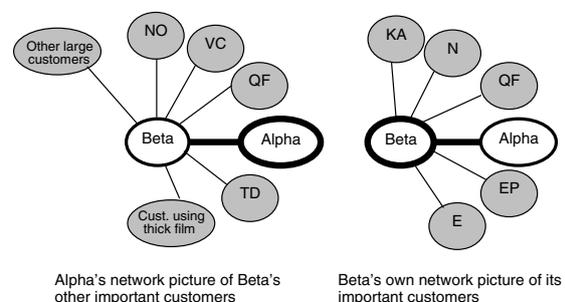
Fig. 1. Network pictures relating to Beta.

large customers, as this will make it easier for Beta to obtain better purchasing deals and discounts. Alpha emphasizes that it is important for Beta to have a clearly defined purchasing plan for handling its suppliers in order to pay the lowest possible price for components, to the benefit of all Beta's customers. According to Beta, price is a more important factor in the industry Alpha represents than in other industries where more emphasis is put on quality and advanced capabilities. Alpha identifies the companies NO, VC, and TD as large customers of Beta. Alpha's network picture of Beta's most important customers is shown on the left-hand side in Fig. 1. On the right-hand side, Beta's own network picture is depicted.

Beta ranks Alpha as their fourth or fifth largest customer in terms of turnover. However, Alpha's slow innovation rate and inward-looking innovation model are negative factors when Beta ranks its customers. Beta supplies standard PCBs to Alpha and recognizes that these could be sourced from anywhere in the world, implying that Beta could be replaced easily. However, finding suppliers of thick film products is more difficult, and Beta feels that they have a strong position as a supplier of such products to Alpha. Overall, Alpha is (still) regarded as an important customer, and the two companies know each other very well from their long-lasting relationship. From Beta's perspective, however, it would be beneficial if they could produce more complete systems for Alpha and/or become more involved in their product development. However, Beta knows that Alpha views product development and assembly as its core competences, and wishes to keep these as internal functions.

The largest and most influential customer of Beta is company QF, a supplier of intelligent transport systems and automatic toll collection systems. Beta produces thick film hybrids and complete toll road tags for these system. Beta was involved in developing the first generation of toll road tags in the 1990s, and has manufactured 1.5 million units since then. QF continuously involves Beta in the technical development of the PCBs to enable more efficient, automated production. In cooperation with QF, Beta has developed an automated production line that is specifically adjusted to the production of toll road tags for QF. Beta produces complete systems for QF, including assembly of components from other suppliers. As mentioned earlier, Alpha is aware of Beta's relationship with QF (see Fig. 1).

Another large customer that cooperates closely with Beta is KA, a company that manufactures systems for gearshift, clutch actuation, and seat comfort. Lately, the use of electronics in automobiles has accelerated, and this trend seems set to continue for some time to come. The automotive industry has highly demanding quality requirements, making it imperative to minimize production errors. Beta is allowed a maximum error rate of 25 parts per million (ppm), and Beta has worked hard to fulfill KA's strict quality standards and eliminate defects. KA involves Beta from the specification stage when developing circuit boards that are part of the seat control units. As several components have to be adapted to each other, Beta also cooperates directly with some of KA's other suppliers. Including Beta at an early stage makes it much easier to optimize the production process. From the early functional specifications provided by KA, Beta developed a PCB that is now produced in approximately 180,000 units per year. KA and Beta also spend much time finding the most appropriate layout of components on the PCBs to ensure efficient production. This is a continuous process and minor adjustments are made when necessary. Due to the potential of growing as a supplier to the automotive industry and the capabilities they are developing, Beta currently allocates considerable time and resources to KA. For example, KA is presently involved in developing an automated production line in cooperation with Beta. The development of this production line is, to a large extent, based on the process knowledge that Beta has obtained from its close relationship with QF. The main reason that Beta views KA as an important customer, also in the future, is the high degree of predictability related to production in the automotive industry. Production quantities are usually decided on a three-year basis, which makes it easy to relate to forecasts. Even though Beta

ties up many of its resources working for KA, Alpha is not aware of Beta's relationship with KA.

As this case study shows, Beta has customers in a variety of industries. According to Beta, the company has improved the quality and reliability of its products by working with different types of customers with somewhat different needs. Feedback from the customers also influences the development and performance of Beta's assembly lines, which, in turn, have an effect on the end products. In addition to the customer relationships already mentioned, Beta views its relationships with N, EP, and E as especially important. N produces radio communication systems, EP supplies radar and sensor systems, and E provides telecommunication systems. The circuit boards Beta produces for these customers are based on thick film substrates. Alpha does not know about Beta's relationship with any of these customers (see Fig. 1).

4.2. Changing Alpha's network picture to find new opportunities

After the workshop with Alpha where network pictures of Beta and the other three key suppliers were discussed, followed by discussions with Alpha's purchasing manager on the network pictures of Beta's wider network, the purchasing manager started to reflect on which potential opportunities could be found if Alpha changed its network picture of supplier Beta's other customers. Moreover, a particular point that came up during the discussions with the purchasing manager was how Alpha could change its network picture so that opportunities could be identified.

Early on, the purchasing manager realized that some interesting opportunities were related to quality control systems and environmental assessment systems. To gain insight into these types of issues, the purchasing manager stressed that it would be important to explore, in an organized way, how the supplier is handling these issues in relation to other customers. It was the experience of the purchasing manager that most firms seem willing to tell others how they have developed their quality control system. Therefore, the purchasing manager believed that it would be easy to obtain access to such information. However, the purchasing manager realized that it could be demanding, and costly, to obtain a large amount of information on many different themes at the same time. Therefore, he viewed it as vital to carefully analyze which issues, or themes, Alpha should focus on when gathering information from Beta. Nevertheless, as the purchasing manager was aware of many points of contact between Alpha and Beta, he thought that it could be possible to use these more deliberately to gain more insight into selected issues. In that way, some information could be collected without incurring high costs. The ability to gain information at a relatively low cost was important to the purchasing manager, since the time and resources Alpha could spend on pursuing new opportunities related to Beta were limited.

5. Discussion

Having presented our findings, we shall now address the three research questions, as outlined in Section 2.5.

5.1. Conceptualizing the congruence between network pictures

The first research question concerns how a buying company can consider whether its present key supplier network picture is in line with the key supplier's network context. We suggest that one way of doing this is by assessing the congruence between the buyer's key supplier network picture and the key supplier's network picture. Juxtaposing the two network pictures, we can identify four different ways in which Alpha's key supplier network picture differs from Beta's network picture. Firstly, some elements in Alpha's network picture are *obsolete*, in the sense that parts of the network picture are no longer correct, although they were correct at an earlier point in time.

Table 2
Status of elements in a network picture.

Element is:	Explanation
Obsolete	Elements in a buyer's key supplier network picture may be obsolete in the sense that they are no longer correct, although they were correct at an earlier point in time. Since a key supplier's network is in constant flux, one issue therefore becomes how often a buying company should update its insight into its key suppliers and their surrounding networks.
Incorrect	Elements in a buyer's key supplier network picture may be incorrect in the sense that some elements are incorrect now and, furthermore, have always been incorrect. Such erroneous elements in the picture of a key supplier's network may have arisen due to misunderstandings or lack of detailed information. If *some elements* in the network picture are (becoming) particularly important for the buying company's actions, it ought to consider having these elements *corroborated* or *refuted*.
Incomplete	A buyer's key supplier network pictures may be (and probably always are) incomplete in the sense that the buyer's key supplier network picture is less comprehensive and detailed than the key supplier's network picture. The buyer's network picture is bounded by its present network horizon. Therefore, the buying company should consider the possibility of changing the horizon by acquiring additional insight, and adding new elements, in order for the picture of the key supplier's network to become more comprehensive in the directions deemed important.
Generic	A term is generic when it relates to or describes an entire group or class. Some elements in a buyer's key supplier network picture may appear as generic categories, aggregating specific counterparts or other items into groups at a higher level. Different generic categories may appear, e.g.: ◦ Product (e.g. group of customers buying a specific product) ◦ Facility (e.g. other customers using a specific facility) ◦ Technology (e.g. group of customers using a specific technology) ◦ Industry (e.g. other customers within a specific industry) ◦ Geography (e.g. other customers in a specific area or country)

One of the customers (TD) that Alpha believes to be important for Beta is no longer an important customer of Beta. TD was an important customer of Beta some twenty years ago. TD was very focused on quality, and its high demands were important for the development of Beta, especially in terms of TD's attention to development of efficient production techniques. TD was a company in rapid growth and Beta was not able to deliver the large quantities that TD demanded. TD therefore found another supplier that could supply the amounts needed. Secondly, parts of Alpha's network picture are *incorrect*, since some of the counterparts that Alpha identifies as important for Beta (VC and NO) have never been customers of Beta. Thirdly, parts of Alpha's network picture are *incomplete*. Beta listed KA, N, EP, and E among their most important customers, none of which Alpha seemed to be aware of. Of these customers, KA was mentioned by Beta as currently being particularly important, and a company Beta spends much time on. By cooperating with KA, Beta has developed its industrialization capabilities, as well as its ability to deliver products with very few defects. Fourthly, parts of Alpha's network picture appear as *generic categories* that contain classes of not individually identified customers such as "other large customers" and "customers using thick film products". We suggest that these four concepts can be useful for discussing, in more detail, the congruence between the key supplier network pictures of a buyer and a key supplier's network picture. The concepts are presented in Table 2.

When *generic terms* appear in a key supplier network picture, the buyer should consider whether it would benefit from acquiring insight into the concrete identities of the counterparts in the generic categories. In some situations it may be sufficient to use generic terms; for instance, knowing how customers from a particular industry influence the development of a key supplier on an overall level. In other situations, however, it may be risky to use generic terms for a key supplier's other customers. By generically grouping the other customers of a key supplier, a buying company may also miss out on

detailed information on the type of technology that is being developed, how the production process is handled, etc. The buyer may also miss out on information on the direction in which the key supplier is moving technologically, which may have a large impact on the buying firm in the future. A buyer's lack of detailed insight may also prevent the key supplier from making the best use of its surrounding network. Convincing a buying company of a certain technology or production procedure that the key supplier has developed in a particular other customer relationship may be more difficult if the buying company is unaware of details in the supplier's extended network.

Closer consideration of the generic category "industry" reveals several issues that are interesting to pursue. As mentioned in Section 2.2.2, Nobeoka et al. (2002) claim that it is beneficial for a supplier to have several customers operating within the same industry. One may argue that if that be the case, it is sufficient for a buying company to use a generic element e.g. "other customers within our industry". However, we argue that other terms that capture an entire group may be equally useful. In our case study, Beta has customers in a variety of industries, and the needs and requirements from different customers within different industries seem to contribute positively to Beta's development as a competent key microelectronics supplier. Hence, generic terms that capture technology-based similarities such as "customers buying thick film products" can be more important than generic terms that capture industry-focused similarities. Overall, this points to the need for considering which generic terms are useful for a buying company to use in its key supplier network pictures, when one focuses on the key suppliers' other customers.

The lack of detailed insight that Alpha has of Beta's other customers may be due to the variety of industries the customers represent. Pursuing the line of reasoning suggested by Nobeoka et al. (2002), information that a key supplier has customers from many industries may offer an (early) warning sign that the supplier will not be able to achieve or maintain sufficient performance levels, and will develop capabilities that are not sufficiently specialized toward a category of customers with similar needs and requirements. We argue, however, that it may also be useful to gain insight into a key supplier's other customers when these customers are in a variety of industries. The key supplier will then have multiple sources of information and access to a wider spectrum of resources and these, in turn, may affect positively the buying firm's knowledge development and innovation.

While generic terms are useful for some purposes, they hide the concrete identities of the categorized elements, and these may be important on some occasions, e.g. when a company files for bankruptcy, is acquired by a competitor, makes changes of the businesses it operates in, or changes its competitive and collaborative strategy. Even if public information is available on such issues on specific companies, it may be of little use to a buyer because it cannot attribute the information with certainty to the generic category, because the specific company in question may, or may not, be a part of the category. Hence, a buying company may question how useful the generic categories in their key supplier network pictures are. Firstly, there may be variations within the generic category that are important to consider, and that would lead to *breaking up the generic category* into smaller generic categories or concretely identified counterparts. Secondly, generic terms other than those presently used may be more valuable, which would lead to *changing the type of categories* used. Thirdly, it may also be useful to let categories merge, becoming more generic, when differences that were important earlier on no longer seem relevant.

Alpha seems to have purposely limited its efforts at investigating Beta's wider network, and handled the relationship to Beta on the basis of an understanding that Alpha's requirements and needs are too unique to be influenced by Beta's other customers. For example, Alpha's picture of Beta's network contains the generic category of "other large customers". Our case study seems to suggest that Alpha

could utilize several of the capabilities Beta has developed in its other customer relationships, even though the other customers operate in various other industries. Hence, instead of drawing the conclusion based on scant data that "our requirements and needs are unique", a buyer could benefit from posing it as a *question* to the key supplier, i.e. "How unique are our needs, really?"

5.2. Rules for network picture update and revision

The second research question concerns how a buyer can become aware that its key supplier network pictures may benefit from being revised or updated. In other words, what might inspire a buyer to acquire new, or corroborate existing, insight into a key supplier's network? In Section 5.1, we suggested that elements in a buyer's key supplier network picture could be obsolete, incorrect, incomplete or generic. For each of these situations, we suggest that a buying company may benefit from developing a rule or routine that makes the buyer think "perhaps it is time that we update or revise our key supplier network picture". For example, if a buyer wants to avoid basing its actions and reactions on *obsolete elements* in its key supplier network picture, it could consider making a rule for how often its network pictures should be updated. In the case of Beta, Alpha might want to periodically check that Beta still has other customers within the thick-film segment.

In relation to *generic elements*, a buyer may want to make sure that a certain category does (or does not) contain particular other counterparts of which the buyer does not approve. In relation to Beta, Alpha may want to make sure that its head-on competitor is not one of Beta's "other customers using thick-film". If Alpha wants to avoid being ignorant of such a situation, it may make it a rule to check both "that the key supplier has other customers of thick film products" and "that the main competitor is not among these other

Table 3
Rules for revision of network pictures.

Element may be…	Issue to consider…	Occasions for considering…
Obsolete	"How often should we update the network picture?"	When the buying company want to know if a supplier has acquired a new (or lost an old) large customer
Incorrect	"Which elements in the network picture are critical for us to have corroborated or refuted?"	When a particular company is viewed as important for the development of its suppliers, and the buying company is uncertain whether this other company is, in fact, a customer of the supplier or not
Incomplete	"When and in which direction should we widen the network picture?"	When the buying company would like to get more insight into (parts of) the supplier's network and how the network affects the performance and development of the supplier, e.g. its other customers, sub-suppliers, distributors, or technology collaboration partners
Generic	"Should we break up some of the aggregate categories into concrete identities of counterparts?"	When idiosyncrasies among customers in an industry matter more than similarities, the buying company may want insight into the concrete identities of the other customers
	"Should we change the type of aggregate categories we use?"	When it is less important which "industries" the other customers belong to, but more important whether the other customers "engage in supplier development", or "involve the supplier early in product development processes", etc.

Table 4
Strategies for gaining network insight and finding opportunities.

		Does the buyer know which themes it would like to know more about?	
		Specified theme	Unspecified theme
How does the buyer look for insight and opportunities?	Systematically	1. Systematic search	2. Systematic discovery
	Ad hoc	3. Chance search	4. Chance discovery

customers". In a more positive vein, if a particular admired and outstanding company is known to use products or services that the key supplier can supply, the buyer may want to make sure that its key supplier is a supplier also to this particular other company. As one executive stated, "if it is good enough for Toyota, it is good enough for us". In the case of Beta, Alpha may make it a rule to check both "that Beta has other customers of thick film products" and "that admired company TD is among Beta's other customers".

In Table 3, we provide inspiration for such "rules for updating and revising network pictures" for obsolete, incorrect, incomplete, and generic elements.

5.3. Strategies for gaining insight and finding opportunities

In Section 5.1, we suggested that a company could benefit from updating its key supplier network pictures to handle obsolete, incorrect, incomplete and/or generic elements in the pictures. An important question, however, is *how* a buying firm can proceed to acquire new insights, which may lead to revision of key supplier network pictures, and spur new actions and reactions toward key suppliers. The discussion that follows thus relates to our third research question.

In Section 2.2.3, we suggested that a buying firm needs to develop capabilities for searching the key supplier's network, so that opportunities can be found in a deliberate way. Furthermore, we added the notion that some opportunities may only be discovered if the firm is alert. In Table 4, we offer a matrix that describes four different strategies for "how to" gain insight and find hitherto unknown opportunities in key supplier networks.

The first dimension of the matrix represents *how* the buyer looks for network opportunities, and varies from *systematically* to *ad hoc*. The second dimension concerns which *type* of network opportunities the buyer looks for, and reflects the extent to which the buyer is aware ex ante of the particular network opportunities ("themes") into which it would like to gain more insight. This dimension varies from *specified* themes to *unspecified* themes. The strategies of "systematic search" and "chance discovery" cover the concepts of search and discovery as proposed by Kirzner (1973). However, we suggest that the manner in which one looks for something, and the extent to which one is ignorant about the objects of one's attention, may be regarded as two separate dimensions. Thus, the main differences between Kirzner's view and ours consist of "systematic discovery" and "chance search". We shall now discuss these four different strategies, and offer examples and reflections by Alpha's purchasing manager for each of the strategies.

Since the strategies have different advantages and disadvantages, a buying firm may benefit from using a combination of the four strategies in its key supplier relationships. However, the weight assigned to each of the strategies may vary across key supplier relationships, as well as within a key supplier relationship over time.

5.3.1. Systematic search

When a buyer searches systematically for opportunities in key supplier networks, this means that it makes an organized effort to find more information and gain more insight into particular themes that are viewed as relevant for the buyer. For example, a buyer may make systematic reviews of the supplier's capabilities, quality control

systems and certificates, new products planned, the identity and percentage of turnover of its other main customers, participation in supplier development programs, etc. Use of assessment forms, benchmarking studies, and annual structured dialogs between the buying company and its key suppliers are all examples of systematic search.

One advantage of systematic search is that it is an organized and focused approach, which can be planned in advance. When searching for new opportunities in a systematic and focused way, it may also be easier for the buyer to seize the opportunities that arise, as the buyer is searching for insight related to themes that it is determined to pursue. Using this approach requires that the key supplier is willing to share information. It may also be a resource-intensive and time-consuming approach, for both the buying company and the supplier.

For Alpha, this strategy can be used for finding opportunities related to development of quality control systems and environmental assessment systems. Such systems are demanding to develop, and it is important to get inspiration and learn from other firms. Since Beta's customers generally do not compete regarding such systems, it should be possible to discuss such opportunities openly, and hence transfer knowledge from Beta's other customers to Alpha. Disadvantages relating to this approach are the time needed to employ the strategy, and the fact that some themes will be difficult to discuss openly.

5.3.2. Systematic discovery

Systematic discovery entails that, while the objects of discovery (i.e. opportunities) are relatively unknown, the buyer has an idea where to find them. For example, when a buying company makes a systematic search effort to acquire more insight into its key suppliers and their capabilities and performance, as described above, it may at the same time include some "open questions" in the assessment form, where the key supplier can bring up issues that it believes may be relevant for the buyer, but of which the buyer presently is unaware. Similarly, time may be reserved in structured key supplier dialogs for themes raised by the key suppliers. Systematic discovery may also include the recurrent, systematic organization of, or deliberate participation in, workshops or other arenas where the buyer may meet its key suppliers, and where there are "open themes" or time set aside for informal "networking". Temporary inter-firm employee transfers also offer an opportunity for systematic discovery. Having an open innovation model may also enable systematic identification of external ideas, submitted by suppliers, which the buying firm can leverage. Systematic discovery is particularly relevant in relation to opportunities envisioned by the supplier, and the buyer needs to create structures and processes to capture these.

One advantage relating to systematic discovery is that it is a planned and organized way of sensing new opportunities, even though the themes of interest are relatively open. A buyer applying this approach is not dependent on having its own specific ideas regarding what is important, but can become alert to new opportunities via its key suppliers. Systematic discovery may demand considerable resources, but this does not apply in every case. Furthermore, it requires active involvement of the suppliers, and involves some degree of uncertainty; the buying firm may spend time on sorting input on opportunities that it has no intention of seizing. To be able to come up with interesting opportunities, the supplier may need to know the buying firm quite well. Hence, it may be an especially useful strategy for key supplier relationships that have lasted for some time.

For Alpha, this strategy can be employed in some of its long-lasting key supplier relationships that comprise plans for future collaboration. Using this strategy requires that the top management in both firms need to be strongly committed and to view the method as a way of strategically managing relationships; if they are not, they will not share sufficient information. Beta could, for instance, be encouraged to raise issues that it believes are relevant for Alpha, such as production process solutions developed with other customers. The main advantage is that the buyer may actually identify opportunities by having a deep and open dialog, thus developing "competitive advantages" in a collaborative manner. A major disadvantage of this strategy is that it may be too time-consuming for Alpha to employ. As the purchasing manager of Alpha remarked, "*there is little time to allocate to systematic search for unknown possibilities related to our suppliers*".

5.3.3. Chance search

A buying company is often alert to issues and themes that are important to it, without continuously and/or recurrently making systematic efforts to acquire new insight related to these. There is simply not sufficient time and resources to inquire into all themes of interest to the firm. However, the buyer engages in daily or at least recurrent interaction with its key suppliers, where the main issues concern aspects such as deliveries, product adaptations, product development, quality control, or ordering procedures. During interaction on these issues, other themes may come up as a nonlinear, interactive effect. If the buyer is interested in and alert to these themes, it may note the insight gained as a network opportunity.

For example, during a discussion on logistics, a key supplier may mention that it has recently developed a new logistics solution for another customer, and that this solution is related to a new product feature developed for this other customer. If the buyer is interested in this type of feature, it is probable that it will note it, and possibly act on it. In *chance search*, the managerial challenge is to ensure that the insight is noted in a systematic manner, either by written communication or socialization. It is likely that an enormous amount of insight from chance search is continually generated; possibly every time a representative of the buyer interacts with the key supplier. However, most of it may be remembered only by the individual who was exposed to it, if at all. The challenge of the buyer is to be aware of which themes are important, and to design procedures for capturing, debriefing, and documenting opportunities gained from chance search, as well as to develop a culture supportive of this. Chance search may not require many resources, and can be carried out in an informal manner.

Alpha can use chance search in the ongoing interaction with key suppliers, and become better at writing down ideas and insight. The main advantage is that the strategy is informal, and not so time-consuming. The main disadvantage is that it can be difficult to obtain sufficiently relevant information if the discussion is not part of a formal collaboration initiative approved by top management.

5.3.4. Chance discovery

Chance discovery occurs when a buying company neither organizes systematic efforts to acquire insight, nor specifies themes of interest upfront. However, in ongoing interactions, themes that arise may catch the attention of the buying company; perhaps because they could be a novel solution to a problem for which no solution has yet been identified, or perhaps because they seem to offer a potentially interesting novel connection to the buying company's current businesses. It may also happen if the buyer and the key supplier bump into each other at unfamiliar places, in committees, regional councils, etc. or when attending forums with few expectations or intentions. Often, it will trigger the reaction "this may be interesting for us to look into". The main advantage of this strategy is that it requires little preparation ex ante. With this strategy, a buying firm may come across opportunities that have never been imagined before, and may therefore represent substantial potential if seized. Disadvantages of the strategy are that it relies on the entrepreneurial alertness and curiosity of managers in the buying firm.

Considering this strategy, Alpha can try to make the managers more alert to themes that key suppliers bring up and that might have future potential. The main advantage is that it requires little preparation. During interactions with Beta, Alpha may discover interesting opportunities in relation to Beta's other customer relationships, especially if an open-minded and relaxed mood prevails.

Disadvantages of chance discovery are lack of direction (no guiding themes) and that it may be quite time-consuming.

6. Conclusions and implications

In this article, we have proposed that a buying firm may use network pictures for managing key suppliers in their wider network contexts. We set out to investigate three issues. First, how can a buying company consider whether its present key supplier network picture is in line with the key supplier's network context? Based on our research, we suggest that one way of doing this is by assessing the congruence between the buyer's key supplier network picture and the key supplier's own network picture. In particular, we propose that a buying company may consider whether elements in its key supplier network picture are obsolete, incorrect, incomplete, or generic, as well as reflecting on the usefulness of the generic categories used in the network picture.

The second question we posed concerns how a buying company can become aware that its key supplier network picture is in need of revision. We suggested that a buying firm could be inspired by a question or "rule" related to each of the four types of elements mentioned above. Firstly, "how often should we update the network picture?" enables the buyer to reflect on possible obsolete elements in the network picture. Second, "which elements in the network picture are critical for us to have corroborated or refuted?" may help the buyer in addressing possibly incorrect elements. Thirdly, "when and in which direction should we widen the network picture?" inspires the buyer to consider that although network pictures are always incomplete, parts of the key supplier's network may be worth discovering and including in the key supplier network picture. Fourthly, the questions "should we break up some of the aggregate categories into concrete identities of counterparts?" and "should we change the type of the aggregate categories we use?" encourage the buying firm to consider if generic elements in the network pictures should be opened up so that concrete identities and more details of the generic groupings are revealed.

The final issue we addressed was *how* a buying firm can proceed to acquire new insights, which may lead to revision of key supplier network pictures, and spur new actions and reactions toward key suppliers. We proposed that a company might benefit from employing a combination of different strategies for gaining new insight: systematic search, systematic discovery, chance search, and chance discovery. These strategies differ according to the extent to which the buyer deliberately searches for new insights, and the degree to which the buyer can specify in advance what is searched for. The buying firm has to decide the amount of time, personnel, and other resources a company should allocate to each of the four different strategies, and a key supplier manager should be deeply involved in making such decisions.

6.1. Implications for key supplier managers

While some managerial implications are mentioned in the discussion and conclusions, there are a number of specific implications for key supplier managers we would like to stress.

An important task of the key supplier manager is to assess whether the buying firm's key supplier networks sufficiently reflect the key supplier's network contexts. Acknowledging that elements in the pictures are or will become obsolete, incorrect, incomplete or generic is a first step toward ensuring that a buying firm does not adhere to rigid and unquestioned maps of the key supplier that may hamper creativity and identification of new opportunities related to key suppliers. A key supplier manager may also be responsible for having an overview of the different business artifacts in which elements of key supplier network pictures are inscribed, for example, supplier contracts,

supplier selection and qualification forms, supplier assessment and measurement schemes or supplier development programs.

The key supplier manager should also be in charge of establishing and posing questions that can lead to updating and revising key supplier network pictures. Based on the rules we suggest for updates and revision, the key supplier manager may reflect on and formulate company-specific rules and questions, and identify recurrent or identifiable occasions where the questions should be addressed in the buying firm.

We suggested four strategies for gaining insight and identifying opportunities in key supplier networks. It would be an important task for the key supplier manager to ensure that a useful mix of strategies is practiced in relation to a key supplier. Knowing how and when the different strategies are practiced may be a major task for a key supplier manager. S(he) should seek to have an overview of: the variety of the buyer's interactions with a key supplier, which new insights are gained, and whether they result in major revisions of the buyer's key supplier network picture. Deliberate systematic search and systematic discovery initiatives are likely to benefit from being organized by a key supplier manager, since these demand some degree of planning and thinking-before-doing. For chance search to be productive, a key supplier manager should be in charge of clarifying upfront which themes are important, so that the representatives of the buying firm know what to be alert to. In addition, the key supplier manager may develop or acquire a system and processes for collecting and collating opportunities found and insights gained regarding key suppliers. When it comes to chance discovery, the main responsibility of a key supplier manager may be to ensure that some of the people that interact with the key supplier have an entrepreneurial attitude and alertness. This has implications for the buying firm's HRM and recruitment criteria and training, since old-school purchasers traditionally have been chosen for their ability to drive hard bargains rather than for their entrepreneurial spirit.

Devising incentive systems that support search for and discovery of new insight and opportunities in key supplier networks may also be an important task for a key supplier manager. In line with continuous improvement systems that measure the number of suggestions for improvement per employee per year, it may be possible to think up a system that rewards identification of new insight and opportunities related to key suppliers. Allocating time and resources to the different strategies, and the different employees who pursue them, may also be a major task for a key supplier manager, as well as assessing whether insight gained and opportunities identified result in cost or value advantages for the buyer. The key supplier manager should also facilitate internal sharing of important new insights related to the key supplier, in order to support the internal amalgamation process among the key supplier network pictures of individual managers in the buying firm. For reasons discussed earlier, we did not explore details of the buyer's internal amalgamative interaction processes in this article; however, this would be an important issue to pursue in future studies.

6.2. Implications for research

The article is based on theory on key supplier management and network pictures, both of which are emerging fields. A particularly interesting avenue for research within KSM is investigating a buying firm's insight into its key suppliers' networks. Two main directions are possible. Firstly, taking a sense-making perspective, one could investigate key supplier network pictures in use, and discuss and explain why the buyer has constructed the pictures they have, and the type of key supplier management they allow for. Secondly, one could opt for a cognitive mapping perspective, and carry out experiments with buyers, with a focus on constructing new network pictures, and developing practices and improving key supplier network management-by-pictures. Further research on network pictures may benefit from study of

the company-crossing and company-internal congruence between (key supplier) network pictures of individual managers and interactive amalgamation related to these pictures. While this would require a leap in conceptual complexity, it could be interesting to consider the possibility of network pictures being more congruent across company boundaries than within them. In terms of method, it is a challenge to investigate network pictures across company boundaries. While we acted the role of mediator, crafting network pictures (with some hidden identities of counterparts), and sharing them with the companies, it would be interesting to carry out joint workshops where the buyer and the supplier interactively developed their network pictures. Finally, while we have concentrated on finding opportunities in, and gaining more insight into, the wider network of key suppliers, future studies may focus on identification of threats, and economizing on network insight and pictures. Combining such studies would potentially provide us with a better understanding of how a buyer's insight into its key suppliers' networks affects the performance of the buying firm, and the key supplier.

Acknowledgments

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Beyond Dyadic Supplier Development Efforts: The Multiple Roles of the Network in Bringing About Supplier Development

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Paper IV

Beyond dyadic supplier development efforts: The multiple roles of the network in bringing about supplier development

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Abstract

Past studies of supplier development have focused on the dyadic relationships between the buyer and its suppliers. However, these dyads do not capture the influence of the network in which the supplier development efforts are embedded. Based on a single case study of a supplier and the supplier development efforts of its six most important customers, we contribute to the literature on supplier development by showing how the network can play a role in supplier development. We propose and discuss three different strategies a buying company can employ in order to develop its suppliers: indirect and peripheral; direct and central; direct and networking. Our findings have managerial implications for buying companies that wish to gain insight into how supplier development can be conducted, for the suppliers that are developed, and for companies in the network to which the supplier development efforts are connected.

Keywords: Supplier development, capabilities, triads, network, SME

1. Introduction

Purchasing and supply management has traditionally been viewed as a support function in firms. However, given the increasing demands of end customers, as well as an increased focus on specialization and outsourcing, there have been pronounced developments in buying activities and the management of supplier relationships. During the last two decades, increasing attention has been paid to the importance of suppliers and, consequently, the importance of managing and developing cooperative supplier relationships (Carlisle & Parker, 1989; Helper, 1991; Ellram, 1995; Lewis, 1995; Dyer, 1996; Gadde, Håkansson & Persson, 2010). The attitude to purchasing has therefore changed towards acknowledging the increasing strategic importance of the supply side of a company's operations and it is widely accepted that companies must seek, build up and maintain relationships with capable suppliers in order to compete and survive (Dyer, 1996)

The increasing importance of suppliers for a company's performance has increased attention to supplier capabilities. Having suppliers with strong capabilities is perceived as key to success and therefore building supplier capabilities through supplier development activities has become strategically important for companies. So far, most studies of supplier development have focused on dyadic relationships between a customer and its suppliers. Furthermore, the supplier development literature has focused on identifying different approaches that a customer can pursue in order to develop its suppliers, e.g. direct and indirect approaches. Only to a very limited degree has research on supplier development investigated and conceptualized the role of the network surrounding the buyer-supplier dyad(s) in bringing about supplier development.

Studies on relationships and networks have shown that "it is troublesome to understand the development of a certain supplier-customer relationship if it is viewed as an isolated phenomenon" (Håkansson & Snehota, 1995, p.3) and that it is beneficial to take into account the larger network of relationships in which it is embedded (Ford, Håkansson & Johanson, 1986). Consequently, based on literature on relationships and networks, one may assume that the network also plays a role in supplier development. Opting for a network perspective on supplier development, in this article we will investigate different strategies that a company may employ to develop its suppliers.

The paper is structured as follows. In Section 2 we review theory on supplier development and theory on networks and triads. Section 3 presents the methodology and the empirical background. In Section 4, the empirical basis is presented, focusing on four buyer-supplier relationships. Section 5 presents the analysis and discussion and, based on these, three different strategies for supplier development are proposed. In the concluding section, we discuss the results of the study and derive implications for further research and for managers.

2. Theoretical basis

2.1 Supplier development

Due to increased specialization and outsourcing, companies increasingly rely on the capabilities and performance of their suppliers. Thus, companies need to pay close attention to the management and development of their suppliers. Research has shown that the value of a supplier – potential or realized – is related to its various capabilities (Möller & Törrönen, 2003), and that the quality of a company's products is ultimately determined by the capabilities of its suppliers (Watts & Hahn, 1993). Möller and Törrönen (2003) propose that suppliers can potentially provide their customers with value propositions in a number of areas based on their distinct capabilities such as production, delivery, and process improvement capabilities; capabilities for incremental as well as radical innovation; relational and networking capabilities; and capabilities for mastering the customer's business. The importance of the suppliers' core capabilities and absorptive capacity, i.e. the supplier's ability to utilize external knowledge, is also discussed by Arroyo-López, Holmen and De Boer (2012) studying supplier development

programs in Mexico.

Acknowledging that relationships with suppliers possessing strong capabilities represent a key to success, many firms are focusing on supplier development to assist suppliers in developing their capabilities. According to Krause, supplier development broadly refers to "any effort by a buying firm to improve a supplier's performance and/or capabilities to meet the buying firm's short- and/or long-term supply needs" (Krause, 1999, p.206). The purpose of supplier development is to improve suppliers' capabilities and enable them to enhance quality, delivery, and timeliness, as well as to reduce the costs of products and services. Supplier development may also stimulate innovation by suppliers to support the customer's sourcing and procurement targets and sustainable development objectives. These improvements may increase suppliers' profitability in addition to providing benefits to their customers.

2.2 Supplier development activities

The concept of supplier development has received considerable attention from researchers (e.g. Leenders, 1989; Lamming, 1996; Hines, 1996; Krause, 1997; Krause & Ellram, 1997; MacDuffie & Helper, 1997; Hines & Rich, 1998; Handfield et al. 2000; Helper & Kiehl, 2004; Sako, 2004; Sánchez-Rodruíguez, Hemsworth & Martínez-Lorente, 2005; Wagner, 2006; 2011; Krause, Handfield & Tyler, 2007; Lu, Lee & Cheng, 2012). Based on research on supplier development, a wide range of supplier development activities have been identified that aim to improve the suppliers' performance and/or capabilities. Krause, Handfield and Scannell (1998) and Krause, Scannell and Calantone (2000) make a distinction between two different approaches towards supplier development. The first includes a reactive approach towards supplier development where a company responds to poor supplier capability and performance. The second is a proactive or strategic approach where supplier performance is improved actively for the long term, to prevent potential problems. Sánchez-Rodruíguez et al. (2005) categorize supplier development activities based on the level of firm involvement and implementation complexity including basic, moderate and advanced supplier development. Basic supplier development includes evaluating supplier performance and providing feedback to suppliers, sourcing from a limited number of suppliers per purchased item, parts standardization, and supplier qualification. Moderate supplier development includes visiting suppliers to assess their facilities, rewarding and recognizing the suppliers' performance improvements, and collaborating with suppliers in materials improvement and certification of suppliers. Advanced supplier development includes measures of training provided to suppliers, suppliers' involvement in the buyer's new product design process, and the suppliers sharing accounting, cost and quality information with the buyer. The application of these approaches depends on the skills, time and resources the buying company has.

Wagner (2006) makes a distinction between direct and indirect supplier development practices. Much of the literature focuses on the first of these, the direct and systematic supplier development practices, emphasizing the active role a buying firm plays in dedicating human and/or capital resources to a specific supplier (e.g. Hartley & Jones, 1997; Krause, 1997; 1999; Krause et al., 2000). Direct supplier development can include activities such as on-site consultation, education and training programmes, temporary personnel transfer, inviting the supplier's personnel to visit the buyer's operations, as well as provision of equipment

and capital to the supplier (Monczka, Trent & Callahan, 1993; Krause, 1997; Krause & Scannel, 2002). Toyota is a frequently used example of a buyer applying a direct, systematic and standardized way of working with its suppliers and building supplier capabilities that benefit both the suppliers and Toyota in the long run (Dyer & Nobeoka, 2000; Nobeoka, Dyer & Madhok, 2002).

In contrast, indirect supplier development occurs when a buying company commits no or limited resources to a specific supplier, and instead offers incentives for or enforces supplier development (Wagner, 2006). Indirect supplier development can be done by assessing suppliers, communicating supplier evaluation results and performance goals, or promising future business (Krause, 1997; Krause et al., 2000). Buying firms use these activities to encourage suppliers to improve with little involvement by the buying firm. According to Prahinski and Benton (2004) and Wagner (2006), indirect supplier development can be associated with improved product and delivery performance, as well as an improved buyer-supplier relationship.

Arroyo-López et al. (2012) argue for the importance of a collaborative and relational learning context in supplier development. They discuss the quality of the buyer-supplier relation as an important factor, and distinguish between high and low involvement in supplier development programs. They claim that "Results suggest that basic and widely used forms of supplier development hardly lead to improved operational and financial performance of suppliers. More demanding and less frequently used forms of supplier development may lead to improved supplier performance given the suppliers have sufficient absorptive capacity and the presence of an adequate collaborative and relational learning context." (Arroyo-López et al., 2012, p. 680). Thus, the interaction between the buyer and the suppliers taking part in supplier development programmes is of vital importance.

Literature on supplier development has traditionally focused on the buyer-supplier dyad. Some research focuses on supplier development of larger supplier networks – i.e. first, second and third tiers of suppliers – for example studies by Hines (1996), Hines and Rich (1998) and Dyer and Nobeoka (2000) of Toyota and its supplier associations. However, very little research on supplier development has investigated and conceptualized the role of the network surrounding the dyad in bringing about supplier development.

2.3 Towards a network view on supplier development

In research on supplier development, efforts to develop suppliers are placed at centre stage and the relationship in which the supplier development efforts take place is conceptualized as a contextual variable. Other lines of research, however, bring the relationship to the fore, and treat efforts at developing the supplier's performance and capabilities as one of many types of efforts made in order to improve the relationship between the supplier and the buyer. In literature on relationships and networks, such as the IMP literature, supplier development has hitherto not been extensively discussed as a theme in its own right. However, in buyer-supplier relationships, different types of supplier development activities are seen to take place. Firstly, IMP literature emphasizes that capabilities are interactively developed and adapted across episodes in relationships over time (Håkansson & Snehota, 1995; Rosenbröijer, 1998; Brennan & Turnbull, 1999). To develop and adapt capabilities, close interaction between the customer and the supplier is important.

This interaction enables the two actors to appreciate each other's needs and capabilities, so that they can adapt their needs and match their capabilities accordingly. The interactive nature of capability development means, however, that the supplier also plays an active role in the creation of its capabilities, and is not only a passive recipient of the customer's supplier development efforts. A supplier can focus on developing the areas in which its capabilities are weak or underdeveloped, thus arming it with greater power to act to change the nature of its relationships with its customers and establish a stronger position within them (Johnsen, 2005). On the other hand, a supplier's customer relationships may control or restrict the development of its capabilities. For example, overly detailed directions by a specific customer can make it difficult for the supplier to use and develop its capabilities in a way that fits well with the supplier's total set of customers and their requirements. Such instructions may also prevent the supplier from using its experiences from other relationships and may thus hinder the exploitation of knowledge gained from its interaction with other customers (Araujo, Dubois & Gadde, 1999).

From an IMP perspective, buyer-supplier relationships are built up over time by interaction and mutual adaptations across multiple episodes. Viewing supplier development in this context, we suggest that (a) these episodes may comprise supplier development efforts that are formal and/or informal; indirect and/or direct; basic, moderate and/or advanced; as well as proactive, reactive and interactive and (b) that such episodes may result in adaptations of the supplier's capabilities and its performance.

2.4 Networks, connections and triads

As mentioned earlier, what happens in a focal relationship is affected by other relationships in the surrounding network to which the focal relationship is connected (Anderson, Håkansson & Johanson, 1994; Håkansson & Snehota, 1995). Frameworks for analysing the interconnectedness of relationships have been developed (Ritter, 2000). To study and discuss how the network can affect the supplier development that takes place in a dyad, we may rely on the concept of a triad. A triad is a set of three actors and the potential ties between them. It is thus the smallest unit of analysis that allows us to study connected relationships (Cook & Emerson, 1984). Blankenburg (1992) and Laage-Hellman (1989) claim that it is useful to study connected relationships within triads because of the possibility to delimit network phenomena in different ways. "The addition of a third actor represents a leap-wise increase in complexity which makes it possible, in a simplified way, to analyse connections and other network phenomena which cannot be handled in the received interaction model" (Laage-Hellman, 1989, p. 31). A number of studies have used the concept of triads to study various network phenomena, such as Laage-Hellman (1989), Blankenburg (1992) and Havila (1996).

Building on these early studies of triads, business researchers have analysed triadic supplier relationships to tackle greater complexity in supply network structures and dynamics. In research on the development of supplier relationships, Pedersen (1996) investigated how these relationships were affected by different relationships connected either via the focal firm or via the respective suppliers. Wu and Choi (2005) and Wu, Choi and Rungtusanatham (2010) studied supplier-supplier relationships in the triadic context of the buyer-supplier-supplier triad. Dubois and Fredriksson (2008) studied a buyer's interaction with two suppliers with overlapping capabilities and identified a particular type of sourcing called "triadic sourcing". Rosetti and Choi (2008) investigated a triad across three tiers of supply chain. In this context the buyer interacts with its customer and its supplier, and "supply chain disintermediation" occurs between the customer and the supplier. Choi and Kim (2008) studied the dynamics within a triad consisting of a focal buyer, a supplier and another buyer. Peng et al. (2010) studied the phenomenon of triads within supply networks and investigated how different triadic structures affect a focal company's perceived cooperative performance. According to these researchers, a triadic framework offers supply chain researchers an expanded vocabulary to describe a complex relationship that is absent if they are confined within the one-to-one dyadic discussion (Choi & Wu, 2009). Madhavan, Gnyawali and He (2004) further argue that triad-level analysis is critical, because the triad occupies an intermediate level in network analysis, which represents a valuable layer of meaning, since dyads are embedded in triads.

2.5 Triads, and how connections can affect capabilities

Most studies on triads have not paid explicit attention to the development of capabilities. One exception is Rosenbröijer (1998), stating that a company's capabilities can be developed internally but more often are a result of continuous confrontation processes in and across its relationships. Aided by the concept of triads, he suggests that "every firm is always in a capability connector position" (Rosenbröijer, 1998, p.238). In a similar vein, Gadde et al. (2010) propose that a supplier's capability development results from combining the capabilities from the focal buyer-supplier relationship with resources in other relationships of the supplier. For example, a supplier can develop its capabilities through the combining of one of its own resources with a resource of a specific buyer and a resource of one particular vendor of the supplier. The same potential for capability development can be identified on the buying side. A specific capability of the supplier can be tied to some specific capability of the buying company which, in turn, may be tied to a third capability of a customer or another supplier of the buying firm. In the long term, with well-developed and significant relationships, the total potential for all these opportunities for combining is huge, which "creates a need for systematic and structured approaches" (Gadde et al. 2010, p. 162).

If capability development can result from connections across relationships, an important issue becomes how such connections are brought about. In a study of network horizons, Holmen and Pedersen (2003) introduced three ways in which a company can mediate between a focal counterpart and third parties. By performing a joining function, the company enables direct coordination between a focal counterpart and a third party. By performing a relating function, a company enables coordination between a focal counterpart and a third party via the company. Finally, by performing an insulating function, a company enables coordination between a focal counterpart and a third party without them having any knowledge of each other. A similar issue is addressed by Shipilov and Li (2012, p. 475) suggesting that in interorganizational business networks, insulating, relating and joining functions come about and (may) persist for other reasons than they do in interpersonal networks where a third party is expected to always join its counterparts to reduce psychological imbalances from experiencing disconnections.

2.6 Framework and research questions

In order to explore the role of the network in bringing about supplier development, we rely on triads as a means to introduce third parties to a focal buyer-supplier relationship. Analysis of different triads is thereby used as a systematic approach to identify the effects of connected dyads in supplier development. In accordance with previous network studies, this paper views individual relationships as specifically embedded in triads which, in turn, are embedded in the wider network (Dubois, 2009).

Furthermore, to study how third parties affect or become involved in supplier development, we use the three mediating functions discussed above. In line with the interactive view, we recognise that in processes of supplier development, it is conceivable that the supplier as well as the buying company can perform any of these mediating functions in order to connect the surrounding network to the supplier development efforts at hand.

Based on these underpinnings, we aim to contribute to literature on supplier development by scrutinising the role(s) of the network in bringing about supplier development. Accordingly, our research question is twofold:

(1)   How do companies activate third parties in the wider network in order to bring about supplier development?

(2)   What are the managerial implications for the buying company, the supplier, and the third parties, which are or become involved in supplier development efforts embedded in a network context?

3. Methodology and empirical background

The empirical data underlying this article consists of a single embedded case study (Eisenhardt, 1989; Yin, 1989; 1994; Ragin, 1992; Dubois & Gadde, 2002; Dubois & Araujo, 2004; 2007), which takes six buying companies and their relationships with one common supplier as the point of departure. Typically, the case study method is regarded as advantageous when the phenomenon studied is complex and difficult to separate from its environment (Yin, 1989), which is certainly the situation for this study. The empirical basis was built up through several rounds of inquiry. First, a study of the six buying companies and their surrounding business networks was conducted as part of a large project in 2008 involving a local industrial cluster. At the time of this large project, the cluster consisted of 10 member companies. The project focused on the companies participating in this cluster and their surrounding business networks. By mapping the networks of these companies, the researchers found that the companies had some relationships to common buyers, suppliers or horizontal actors. Most of the common relationships were found on the supplier side. A supplier that many (six) of the companies had in common, and that was also mentioned as very important, was an electronics subcontractor, named Electra. The relationships between the six customers and Electra were chosen as a starting point for further study.

Second, interviews have been conducted at Electra in order to gain an understanding of its view of its relationship with these six buying companies, the buying companies' strategies, supplier development efforts, level of involvement, etc. The interviews at Electra took place in the summer 2010 and involved three researchers and the general manager and marketing manager of Electra. A guided tour of the plant was also arranged for the researchers.

Third, interviews with the six buying companies were conducted in the autumn 2010. These interviews focused on the six buying companies' purchasing strategies in general and specifically on their supplier development strategy and management of Electra. The interviews involved one researcher and engineers, operation and production managers and purchasing managers at the buying companies. The interviewees are key decision makers for purchasing in relation to Electra. At five of the companies, one informant was interviewed, whereas at one company a group interview was conducted with three informants. All interviews were conducted face-to-face, following a semi-structured interview guide. The interview guide consisted of four sections. In the first section, the informants were invited to describe themselves and their background at the company. In the second section, the informants were asked to describe the company they work for (i.e. the different departments, number of employees, the company's products and core competence of company, etc.). Particular attention was paid to describing how the company manages projects and how the departments cooperate in projects. In the third section, the informants were asked to describe the company's supplier strategy. Here the most important suppliers of the company were mentioned as well as the company's sourcing strategies, supplier development strategies and cooperation with suppliers in general. The final and most comprehensive section focused on the company's relationship with Electra. The informants were asked to describe how the relationship has evolved over time and how it is today. Much attention was paid to understanding in detail the interaction pattern between the two companies. To facilitate the process, participants were asked to describe some products where Electra delivers significant parts, which in turn allowed the interviewees to describe activities between the supplier and the buying company. Examples of themes that were discussed are supplier development strategies, competences used and developed in interaction, product development with the supplier, adaptations in the relationship and coordination with other actors in the supply network. On average, interviews lasted one and a half to two hours. With the interviewees' consent, the interviews were recorded to prevent missing essential information. The procedure of every interview involved transcribing it and submitting it to the interviewee for further comments, corrections, and potential removal of sensitive information. This part of the procedure was also clearly described prior to the interview, and is believed to have made the interviewees more confident with respect to discussing potentially confidential matters. In addition, follow-up telephone interviews on a few selected topics were conducted with three of the buying companies. These interviews were important in clearing up a few details as well as providing additional insight.

Overall, the paper is based on extensive empirical material. Some of the material is older and was collected for other purposes. Some of the material is recent and was collected specifically for the purpose of the present paper. The study has followed the procedure of systematic combining (Dubois & Gadde, 2002) where the empirical material and theory have influenced each other over time. The theoretical foundation and the research question have therefore been shaped, reformulated, and refined throughout the collection of the empirical data.

Figure 1 is an illustration of a network involving the most important actors connected to the six buying companies and the supplier Electra. The network forms an interesting starting point for studying supplier development in a network context because it provides an opportunity to investigate different strategies a company may employ in order to develop a
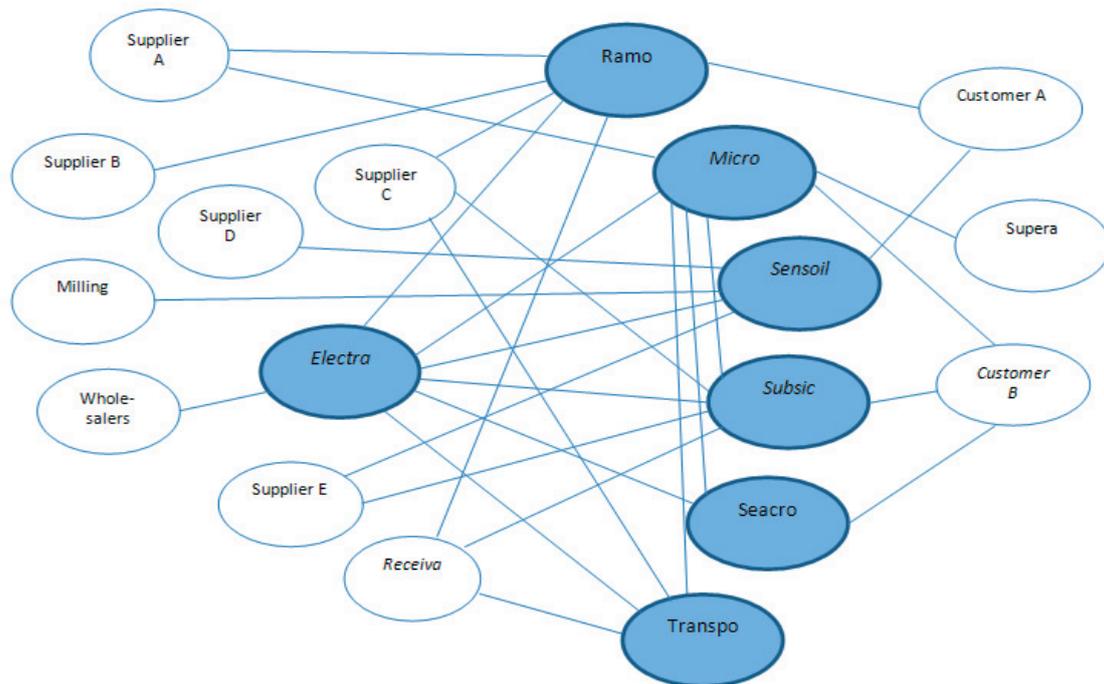
*Figure 1: The network surrounding Electra and the six buying companies. *The companies with names in italics are still a part of the industrial cluster initiative.*

supplier. By focusing on one supplier, we are able to study how this supplier can be developed by being exposed to different network strategies and we can compare the different strategies. Conceptual saturation was reached with a total of four out of the six buyer-supplier relationships. In the rest of the article, the focus is on data collected on these four relationships. According to Glaser and Strauss (1967), theoretical saturation is simply the point at which incremental learning is minimal because the researchers are observing phenomena seen before. In other words, the descriptions, explanations and strategies employed were repetitive, which allowed us to identify common patterns across the relationships studied.

Before going into details of the buyer-supplier relationships, we should mention that the industrial cluster has changed its member companies since 2008, and has also changed during the writing of this article. Of the original 10 member companies, three companies are no longer a part of the cluster, and many more have joined. The industrial cluster now consists of 26 member companies. We have indicated in Figure 1 which companies that are still a part of the cluster. Even though the number of members in the cluster has changed, the involved companies have not made any changes in their patterns of sales and purchases. Their relationships remain despite the formal changes in the cluster.

As mentioned earlier, this article focuses on how a company can activate third parties in the wider network in order to bring about supplier development. To study this, the focus is held on different types of triads involving interdependence between the supplier Electra, one of the four buying companies and various third actors and their relationships. In sum, the paper relies on an extensive set of data regarding the buying companies' interaction with Electra and their use of third actors. The data focused on the content and function of the relationships among three actors and was continuously analysed through the use of theory on supplier development and capability development in networks.

4. Empirical basis

In the following, we will present the supplier Electra before we present four buyer-supplier relationships. The description will focus on how the relationships have evolved and how the supplier's capabilities have been developed by interacting with the different buyers as well as third parties.

4.1 Electra

Electra was incorporated in 1990 as a continuation of a company that produced mobile phones. Electra is located in central Norway and has around 30 employees. The company has grown rapidly since its establishment and had revenue of 11 million Euro in 2009. Being specialized in wireless products in the electronics industry, Electra provides a variety of circuit boards and other products related to remote control and monitoring equipment. Electra's competences range from purchasing and production to making prototypes and industrializing them for serial production. Through a 50% ownership in a development house, Electra also offers product development services. The four main segments to which Electra delivers circuit board assemblies are offshore/ marine, defence, industrial, and medical. About 90% of the sales are related to local customers. Traditionally, Electra has had a small number of customers that have constituted a very large share of the turnover. A handful of customers may therefore account for 90-95% of the turnover. Electra manages its present customer relationships through key account managers who have a combined purchasing and customer-contact role. The key account managers need to keep control of the customers' requirements as well as what the component suppliers can deliver. In addition, they have responsibility for maintaining the dialogue

with the customer and for following the process from prototype development to full production. Having employees with this type of responsibility is regarded as vital to Electra's success. The key account managers handle the day-to-day communication, while the sales representative meets the customers on a regular basis. The sales representative deals with business strategies and long-term planning.

4.2 Relationship I: Ramo - Electra

Ramo, established in 1984, develops and produces radio remote control systems for the offshore, mining, maritime and process industries. Ramo has 48 employees and is part of a larger corporate group. As of today, Ramo does not have an established supplier strategy. The company has experienced rapid growth in the past few years, and procedures and strategies have not been updated in line with this growth. The company does, however, divide its suppliers into two categories, A and B, where category A comprises strategically important suppliers with which Ramo tries to have partnerships and form framework agreements. Category B suppliers are also important, but not to the extent where close partnerships are needed. Ramo aims to have dual sourcing for both category A and B suppliers.

Custom-made electronics are among the most critical products for Ramo and cannot simply be "shopped from the market". Such electronic parts would mainly consist of different types of circuit boards. Ramo's largest supplier of circuit boards is Electra, which provides Ramo mainly with circuit boards related to radio units. The relationship between Ramo and Electra has lasted for about 14 years. Approximately ten people from Ramo have continuous contact with approximately seven people from Electra. The two companies have a very good and trusting relationship and refer to each other as "cooperating partners". Although Ramo aims to have dual sourcing for its category A and B suppliers, Electra is Ramo's only source of electronics related to transmission units. According to Ramo, it would be very complicated to switch from Electra to another supplier or even to use a second source. One of the reasons for this is the extensive documentation that has been built up over the years. This documentation includes production drawings, which might not be completely accurate because of the many changes in the product that have taken place from discussions over the phone and e-mails. As a result, in certain cases the production drawings at Electra may be different from the production drawings at Ramo. It will therefore be very difficult to transfer the exact documentation to someone else.

Ramo is dependent on a number of Electra's capabilities. The most important of these capabilities would include knowledge in radiotechnology, high flexibility and short delivery time, ability and interest in doing new things, production in line with the ISO-standard, the ability to ask critical questions, and testing capabilities. Electra's competence regarding components is also important for Ramo. Ramo involves Electra when developing new products in order to discuss different solutions and to get Electra's perspective on components used as well as the design and placement of components. To stay updated on components in order to be well prepared for its customers' requests, Electra makes use of its relationship with wholesalers. The wholesalers possess important knowledge regarding components, which is very useful for Electra. Ramo encourages Electra's relationship with the wholesalers as Ramo sees that Electra develops its competence from these relationships.

In different ways, Ramo has also contributed to developing Electra's competences. As Ramo's core competence is within radiotechnology, this is the area where Ramo has influenced Electra the most. Electra reports that it has been able to acquire new customers based on the radiotechnology capabilities built into the relationship with Ramo. Further, Ramo has contributed to building Electra's capabilities in producing products for the oil and gas industry, where safety requirements are very high. Products that are safe to use in potentially hazardous environments where explosions can occur ("Ex"-products) are essential in this industry. Ramo needed such products for its customers and strongly influenced Electra to invest in equipment to produce Ex-approved products. For Electra, producing Ex-products meant a different way to design and test components. Another way in which Ramo contributes to Electra's development is by transferring knowledge acquired in its other supplier relationships. In particular, Ramo's relationship with the circuit board supplier Receiva has been important in this respect. Receiva and Electra supply Ramo with circuit boards for different purposes. Receiva supplies electronics for the receiving units whereas Electra supplies electronics for the transmission units. This differentiation is well suited for the core competences of the two suppliers. Combining the technologies from the two suppliers is seen by Ramo as its core competence and therefore something it wishes to control. Ramo therefore finds it beneficial to control the information it shares with the two suppliers, especially what type of information should be transferred between the suppliers. Ramo sees both suppliers as strategic and long-term business partners.

4.3 Relationship II: Micro - Electra

Micro was established in 1995 and has 28 employees. Micro develops industrial electronics for a wide range of industries, for example offshore and defence. Micro has no in-house production; however, it manages production at its suppliers and conducts final testing of products before they are shipped to the customers. Micro's main competence is Original Design Manufacturing (ODM) focused on radio-related products and microwave technology. Micro does not have a clearly defined supplier strategy or an official way of classifying its suppliers. However, over the years a strategy of managing the most important suppliers as partners has developed. Micro finds that certain aspects of a buyer-supplier relationship become so intertwined after some time, that it becomes difficult to switch suppliers. Micro aims to have dual sourcing of its suppliers, but the company has found it difficult to achieve this because it needs to interact very closely with all its suppliers, due to the complexity of its products. In practice, therefore, Micro mainly uses single-source supply. Even though Micro does not have an established supplier development programme, it has just started doing supplier evaluations, as part of the requirements for ISO certification. These supplier evaluations include a meeting with the supplier where both parties can learn from each other. The main goal of these meetings is finding ways of reducing errors in production.

Custom-made electronics are very important parts of Micro's products and Electra has been Micro's main supplier for these electronic parts for about 15 years. In accordance with Micro's other supplier relationships, Electra is a single source for these parts. About ten people in Micro have continuous contact with about ten people in Electra. The direct person-to-person dialogue is very important because Micro does not have its own purchasing department; instead, every employee is responsible

for making purchases related to his or her own projects. Certain aspects of the products are too complex to be described in the production drawings in detail, which makes Micro highly dependent on the people in Electra who have acquired that knowledge. The relationship between the two companies has become so interconnected over the years with such a high degree of involvement and established routines that they compare their relationship to a marriage.

Capabilities of Electra that are important for Micro include knowledge in radiotechnology and flexibility. Micro emphasizes Electra's ability to make rapid changes and find suitable solutions. Production capabilities of Electra that Micro finds very important include the ability to do final assembly, and the ability to switch quickly from prototyping to full production. Even though Micro does not have a formal way of developing Electra's capabilities, Micro believes it contributes to this development through the daily interaction with Electra. Also, by interacting with other actors in the network, Micro contributes to developing Electra's competences. Especially through involvement with one of its largest customers (Supera), Micro has been able to influence the development of Electra. Supera has high demands in terms of quality, which has contributed to boosting both Micro's and Electra's work on quality. In recent years, Micro has taken on larger and larger tasks for Supera and now delivers development and supply of complete systems. In most of its deliveries to Supera, Micro has used Electra as a supplier of circuit boards. Through working closely with Supera, Micro has been able to develop competence that it has subsequently been able to transfer to the relationship with Electra. In particular, this competence has been related to procedures and methods for increasing quality as well as how to be more specific in connection with product requirements and precision in delivery.

4.4 Relationship III: Sensoil - Electra

Sensoil develops and produces sensors for production optimization in the oil industry. Sensoil became a part of a large American group with 120 000 employees in 2008. Sensoil, which is situated in central Norway, has 70 employees. Sensoil does not have a formal supplier strategy. However, it primarily wants dual sourcing of every product. This has proved difficult to achieve in practice, and very often Sensoil uses single sources for its products, especially for electronic products.

Electra has been a supplier to Sensoil for 20 years. The two companies have developed many products together and have a close relationship. About nine people in Sensoil have regular contact with around five people in Electra. Sensoil uses Electra as a single source of circuit boards. Many of the products that Electra delivers to Sensoil have been developed in cooperation between the two companies. Sensoil is satisfied with Electra as a supplier and finds no reason to investigate other sources of supply. The two companies sign a framework agreement for one year at a time, which ensures higher predictability when it comes to forecasts. Sensoil would have preferred to sign an agreement for more than one year, but the parent company does not permit such long-term agreements.

Electra both produces single circuit boards and performs final assembly for Sensoil. The single circuit boards are tested at Sensoil before being assembled into a final product, whereas the products that are assembled at Electra can be tested there before being shipped to Sensoil's customers. When developing new products, Electra is involved at an early stage to check availability of components and to help with the design of the

circuit boards. Electra finds it very important to be involved early in the production process and encourages this.

Because of their long and cooperative relationships, Sensoil and Electra have made many adaptations to each other. One key adaptation has been a particular type of testing equipment that Electra developed especially to meet Sensoil's needs. This testing equipment, called ESS (Environmental Stress Screening) was a very large investment for Electra. In the first years after this investment, Sensoil was the only user of this equipment; however, some other customers started using it after some time.

As Electra is such an important supplier for Sensoil, many of Electra's capabilities are of great importance. Examples include Electra's short delivery time, high flexibility and ability to be early involved in product development. In addition, being able to do final assembly, producing Ex-approved products and the ability to do ESS testing are capabilities that are very important for Sensoil. Sensoil has been involved in developing some of these capabilities at Electra, but has left other capabilities to others to develop. As an example, Electra's competence in producing Ex-approved products has mainly been developed in the relationship between Electra and Ramo. Based on Electra's competence in Ex-production, mainly developed through the relationship with Ramo, Sensoil has been able to offer its customers Ex-approved products.

By connecting Electra and some of its other suppliers, Sensoil has influenced Electra's development in some areas. One example is projects where Sensoil encourages Electra to work with Sensoil's supplier, Milling. Milling is a supplier of hardware products that combined with the circuit boards produced by Electra are vital parts of the final product. Electra and Milling therefore need to coordinate their efforts in order to produce the final product for Sensoil. Because the products are to be used in a subsea setting, everything needs to be clearly documented according to the stringent requirements for subsea products. The quality and testing of the products are also highly important. Sensoil needs to make use of the competences of both its suppliers as well as managing them in relation to each other, and it encourages Electra and Milling to discuss potential problems and solutions. The cooperation between the three companies has been central to developing Electra's competences in working with hardware suppliers and finalizing products for end-users.

4.5 Relationship IV: Subsic - Electra

Subsic develops subsea instrumentation, communication and control systems. It has 20 employees. Since 2007, Subsic has been part of a large American corporation. Subsic does not have an established supplier strategy. The parent company has expectations regarding dual sourcing, but Subsic finds it difficult to achieve this in practice, mostly because of the low volumes of purchases. The suppliers with the most advanced products are classified as "key suppliers" and Subsic strives to develop closer relationships with these suppliers. Subsic does not have any formal supplier development programmes. The parent company does have such programs, however, and Subsic believes that it will be forced to implement such programmes as a part of the corporate strategy.

Subsic is dependent on electronic parts in its products. Its main supplier of such parts is Electra, which has been a supplier of Subsic for about 15 years. Electra has been a single source for Subsic throughout this period, but Subsic has started to explore alternative sources. The reasons for this are requests from the

parent company, which wants Subsic to use a dual or parallel foreign source. Subsic, however, considers it important to use a local supplier that it knows well and that can develop in line with Subsic's needs. About four people in Subsic have regular contact with about three people in Electra.

Subsic clearly specifies the part number and manufacturer of the components that it wants Electra to buy and use for the circuit boards. During the development of new products, Electra is involved in order to make suggestions for changes. Most of the products that Electra produces for Subsic are assembled at Electra, tested, and sent directly to Subsic's customers. Electra has adapted some of its testing equipment to match Subsic's needs. The capabilities of Electra that are most important for Subsic are its radio capability, short delivery time, flexibility, and ability to handle requirements for high quality. Subsic also depend on Electra's ability to do final assembly of products, complete testing, and deliver products with ESS approval. Subsic does not contribute to Electra's capability development in any formal way, but believes that they contribute to this development informally through continuous interaction. For example, Subsic has spent some time on developing testing programmes in cooperation with Electra in order to reduce costs and time spent on testing.

In addition, Subsic contributes to developing Electra's capabilities through its relationship with Micro, one of Electra's other customers. Both Subsic and Micro use Electra as an important source of circuit boards, and the two companies have been able to coordinate some processes related to their joint relationship with Electra. The two companies have coordinated some supplier development efforts with regard to Electra, both in terms of encouraging an expansion of the production volume and in improving routines for early involvement in product development. Due to the cooperation between Subsic and Micro, Subsic has used Micro as a consultant when developing new products. Subsic has also hired a former Micro employee. The relationship between Subsic and Micro and their joint relationship with Electra has resulted in knowledge that has influenced and developed Electra's capabilities.

5. Analysis and discussion

In this section, we present our findings from the systematic combining of theory on supplier development, triads and mediating functions and the case study. As discussed earlier, the triads are essentially a manifestation of broader, networking-based forms of supplier development. We propose three different strategies that companies may employ for bringing about supplier development; see Table 1. Each of the strategies comprises two alternative configurations. The table thus contains six different triads that capture the different roles the network can play in supplier development. In the following subsections, we shall discuss each of the different strategies for supplier development in a network context. In line with previous studies on supplier development that focus on the buyer as the prime instigator or mover of the efforts, we have structured the strategies in relation to the buying company as the focal actor employing the strategies in the triads.

5.1 Indirect and peripheral supplier development strategy

From the case study, we can identify two different approaches

employed by the buying companies when using an indirect and peripheral supplier development strategy, illustrated in figures (a) and (b) in Table 1.

5.1.1 The supplier performing a relating function

The supplier development strategy illustrated in Figure (a) describes a situation where Sensoil relies on one of Electra's other customers to develop Electra's capabilities. Ramo has been heavily involved in developing Electra's capabilities in producing Ex-classified products. These capabilities are important for Sensoil; however, Sensoil has been able to utilize Electra's capabilities in this area to its own benefit without being actively involved in developing them. Sensoil has stressed the need for Electra to develop such capabilities and, thereby, it has influenced the development, but it has left it to Electra to bring about the required development "on its own". In this supplier development strategy, the focal buying company takes on a role that is indirect and peripheral, leaving it to the supplier to get assistance from its other counterparts. This can be an efficient strategy when the supplier delivers components that are identical and/or similar to other companies that rely on the same capabilities, as is the case with Sensoil and Ramo. In this particular case, Electra performs a "relating function" in order to transfer relevant knowledge from one relationship to the other. As such, Sensoil is aware of which other customer Electra relies on when developing the required capabilities; however, this is mainly due to Sensoil and Ramo being part of the same cluster, and neither being each other's customer, supplier or competitor. In effect, the capabilities are developed with hardly any involvement of Sensoil, and thus the mediating function performed by Electra comes close to resembling an insulating function. By letting Electra develop its capabilities in cooperation with Ramo, Sensoil gives up some control over Electra's capability development but, on the other hand, if these efforts prove fruitful, Sensoil will have gained the positive effects without having invested much in Electra's capability development.

5.1.2 The supplier performing an insulating function

The other example we have of an indirect and peripheral supplier development strategy is illustrated in Figure (b), which describes a situation where Ramo relies one of Electra's suppliers – in this case a wholesaler of components – to develop Electra's capabilities. The wholesaler possesses important knowledge that Ramo lacks and therefore the wholesaler is in a much better position to transfer this knowledge to Electra. The wholesaler has been heavily involved in developing Electra's knowledge and capabilities regarding components. This includes knowledge of component functionality, as well as capabilities in component use and in design and circuit board use. Having a supplier with such knowledge is important for Ramo, as this knowledge can be utilized in the design and development of new products. Even though Ramo finds it important and encourages Electra to develop its capabilities in interaction with the wholesaler, Ramo is not aware of who this wholesaler is and has no intention of intervening in the relationship between Electra and the wholesaler. Ramo only knows that the wholesaler is large and possesses much knowledge regarding components. Electra can therefore be said to perform an "insulating function" in this situation, meaning that Ramo does not need to investigate further who the wholesaler is or spend resources on developing Electra's capabilities. In this situation, Electra needs to function

Table 1: Strategies for supplier development in a network context

as a bridge between the wholesaler and Ramo and to transfer relevant knowledge between the two relationships. By letting the unknown wholesaler develop Electra's capabilities, Ramo accepts giving up some control over Electra's capability development, and Ramo must trust that Electra is able to take care of Ramo's interests while developing its capabilities together with the wholesaler. If these efforts prove fruitful, Ramo will have gained the positive effects without having invested much in Electra's capability development.

5.1.3 Implications for the buyer, for the supplier, and for the third party

By pursuing an indirect and peripheral strategy for supplier development, a buying company can capitalize on capabilities developed elsewhere in the network without having to spend substantial resources on this development. The buying company may advise or encourage the supplier to develop a certain capability and improve its performance, or inform the supplier of the consequences of not developing the capability or improving its performance, but the buying company leaves it to the supplier

to find a way to develop this capability by using or developing its surrounding network. Hence, the focal buyer relies on the supplier already having suppliers, customers and/or other parties in its network that are able and willing to help the supplier make the required improvements. Alternatively, the focal buyer relies on the supplier being able to find and establish relationships to parties that can assist it in developing the required capabilities. In this situation, the focal buyer takes on a peripheral role in the triad. By relying on a third party to build the supplier's capabilities, the buying company misses out on possible nonlinear effects that could have arisen from direct interaction between the buying company and the third actor, and it gives up some control over the capability development process. A direct relationship between the focal buyer and the third party might have created knowledge and insights that could have contributed to better development of the supplier's capabilities in line with the buying company's requirements.

Being in a network where a focal buying company employs an indirect and peripheral supplier development strategy can provide the supplier with both benefits and challenges. The supplier is given much freedom to develop its competences in a

direction that it finds useful without being dictated by the buying company. As such, the supplier can take on a much more active role and it is free to discuss with third parties the particulars of the capabilities to be built. The supplier can take more control of its own capability development, and it may find it easier to redeploy knowledge from one relationship to the other because the buying company does not actively engage in or interfere with the knowledge transfers and creation. Thereby, the supplier may ensure that the capabilities it develops can be useful in many of its relationships. A risk of this strategy is that the supplier may develop capabilities that turn out not to be in line with the buying company's requirements, since the supplier may be unsure of the directions in which to develop its capabilities because the buyer is not actively and directly involved. In addition, possibilities for supplier development may be missed, due to the buying company taking an indirect approach and peripheral role.

The third party may be unaware that it is being used for developing capabilities at the supplier as required by a focal customer of the supplier. However, being involved in developing the supplier's capabilities may be seen by a third party as an opportunity. In Figure (a), it may appreciate that more attention will be paid to its requirements than those of the supplier's other customers. Alternatively, in Figure (b), it may see it as an opportunity to develop the supplier so that it will generate more business for itself and, in turn, for the supplier. However, since the third party will bear much of the cost involved in developing the supplier's capabilities, it may refrain from participating or may reduce its involvement according to the (future) benefits it expects to gain from the relationship to the supplier. The third party may also appreciate knowing which customer(s) of the supplier the capability development concerns, in case it already has a relationship to the customer or alternatively, in case the third party anticipates deleterious and/or constructive effects in the wider network from assisting the supplier in developing capabilities for particular customers.

5.2 Direct and central supplier development strategy

In the case study, we have identified two different approaches employed by the buying companies when using a direct and central supplier development strategy, as illustrated in Table 1, figures (c) and (d).

5.2.1 The buyer performing a relating function

The supplier development strategy illustrated in Figure (c) describes a situation where Micro is actively involved in developing Electra's competences by transferring knowledge developed in the relationship with its own customer Supera. The particular knowledge developed in the relationship between Micro and Supera that has influenced Electra's capabilities concerns procedures and methods for improving quality as well as how to be more explicit and unequivocal in communicating requirements and specifications for products and for deliveries. In this situation, Micro has performed a "relating function" by translating and sorting information from its relationship with Supera to its relationship with Electra. This has been beneficial for Micro, as it has been able to shape and influence the development of Electra's capabilities to fit its own needs as well as the needs of the end-user. Knowing that the capabilities developed are in line with the end-user's needs also makes Electra more confident in participating in the development efforts. This strategy can, however, be challenging for the supplier if the end-user has very

specific needs and wants the supplier to develop in a direction that is incompatible with the supplier's other relationships.

5.2.2 The buyer performing an insulating function

The supplier development strategy illustrated in Figure (d) describes a situation where Ramo is actively involved in developing Electra's competences by using knowledge developed in a relationship with another supplier (Receiva) and transferring this to Electra. Both Receiva and Electra supply circuit boards to Ramo. The circuit boards are used by Ramo for different purposes and products as Receiva supplies electronics for the receiving units whereas Electra for the sending units. Still, Receiva and Electra possess many of the same capabilities, and some aspects of competition are present in the horizontal relationship between Electra and Receiva who are both involved in the same local cluster. By using this strategy, Ramo makes use of knowledge developed in its relationship with Receiva and transfers relevant knowledge to Electra, thus contributing to building Electra's capabilities. By performing what mostly resembles an "insulating function" between two fairly similar suppliers, Ramo ensures that it has access to comparable capabilities and technology from two sources and that it can initiate supplier development at either supplier when deemed necessary. However, since the suppliers are part of the same cluster, the insulating function may turn into a relating one, requiring the suppliers to accept the buying company's approach to supplier development. If there are large differences between the two suppliers and in the amount of effort they respectively spend on developing their capabilities, and the transfer of capabilities is mainly in one direction, it may cause friction in one or both of the relationships to the suppliers. Another challenge with this strategy may be to find a balance between developing the suppliers' capabilities to become more alike while, at the same time, maintaining the two suppliers' uniqueness. Advantages for Electra are that Ramo is actively engaging in supplier development activities that ensure that the capabilities are developed in accordance with Ramo's needs. The danger is that the capabilities developed can be too specifically related to Ramo and not easily redeployed to other customer relationships. Furthermore, the supplier may risk losing some of its distinctiveness and uniqueness by becoming more similar to a competitor.

5.2.3 Implications for the buyer, for the supplier, and for the third party

By pursuing a direct and central supplier development strategy, a buying company is in a position to actively influence and control the development of a supplier. In this situation, the buying company takes on a central role by connecting two actors that may not earlier have been connected, or by influencing an existing relationship between two actors that have not previously seen it as advantageous to have their efforts at capability development connected. Pursuing this strategy, the buyer relies on having in its network customers and/or suppliers that are able and willing to directly assist the buyer in developing knowledge and capabilities and/or that see benefits in allowing the buyer to transfer them to its (other) suppliers. The strategy allows the buying company to select the parts of the knowledge developed with a third party that the buyer finds particularly relevant and transfer to the supplier, thus influencing the development of the supplier's capabilities. The selecting and transfer may be

best handled by the buying company and it can therefore be uneconomical for the supplier to have direct contact with the third party.

When the buying company pursues a direct and central supplier development strategy, the supplier can be more confident that the capabilities being developed are in line with the buyer's requirements. This may make the supplier more willing to take part in the supplier development activities directed by the buying company. From the supplier's perspective, however, a possible drawback of this strategy is that the capabilities developed are too specific and not transferable to other customer relationships of the supplier. Another possible downside can be that opportunities are missed because of the lack of connection between the supplier and the third party. If the supplier and the third party had engaged in direct interaction, the two parties might have been able to create knowledge to build the supplier's capabilities that the buying company could have perceived as useful.

For the third party, it may be viewed as beneficial and/ or detrimental that the buying company pursues a direct and central strategy when developing its suppliers. However, this would depend on the substance of the relationship between the supplier and the third party. If the third party is a customer or a complementary supplier it may be viewed as positive that the buyer performs a relating function between the third party and the supplier. However, in cases where the third party and the supplier are partly competing for the buying company's business, it may be more of a challenge to get the consent of the third party to perform a relating function. This may also be a reason why a buying company may opt for performing an insulating function in cases such as these. Furthermore, the attitude of the third party may depend on the substance of the relationship to the buyer. As suggested by Shipilov and Li (2012), a vertical relationship to a buying company, that encourages a third party to become related to a supplier with which the third party has a horizontal competitive relationship will usually predominate over the third party's relationship to the supplier. In other words, if a valued customer ask for permission to transfer knowledge to a competing supplier, the supplier being asked is likely to accept this in order to preserve the relationship with the customer.

5.3 Direct and networking supplier development strategy

In the case study we have identified two different approaches employed by the buying companies when using a direct and networking supplier development strategy, as illustrated in Table 1, figures (e) and (f).

5.3.1 The buyer performing a joining function while the supplier performs a relating function

The supplier development strategy illustrated in Figure (e) describes a situation where Subsic performs a "joining function" between its relationships to one of Electra's other customers (Micro) and its relationship to Electra in order to develop Electra's capabilities. Being part of the same cluster, Micro and Subsic are well acquainted with each other and, for many years, they have had a relationship that is mainly complementary but that occasionally has involved Micro being a supplier to Subsic. On some occasions, Subsic and Micro have coordinated their supplier development efforts towards Electra, both in terms of encouraging an expansion of the production volume as well as improving routines for early involvement in product development.

Subsic is well aware of the areas in which Micro have superior capabilities (compared to Subsic), and by requesting Micro to assist in developing Electra's capabilities, it has reasons to believe that, due to Micro having a relationship to Subsic as well as to Electra, the capability development at Electra will be more effective as well as efficient than if Subsic had tried to bring about the development by itself. However, by letting Electra and Micro take the lead in developing Electra's capabilities, Subsic accepts giving up some control over Electra's capability development, and Subsic must trust that Electra and Micro take care of Subsic's interests and do not form a coalition that bring these into jeopardy. In other words, Subsic relies on Electra and Micro putting more weight on preserving and improving their respective relationships to Subsic than on improving the relationship between Electra and Micro. Pursuit of this strategy ensures that Electra develops capabilities it can leverage across several customer relationships, here the relationships to Subsic and Micro. Furthermore, due to Electra and Micro having an existing buyer-supplier relationship, Electra is in effect performing a relating function, by connecting its relationship to Micro to its relationship to Subsic. However, in the particular case investigated here, it was Subsic that took the initiative to join Electra with Micro and not the other way around.

5.3.2 The buyer performing a joining function

The supplier development strategy illustrated in Figure (f) describes a situation where Sensoil performs a "joining function" between its relationship to a complementary supplier (Milling) and its relationship to Electra in order to develop Electra's capabilities. Milling and Electra need to coordinate their efforts in order to produce Sensoil's final product since the components from Electra need to be adapted to Milling's components. Sensoil needs Electra to have capabilities for working with hardware suppliers and finalizing products for end-users. Therefore, it chooses to make use of Milling's knowledge in this area to assist it in developing Electra's capabilities. In this situation Sensoil actively encourages the two suppliers to share information and discuss technical issues in order to enhance knowledge and capability development. By performing a "joining function" between the two suppliers, Sensoil aims to create and improve the interdependencies between them. By orchestrating direct communication between the two suppliers; Sensoil hopes that the interaction and capability development is more effective and efficient than could have been achieved if Sensoil were to pass on the information from and to the two parties. By letting Electra and Milling take the lead in developing Electra's capabilities, Sensoil accepts giving up some control over Electra's capability development; Sensoil must trust that Electra and Milling will take care of Sensoil's interests and will not form a coalition that jeopardizes these interests. Thereby, Sensoil relies on Electra and Milling putting more weight on preserving and improving their respective relationship to Sensoil than on developing a relationship. Electra can benefit from being actively involved in developing its capabilities. By engaging in discussions with Milling, being one of Sensoil's other suppliers, Electra may get access to complex knowledge that can enhance its skills in developing finished products for Sensoil, and possibly for other customers to the extent that the capability Electra develops from the interaction with Milling are based on other clients of Milling. Since the two suppliers' products are different, the suppliers do not compete for the same business and can collaborate by exchanging technical information without concern for possible

deleterious effects arising from interaction with competitors. Such collaboration between non-competing suppliers can also be found in Dyer and Nobeoka's (2000) studies of Toyota and its supplier network.

5.3.3 Implications for the buyer, for the supplier, and for the third party

By pursuing a direct and networking supplier development strategy, a buying company can actively join a supplier with third parties in its network to develop the supplier's capabilities. In settings where the buying company has not (yet) internally developed or absorbed from its other relationships all of the competencies that are to be transferred to the supplier, as is the case in the direct and central supplier development strategy, a direct and networking strategy can be useful. When using this strategy, the focal buying company relies on it having in its network, other suppliers and/or customers, which are able and willing to directly assist the focal buying company's supplier in making the required improvements, while taking proper care of the focal buying company's interests. By encouraging the supplier and a third party to interact and share knowledge directly, the buyer creates the possibility for the two parties to jointly shape the knowledge, capabilities and ideas being exchanged. Furthermore, this strategy may be particularly well suited in connection with sharing, developing and transferring complex knowledge that the buyer is neither able to fully absorb from or to emit to the involved counterparts. By employing this strategy, the buying company accepts having less control over the development of the supplier's capabilities compared to the direct and central supplier development strategy, as the interaction between the supplier and third party may give rise to nonlinear effects over which the buyer may have little or no control. Therefore, the buyer depends on being able to mobilize a third party that is willing and able to develop the supplier in the direction requested by the buyer. Furthermore, the buying company must accept the risk that the supplier and the third party, whether having an existing relationship or starting to develop one, do not prioritize their joint (possibly newfound) interests above those pertaining to their respective relationships to the buyer.

For the supplier, the pursuit of a direct and networking strategy implies that the supplier is more actively involved in developing its own capabilities, since it does not receive direct instructions from the buying company. This, however, would depend on the posture of the third party, which may take on a more interactive or a more directing role, depending on how it interprets the role it has been allotted by the buying company. In addition, it would depend on the third party's experience in emitting the knowledge and capabilities needed to develop the supplier's capabilities and the extent to which the buyer is able to express to the third party which capabilities the supplier needs to develop. In cases where the supplier has an existing relationship to the third party that is put in charge of developing its capabilities, care may need to be taken so that the interaction on issues that have not previously formed part of their relationship does not end up harming the relationship between the supplier and the third party. On the more positive side, the supplier gains the opportunity to initiate or positively develop a relationship to the third party which whom the buying company is joining the supplier.

Third parties who are involved by a buyer in order to develop one (or more) of its supplier(s) may see it as an opportunity to improve the relationship to the buying company and, if engaged in a relationship to the supplier that is being developed, as an opportunity to improve the relationship to the latter as well. Furthermore, the third party may appreciate the opportunity to develop its "teaching" capabilities, becoming more experienced in and reputed for its ability to emit knowledge and develop capabilities of counterparts. However, the third party may need to weigh the value it potentially can create and capture from developing the buying company's suppliers against the negative effect on its relationship(s) and position that may result from a poor outcome of the supplier development efforts in which it has become involved.

6. Conclusions and implications

In this study, the roles of the network in bringing about supplier development have been examined. We set out to investigate two issues. The first one concerned how companies may activate third parties in the wider network in order to bring about supplier development. Based on a single, embedded case study of a supplier and its relationship to six customers, we propose three different strategies that a buying company can pursue for bringing about supplier development in a network context:

1. Indirect and peripheral supplier development strategy

This strategy may be approached in two ways: either by the supplier performing a relating function or by the supplier performing an insulating function. In either case, when pursuing this strategy a buying company can capitalize on capabilities that are developed elsewhere without having to spend any resources on this development. This strategy focuses on indirect supplier development efforts where the buying company encourages improvement initiatives without taking an active role in bringing them about. Traditionally, it is assumed that the supplier must bring about the required improvements on its own when a buying company employs an indirect strategy. However, as our study shows, the supplier tries to obtain assistance from its other counterparts, its suppliers and/or its other customers, in order to improve its performance and capabilities. Hence, the buyer relies on the supplier having in its network suppliers and/or customers that are able and willing to help the supplier make the required improvements. Even though the focal buyer in this situation utilizes supplier capabilities developed elsewhere, the buyer can make an effort to influence the direction in which it would like the supplier to develop.

2. Direct and central supplier development strategy

This strategy may be approached in two ways: either by the buying company performing a relating function or by the buying company performing an insulating function. In either case, by pursuing this strategy, a buyer makes active use of its network to develop the supplier. Traditionally, it is assumed that the buyer has (developed internally) all the competences that the supplier needs to develop and, hence, that it is mainly a matter of the buyer transferring its own competences to the supplier. In such cases, the network does not play a role. However, as our study shows, the buying company's network may play a role in the supplier development efforts. We found examples of a direct and central supplier development strategy where the buying company, from its relationships to its customers and other suppliers, developed

and absorbed competences that were subsequently transferred to the supplier. By employing this strategy, the buyer relies on having in its network other suppliers and/or customers that are able and willing to directly assist the buyer in developing capabilities and allow (or order) the buyer to subsequently transfer them to its supplier.

3. Direct and networking supplier development strategy

This strategy may be approached in two ways: either by the buying company performing a joining function while the supplier is performing a relating function, or by the buying company performing a joining function without the supplier performing a mediating function. In either case, by pursuing this strategy, a buyer directly connects its supplier to a third party, relying on the third party to develop the supplier. In cases such as these, the buyer has not (yet) developed or absorbed all of the competences that are to be transferred to the supplier from its other relationships. Therefore, the buyer relies on it having in its own network other suppliers and/or customers that are able and willing to develop the buying company's suppliers upon the buyer's request; or who may insist on doing so for its own purposes.

These three strategies for supplier development capture a variety of ways in which supplier development can be approached in a network context. As called for by Gadde, Håkansson and Persson (2010), these strategies represent a systematic and structured approach for developing suppliers' capabilities. In line with previous studies on networks and connections, this study shows that supplier development does not only take place in dyadic settings, through indirect and direct approaches employed by a buying company that itself possesses the capabilities to be developed by the supplier. Instead, supplier development may come about by activating third parties in the wider network in different ways. In contrast to much of the literature on supplier development that focuses on systematic supplier development practices employed by a buying company, this study shows that supplier development can also occur through ongoing interactions in networks; as such, development of suppliers may emerge as "consistent patterns" over time rather than being the result of intentionally planned programmes for overarching supplier development. Furthermore, due to the interactive nature of relationships, the supplier is seen to take a more active part in the development of its capabilities, since the supplier may take the initiative to involve third parties in its network in order to develop its capabilities. To be able to make use of the different supplier development strategies, the continuity of the relationships in the network may be significant. Most of the buyer-supplier dyads studied for this article are important for the parties involved, comprehensive, and long-lasting. We cannot dismiss the possibility that such buyer-supplier relationships enable and facilitate network-based supplier development strategies.

6.1 Managerial implications

The second issue we set out to investigate was the managerial implications for the buying company, the supplier, and the third parties that are or become involved in supplier development efforts embedded in a network context. Firstly, this study offers practical guidance to supply managers, as it highlights different levels of involvement in supplier development practices (direct/ indirect) and different positions (central/networking/peripheral)

among which the buying company may be able to choose for its efforts to develop suppliers. However, the main implication for supply managers is the awareness of the different roles the network can play in bringing about supplier development. In contrast to a dyadic view on supplier development, a buying company could utilize the surrounding network in a more structured and systematic manner for its supplier development. However, in addition to the possibilities that arise from taking a network view on supplier development, it is also important that supply managers are aware of the limitations and challenges of relying on the network for supplier development. When employing a direct and central strategy or a direct and networking strategy, the buying company is dependent on having counterparts in its network that are capable of and willing to assist the buyer in knowledge development and that allow the buying company to transfer this to its supplier or, alternatively, engage directly in developing the supplier. When employing an indirect and peripheral strategy, the buying company similarly is dependent on the supplier having counterparts in its network that are capable of and willing to assist it in developing its capabilities. Therefore, pursuing either strategy, the buyer depends on its own relationships to third parties, the supplier and/or the supplier's relationships to third parties. All of these play a pivotal role for the ability to employ network-based supplier development strategies and, consequently, the buying company needs to consider and possibly influence the ability and willingness of the involved third parties to play a part in developing the buying company's suppliers.

The study also allows identification of managerial implications for the supplier. When the buying company employs an indirect and peripheral supplier development strategy, the supplier needs to search within its own network to improve its performance and capabilities. Thereby, the supplier is dependent on having actors in its network that are able and willing to assist the supplier in making the required improvements. The other two strategies involve the buying company to a much larger extent. Even so, the direct and networking supplier development strategy in particular may pose a challenge for the supplier, which may have to rely on a third party appointed by the buyer to develop the supplier's capabilities. Another challenge for the supplier relates to being exposed to different supplier development strategies at the same time. While it was not the main focus of this study, it appeared that a supplier may need to engage in different supplier development efforts from different buying companies. The different buying companies may have different goals regarding supplier development, and this may be of great concern for the supplier.

Finally, a third party must consider the potential constructive and/or deleterious effects, on itself and its relationship(s) to the focal buying company and/or the supplier, that may result from allowing, encouraging, ordering, or being directly involved in, development of the supplier.

This study represents an effort to investigate the roles of the network in bringing about supplier development. To study the different ways of making use of the network, a triadic approach was taken. By bringing third parties into the analysis of supplier development in addition to the buyer and the supplier, we have been able to discover six different strategies for developing suppliers. First, it would be useful if future studies would try to investigate the transferability of the strategies to contexts other than the case from which they were developed. The strategies identified may be a result of the particular setting of the case, being populated mainly by SMEs located in close geographical

proximity. In other words, the identified strategies may be most relevant for consideration by buyers and suppliers that are SMEs, and less relevant for large Toyota-like buyers with world-class capabilities in manufacturing and supply management, which may rely primarily on transferring their own capabilities directly to their suppliers. Secondly, how the strategies evolved over time was not investigated in this study. It would therefore be of interest if future studies would investigate dynamics in supplier development strategies, for example, whether a customer changes strategy over time overall and/or in relation to particular suppliers and the causes and effects of such changes. We also encourage studies aimed at investigating the effectiveness of the different supplier development strategies, and the relational and network factors influencing their effectiveness. Such studies would all serve to enrich our understanding of supplier development in a network context.

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