Minna Oinonen

MANAGEMENT OF CUSTOMER CO-DEVELOPMENT IN BUSINESS-TO-BUSINESS MARKETS

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Abstract

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Management of customer co-development means involving customers in the development of new products and services, and coordinating the process. In business-to-business markets, customer co-development enables the development of innovations that better match customer needs and strengthens customer relationships. However, close collaboration with customers can hamper the innovativeness of new products and lead to overly customized solutions. Therefore, the management of co-development is crucial to its success. Yet the existing research on the topic has mainly focused on selecting the right collaboration partners, and the field lacks understanding on how to manage the tensions inherent in customer co-development.

The purpose of this thesis is to increase understanding on the management of the co-development. The thesis is divided into two parts. The first comprises the literature review and conclusions for the whole study, and the second presents four publications. From the methodological perspective, the research papers follow exploratory qualitative research design. The empirical data comprise interviews with 60 persons, representing 25 different organizations, and a group of 11 end users.

The study conceptualizes management of customer co-development in three dimensions 1) relational co-development processes, 2) co-development challenges and paradoxes, and 3) internal customer involvement processes. The findings contribute to the customer-supplier relationship, innovation, and marketing management literatures by providing a framework on supplier-customer co-development, addressing co-development paradoxes and their management processes, and suggesting practices for customer involvement. For practitioners, the findings provide tools to manage the challenges related to co-development with customers.

Keywords: customer involvement, customer participation, co-development, business-to-business markets, resource-based view, transaction cost economics
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Part II: Publications
LIST OF PUBLICATIONS

The thesis consists of the introductory section (Part I) and the publications listed below (Part II). Their publishers have kindly granted the rights to reprint the articles in the dissertation. Some of the papers were written in cooperation with other authors and a statement of this author’s contribution to each publication is included.

PUBLICATION I


The present author collected and analyzed the data and was responsible for the literature review, methodology and analysis. The conclusions were created in cooperation with the co-authors.

PUBLICATION II


The present author planned the data collection, collected and analyzed the data, and acted as the principal author. The research setting and the conclusions of the article were created in cooperation with the co-author.

PUBLICATION III


The present author drew up the data collection, conducted the analysis, and was responsible for the writing process. The research design and findings were created in collaboration with the co-authors.
PUBLICATION IV


The present author was the sole author and also collected the data used in the publication.
PART 1: OVERVIEW OF THE THESIS
1 INTRODUCTION

1.1 Research background

Customer focus and market orientation were long ago identified as drivers for business success (Kohli & Jaworski, 1990; Narver & Slater, 1990). Market orientation, which also implies a sharper focus on the customer, has been proven to enhance especially manufacturing companies’ innovativeness and performance (Han et al., 1998; Kirca et al., 2005). A firm’s market orientation can be amplified by involving customers in development activities. Co-development enables firms to develop products and services that customers really want, which creates value for the customer but also sustained value for the firm (Prahalad & Ramaswamy, 2004). Thus, in recent years, the question of how to successfully integrate customers in development activities has been a key research priority for both innovation and marketing researchers (Griffin et al., 2013; Biemans & Langerak, 2015).

The innovation paradigm has increasingly shifted towards open innovation in which companies benefit from involving their stakeholders in innovation activities and sharing their own innovations with others (Chesbrough, 2003; West & Bogers, 2014). This has meant changes to the traditional internal development processes and a shift towards collaborative innovations (Aarikka-Stenroos & Sandberg, 2012). Also new business models based on value co-creation have emerged and nowadays customers are often seen as important collaboration partners (Prahalad & Ramaswamy, 2004; Chan et al., 2010).

Collaborating with customers is of particular importance in business-to-business markets, where understanding customers is central to innovation. In this context, innovations are not pushed to market, rather the supplier and customer often collaborate in defining the customer’s needs (Aarikka-Stenroos & Jaakkola, 2012; Johnston & Chandler, 2012). Thus, it is crucial for firms to manage the customer knowledge (Gibbert et al., 2002; Mahr et al., 2014; Cui & Wu, 2016). Studies have shown that that a firm’s competence in understanding customer needs improves its innovativeness (Stanko & Bonner, 2013), and the more innovative the company is, the better it can compete. Thus, it is argued that customer involvement in co-development leads to sustained profits, and user participation is believed to improve firms’ innovation performance (Kumar, 2015; Chatterji & Fabrizio, 2014).

Although collaboration with customers has become a typical way to develop offerings in business-to-business markets, a consensus on the effects of customer involvement is lacking. It has been argued that listening to customers and focusing on technology that customers want impedes companies’ development of something genuinely new and radical (Christensen, 1997). Thus, the literature suggests both positive and negative effects of customer involvement (Fang, 2008; Chang & Taylor, 2016). Some suggest that product variety increases when customers are involved (Al-Za’bi & Tsinopoulos, 2012).
but others claim that not all processes benefit from close customer involvement (Campbell & Cooper, 1999; Chatterji & Fabrizio, 2014).

The current view of customer involvement suggests that co-development is a double-edged sword which entails possibilities to gain benefits but also bears some risks (Peled & Dvir, 2012). It seems that co-development can be beneficial if enacted with the right partners, in a certain type of development process, and in the correct way. This means that the management of customer involvement is central to its success. Management of customer co-development refers to customer involvement in the development of new products and services and coordinating this process both with the customer and within the company.

Co-development between supplier and customer can be analyzed from different perspectives. The existing literature on the topic differentiates two streams: customer involvement and supplier involvement in development. The studies focusing on customer involvement analyze development projects in which the customer participates in the supplier’s development project, and the supplier aims to commercialize a new product or service. Also, the concept of downstream involvement (Fang et al., 2015) is used to describe the process that is the focus of this research. The studies on supplier involvement focus on development processes in which customers aim to develop new solutions and involve their suppliers in the process (Melander & Tell., 2014; Ylimäki, 2014). Even though both streams focus on a similar topic, they adopt a different perspective and the perspective changes the nature of the process. For example, the effects of involving suppliers and customers are different, and studies have shown that compared to suppliers, customers can better contribute for example to product variety (Al-Zu’bi & Tsinopoulos, 2012).

Value co-creation and customer involvement occur in different contexts. There are different literature streams for each type of co-creation, such as customer involvement in value co-creation (e.g. Payne et al., 2008; Aarikka-Stenroos & Jaakkola, 2012), production (e.g. Bendapudi & Leone, 2003; Auh et al., 2007), and development (e.g. Fang, 2008; Carbonell et al., 2009). Customer involvement in co-development is the focus of this research and it is understood to describe the number and depth of activities that the customer performs in a supplier’s new product or service development process (Matthing et al., 2004; Fang et al., 2008). Also concepts such as collaborative development (O’Hern & Rindfleisch 2009), co-development (Fang et al., 2015), user involvement (Alam, 2002) and lead user method (Von Hippel, 1986; Olson & Bakke, 2001) have been used to describe customer involvement in development. This thesis studies co-development from the supplier’s perspective, whose aim is to manage customer involvement, and thus a neutral concept – customer involvement in co-development – is employed in the study.

1.2 Research gap
The existing literature on customer involvement in co-development focuses on the roles the customer takes in the process, the types of customer that are beneficial to
development, and the effects of co-development (Von Hippel, 1986; Coviello & Joseph, 2012; Fang, 2008; Carbonell et al., 2009). However, there is a lack of knowledge on the management of customer involvement (Hauser et al., 2006; Athaide & Zhang, 2011). This is the major gap in the literature that this thesis focuses on. Management of customer involvement in co-development is important as studies have shown that customer involvement may actually impair the performance of the developed product (Chang & Taylor, 2016), and management of the collaboration is a key factor in successful alliances (Ireland et al., 2002; Wang & Rajagopalan, 2014). Thus, management of co-development enables capturing value from customer involvement and avoiding the potential negative effects that may lead to unsuccessful new products and also to the end of an important customer relationship.

The first gap in the literature on co-development that this study addresses is related to management of the co-development process in business-to-business markets. Most of the existing studies on co-development processes are based on traditional new product or service development processes and have shown in which of the known development process phases customers are involved. These kinds of study have resulted in co-development process models that resemble traditional in-house development processes and assumed that the co-development process is similar to in-house development (e.g. Alam & Perry, 2002; Alam, 2002). However, co-development is characterized by actors various goals which are also reflected in the process (Davis & Eisenhardt, 2011). Furthermore, the existing studies on co-development focus mainly on consumer markets (Mustak et al., 2013), thus there is a lack of knowledge on co-development in business-to-business markets. So more reliable depictions of the co-development process in business-to-business markets are needed.

The existing studies also lack a relationship perspective that views co-development as a part of customer relationships. Studies focus on measuring the co-development’s effects on the new product (e.g. Fang, 2008; Carbonell et al., 2009) even though several companies use co-development for building or strengthening customer relationships. As the existing literature on co-development builds on new product or service development literature, there seems to be only a narrow understanding on the interaction that takes place during the co-development process between suppliers and customers and the management of the co-development process. In business-to-business markets, it is crucial to understand these interactions as innovations are developed in interactions between the supplier and its customers (Håkansson et al., 2009). Thus, this study addresses the research gap on managing the co-development process.

The second identified gap concerns the challenges and tensions related to customer involvement. The existing literature has showed that development with customers is far from easy and may actually have negative effects both for the process and on the developed product, as it may increase the product’s time to market and decrease its innovativeness (Fang, 2008). Furthermore, co-development entails multiple risks related to the partner’s opportunistic behavior (Noordhoff et al., 2011). Even though there is knowledge on the challenges related to co-development, there is only a little knowledge
on how to cope with these challenges and actually manage them, which is central to the success of the co-development process. Thus, this study seeks to find management processes for the challenges related to co-development.

Third, the literature on customer involvement lacks understanding on how firms actually involve customers and integrate customer knowledge in their internal processes. There exist some lists of different methods for customer involvement (e.g., Edvardsson et al., 2012) but firms lack the tools to actually involve customers in their development activities. Furthermore, the literature has shown that the actual processes on how to involve customers differ from the theoretical models, as firms may not implement customer involvement as the models suggest (Olson & Bakke, 2001). Thus, a better understanding on the different methods for involving customers is needed.

1.3 Research objective and the research questions

The purpose of this thesis is to increase understanding on the management of customer involvement in co-development. Thus, the main research question (RQ) for the thesis is:

*How do firms manage customer involvement in their development activities in the business-to-business context?*

This is divided into four sub-questions which all adopt a different perspective on the topic. Four different research questions enable the study of the topic from multiple perspectives and at different levels of analysis.

The first question focuses on describing the phenomenon of collaborative value creation between suppliers and customers. The purpose of this research question is to shed light on the collaborative value creation process and its characteristics, and therefore guide the research process. The existing research has stressed the importance of understanding the value co-creation between supplier and customer in order to be able to manage the process (Payne et al., 2008). The existing studies have also called for further research on value creation and value appropriation in supplier-customer collaboration (Wagner et al., 2010a). The first research question concentrates on these issues and focuses on value creation for different actors.

*RQ 1: What are the characteristics of value creation between suppliers, their customer and end users?*

While the first research question focuses on describing the overall phenomenon of value co-creation, the second is limited to a special form of co-creation, namely customer involvement in co-development, which is the main topic of this thesis. The second research question focuses on the co-development process as existing studies have shown that understanding the process is necessary for managing supplier-customer collaboration for example in terms of the customer roles and use of resources within the process (Aarikka-Stenroos & Jaakkola, 2012). The existing research has also emphasized the need
for a deeper understanding of the activities involved in the supplier-customer co-development process (Hoyer, 2010; Coviello & Joseph, 2012). Thus, the second research question focuses on identifying the phases in the co-development process:

**RQ 2: What are the key phases of the co-development process?**

The first and second research question focused on the characteristics of value co-creation and the co-development process. At the same time, they help highlight many challenges related to customer involvement in co-development. Thus, the third research question focuses on the paradoxical nature of co-development and the challenges related to customer involvement in development. Conflict management is a key part of managing interfirm collaboration and a way to improve alliance success (Wang & Rajagopalan, 2015), which means that understanding the potential challenges of co-development and finding ways to manage them is critical to the success of co-development. Thus, the third research question adopts a paradox management perspective on co-development and identifies co-development paradoxes and ways to manage them:

**RQ 3: What paradoxes does supplier-customer co-development involve and how do firms in business-to-business markets manage these paradoxes?**

The final research question focuses on the involvement of customers in practice, and aims to uncover the methods for customer involvement. It answers the call for research on the actual ways to integrate customers in co-development (Neale & Corkindale, 1998; Edvardsson et al., 2012). The existing research has shown that customer involvement in different phases of the co-development process involves different kinds of customer activity and results in different kinds of effect on the developed product (Alam, 2002; Gruner & Homburg, 2000). Thus, firms need to understand the different ways to involve customers in different phases of the co-development process. The final research question focuses on identifying the practices for involving customers and therefore sheds light on the firm’s internal processes in managing customer involvement.

**RQ 4: What kinds of practice for customer involvement can be identified within companies?**

### 1.4 Positioning and context of the research

Customer relationships are a key topic in the *business marketing literature*. For example, the Industrial Marketing and Purchasing Group (IMP) has focused on interaction with customers and emphasized the close and long-term relationships that suppliers and customers have (Håkansson, 1982). While selling and purchasing are key topics in the business marketing literature, several studies also focus on supplier-customer collaboration. For example, the Institute for the Study of Business Markets (ISBM) sees
marketing’s role in improving innovation capability as a key research focus, and customer involvement is identified as a key research priority (Griffin et al., 2013). Thus, customer involvement in innovation has attracted interest from the marketing scholars as innovations in business-to-business markets are typically created in interactions between a supplier and its customers (Håkansson et al., 2009; Noordhoff et al., 2011).

In a broader sense, value co-creation means that customers engage in interaction with firms, and together supplier and customer create unique value for each customer and sustained value for the firm (Prahalad & Ramaswamy, 2004). The existing research has identified that firms need frameworks on managing the co-creation of value, and the existing literature already provides some general level models on the topic (Payne et al., 2008). However, the research shows that co-creation has multiple forms, such as co-design, co-promotion and co-pricing, and managers need tools to identify and organize co-creation possibilities and differentiate between all the possible co-creation types (Frow et al., 2015). Co-development can be seen as a specific type of co-creation, thus the literature on co-creation also offers insights on customer co-development.

Customer co-development is fundamentally collaboration on innovation, which is a key topic in the innovation management literature. This literature stream has shed light, for example, on open innovation that focuses on collaborating with other companies in innovation activities (Chesbrough, 2003; Huizingh, 2011). Thus, the innovation literature has touched on topics such as collaboration with partners in the development of different types of innovation (Song & Di Benedetto, 2008; Menguc et al., 2014), and the effects of supplier and customer integration on product innovation (Lau et al., 2010). Customer involvement has been named as a key research priority also for innovation researchers (Biemans & Langerak, 2015).

The management literature has stressed the topic of strategic alliances and their management. Strategic alliances are “voluntary arrangements between firms involving exchange, sharing, or codevelopment of products, technologies, or services” (Gulati, 1998; 293). While the key research topics in this area are formation, governance, evolution and performance of strategic alliances (Gulati, 1998), the management literature has also contributed to the innovation in strategic alliances and their performance (e.g. Joshi & Nerkar, 2011; Lin et al., 2012). Especially the literature on alliance management provides insights for the management of co-development, as alliance management is seen as the key aspect in explaining why some alliances perform better than others. Alliance management comprises interorganizational coordination and learning, sensing, and alliance transformation (Schilke & Goerzen, 2010).

In sum, customer involvement in co-development is grounded in all these different literature streams (see Figure 1). The literature on supplier-customer relationships points out the special nature of collaboration with customers and ways to manage customer relationships. The innovation perspective provides insights on how to create innovations. Finally, the management literature helps in understanding the management of collaboration.
The context of this study is business markets. In the empirical part of this thesis, the pilot study involves also end users but otherwise the study focuses on customer involvement in business-to-business markets. The study was limited to business markets as co-development with business customers is expected to differ from collaboration with consumers. The reason for that is the differences between business and consumer markets, such as more long-term, personal relationships and interaction between supplier and customer (Håkansson, 1982). These aspects also change the nature of co-development, as co-development methods among business and consumer markets vary. Consumers are for example expected to participate more via the Internet (Nambisan & Baron, 2009), while interaction with business customers typically occurs face-to-face. Finally, compared with consumers, business customers are proven to have a stronger effect on new product development performance (Chang & Taylor, 2016).
The study adopts a broad perspective on co-development in terms of co-development forms and process phases. Co-development can be understood narrowly to cover only the intense co-development phase (Neale & Corkindale, 1998) but in this study, similarly to Fang (2008), customer involvement in co-development is seen to mean both the customer’s active participation in the development as well as using customers as an information source in the development process. Similarly, the study covers the early process phases, the actual development phase, and the later phases of the co-development process.

1.5 Outline and structure of the thesis

The thesis comprises an introductory part and four publications. The introductory part sets the targets for the thesis, introduces the background, and summarizes the contributions of the four publications and that of the thesis. Each publication focuses on one perspective of the thesis topic and contributes to the thesis by answering a sub-question. Figure 2 illustrates the outline of the thesis and the main inputs and outputs of each section.

Chapter 1 introduces the research topic and background, and sets the research questions. Chapter 2 provides the theoretical background for the thesis, and Chapter 3 focuses on introducing and justifying the methodological choices for the study. Chapter 4 summarizes each individual publication and its key findings, laying the groundwork for the contributions of the thesis presented in Chapter 5, which also concludes the first part of the thesis by explaining the theoretical and managerial implications of the thesis and suggestions for future research. The second part of the thesis comprises the publications, which focus on separate research questions and provide the research results.
## 1 Introduction

### Figure 2. Outline.

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**Part II: Publications**

- **RQ1**: What are the characteristics of value creation between suppliers, their customer and end users?
- **RQ2**: What are the key phases of the co-development process?
- **RQ3**: What paradoxes does supplier-customer co-development involve and how do firms in business-to-business markets manage these paradoxes?
- **RQ4**: What kinds of practice for customer involvement can be identified within companies?

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2 THEORETICAL BACKGROUND

The management of customer involvement in co-development is a topic that combines the marketing, innovation and management literatures. Thus, it can be studied using multiple theoretical approaches. This chapter introduces the context for co-development, namely supplier-customer relationships, and then the existing studies on co-development and the co-development process with customers. The chapter also offers the views of the seminal organization theories on studying co-development, and finally presents the theoretical framework showing the key concepts and their relationships in terms of the research questions.

2.1 Management of customer relationships

Customer relationships and their management has always been a key topic for marketing scholars. This literature stream has focused on finding out how to manage customer relationships effectively, and provided strategic frameworks on customer relationship management (Reinartz et al., 2004). The literature on the management of customer relationships has touched upon topics such as selecting customer partners, maintaining relationships (Wilson, 1995), and building profitable customer relationships (Reinartz & Kumar, 2003).

Customer relationship management (CRM) has in itself become an important focus area in the marketing literature. CRM focuses on relationship initiation, maintenance and termination (Reinartz et al., 2004). The studies have shown that effective customer relationship management is beneficial as it increases the value of the customer in the long run (Ryals, 2000). Both in the general marketing literature and that on CRM, the focus has shifted towards increased collaboration with customers. This is evident also in the frameworks for CRM that highlight value co-creation as part of CRM (Payne & Frow, 2005).

The business market context sets its own challenges for the management of customer relationships. The literature on business marketing has identified multiple different types of relationship between suppliers and customers. The relationship can be based for example on features such as information exchange, operational linkages, legal bonds, cooperative norms, and adaptation (Cannon & Perreault, 1999). These different types of connection shape the management of the relationship. In addition, the literature has identified relationship atmosphere factors that need to be considered in CRM. These factors include 1) Power/dependence, 2) Cooperativeness/competitive-ness, 3) Trust/opportunism, 4) Understanding/non-understanding, 5) Closeness/distance, and 6) Commitment/non-commitment (Hallén & Sandström, 1991). Thus, a relationship management capability (Möller & Halinen, 1999) has been suggested for handling relationships in business markets. This capability includes establishing, developing, maintaining and dissolving customer relationships (Möller & Halinen, 1999).
In recent years, the marketing literature on supplier-customer relationships has been characterized by deeper collaboration between suppliers and customers. In the marketing theory, this has been evident in the development of a conceptual framework often referred to as a new logic for marketing, and termed service-dominant (S-D) logic. The main premises of S-D logic emphasize the role of services in value creation and see the customer as the value co-creator (Vargo & Lusch 2004; Vargo & Lusch, 2008).

Thus, value co-creation is a key research topic in marketing. Value co-creation means a more collaborative and interactive relationship in which the customer becomes a value co-creator (Payne et al., 2008). The development of a solution to the customer’s needs can also be seen as a form of value co-creation (Frow et al., 2015). The existing research characterizes co-development with customers as a joint problem-solving process during which customer and supplier co-create value (Cantú et al., 2012; Aarikka-Stenroos & Jaakkola, 2012). The existing studies on the topic have identified that the management challenges of this kind of collaboration are related for example to the value appropriation of the collaboration and resource integration by heterogeneous actors (Wagner et al., 2010; Corsaro et al., 2012).

As co-development is a central part of value co-creation, which is one of the key topics in the marketing literature, this thesis focuses on the co-development and management of customer co-development in particular. Next, the existing research on this topic is reviewed and the conceptual background of the topic introduced.

### 2.2 Co-development with customers

The existing literature on customer involvement in co-development dates back to 1986, to Von Hippel’s seminal works on the lead user method, which encourages firms to collaborate with a customer who faces a need before it is identified by the market and benefits a solution to the needs (Von Hippel, 1986). The first published articles on the topic show the positive aspects of customer involvement, such as those of involving customers in the commercialization of high technology process innovations (Athaide et al., 1996).

The end of the noughties decade witnessed the publication of several articles focusing on the effects of customer involvement. It is, for example, seen to improve the quality of new products (Feng et al., 2010) and the technical quality of services (Carbonell et al., 2009). Using customers as a source of information also increases the innovativeness of a new product when the customer does not directly know the downstream network actors, such as retailers (Fang, 2008). Finally, customer involvement is proven to enhance the effectiveness of the new product development process (Fang et al., 2008; Chien & Chen, 2010), and shorten the time to market for new products and services (Lin et al., 2010; Johnson & Filippini, 2009; Carbonell et al., 2009).

However, the literature has shown that customer involvement also has negative effects and in some situations actually hampers new product development performance (Chang
2.2 Co-development with customers

& Taylor, 2016). For example, Fang (2008) finds that customer involvement decreases the innovativeness of the new product when customers are acting as a source of information and are well connected to the downstream actors. Fang (2008) also argues that time to market lags when suppliers are dependent on customer input and customers are acting as co-developers. In addition, customer involvement can negatively impact the market performance of the developed services when the customer in question is a lead user (Carbonell et al., 2012). Furthermore, Peled and Dvir (2012) point out that the benefits of customer involvement are dependent on the project type, and thus, customer involvement can be a double-edged sword.

The literature on customer involvement in co-development is characterized by many concepts that describe the phenomenon. That stems from the fact that the topic is studied in multiple literature streams and different concepts have a different emphasis on the phenomenon. For example, the concept of customer interaction focuses on the level of interaction between the supplier and customer (Alam, 2006; Bonner, 2010), whereas the concept of lead user involvement stresses the particular type of customer involved (Von Hippel, 1986; Olson & Bakke, 2001; Franke et al., 2006).

As the literature lacks consensus on a single concept that would describe customer involvement in innovation, the phenomenon has accrued multiple definitions. The concepts and definitions also adopt different approaches to the topic. For example, the Carbonell et al. (2009) definition of customer involvement focuses on the co-development process, while Alam (2006) and Bonner (2010) take an interaction approach. Finally, scholars such as Feng et al. (2010) emphasize customer orientation. Table 1 shows the key concepts describing customer involvement in co-development, and their definitions.

Table 1. Key concepts describing customer involvement in co-development, and their definitions

<table>
<thead>
<tr>
<th>Approach</th>
<th>Concept</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Process approach</td>
<td>Customer involvement</td>
<td>“The extent to which service producers interact with current (or potential) representatives of one or more customers at various stages of the new service development process.” (Carbonell et al., 2009, 537)</td>
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<tr>
<td></td>
<td></td>
<td>“Both the breadth and depth of the customer’s involvement in the NPD process. Breath captures the scope of participation across the product development process, where a customer could be involved in just one activity (e.g., product testing) or in a wide range of activities from new concept generation, prototyping, up to and including product testing. Depth represents the customer level of involvement in a phase of the product development process, where some customers may only be superficially involved and other may be deeply involved.” (Fang et al., 2008, 324)</td>
</tr>
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</table>
### Theoretical background

<table>
<thead>
<tr>
<th>Interaction approach</th>
<th>Customer Centricity</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer participation</td>
<td>“The extent to which the customer is involved in the manufacturer’s NPD process.” (Fang, 2008, 91)</td>
<td></td>
</tr>
<tr>
<td>Interaction approach</td>
<td>Customer interactivity</td>
<td>“The degree to which interactions between potential customers and project team members are bidirectional, participative and involve joint problem solving.” (Bonner, 2010, 486)</td>
</tr>
<tr>
<td>Customer-centric approach</td>
<td>Customer orientation</td>
<td>“Interactions between service producers and the representative(s) of one or more customer firms at various stages of a NSD process” (Alam, 2006, 468)</td>
</tr>
<tr>
<td>User-centric innovation</td>
<td>“The degree to which the organization obtains and uses information from customers, develops a strategy which will meet customer needs, and implements that strategy by being responsive to customer needs and wants” (Feng et al., 2012, 930)</td>
<td></td>
</tr>
<tr>
<td>Customer-centered innovation</td>
<td>“Firms or individual consumers who benefit from using a product or service they develop” (De Jong &amp; Von Hippel, 2009, 1182)</td>
<td></td>
</tr>
<tr>
<td>Customer-centered innovation</td>
<td>“In customer-centered innovation programs, innovation is done with customers” (Desouza et al., 2008, 42)</td>
<td></td>
</tr>
</tbody>
</table>

This study employs the concept of customer involvement in co-development, which is defined as the *amount and depth of interaction with the customer during the development process* (Fang et al., 2008; Carbonell et al., 2009). This definition is generalized in the sense that it captures all the different forms of customer involvement with different kinds of customer, but specific enough to also take into account the level of involvement.

As the definition of customer involvement used in this study shows, the level of customer involvement in co-development can vary, and depends upon depth, that is the intensity of interaction, and breadth, which refers to the diversity of activities engaged in by customers (Fang et al., 2008). The existing literature has created categorizations of customer involvement based on three levels of depth; for example, Blazevic & Lievens (2008) perceive customers either as *passive users, active informers, or bidirectional creators*. The breadth of involvement describes the role the customer plays in the co-development process. The customer’s activities can vary from a conveyer of latent needs to a requester, initiator, idea generator, buyer, advisor, co-developer, approver, promoter, sounding board, critic, informant, provider of feedback, and marketer (Coviello & Joseph, 2012; Öberg, 2010; Fang, 2008).
2.3 Co-development process with customers

As the innovation literature has moved towards collaborative innovation models, also the customers’ role in innovation has attracted academic attention. This has resulted in new co-development process models that account for customer participation in the process. Customer involvement changes the nature of the process as it for example dispels the fuzziness from the early stages of the innovation process (Alam, 2006).

Traditionally, the innovation literature has been based on development process models that describe firms’ internal innovation processes. However, the current literature has shown that also customers can act in the development process. This has resulted in more collaborative development process models that show how customers take part by providing comments and feedback (Alam, 2002). The recent studies have shown that the nature of the process changes and also new process phases emerge when customers join the development process. These new phases include for example customer-based funding that enables development deals to be sold in order to collect funds for the development process (Coviello & Joseph, 2012).

The co-development process with customers sets also new challenges for the management of the process. The management literature has suggested that alliance management capabilities include partner selection, bonding, negotiating, communicating, and conflict management (Wang & Rajagopalan, 2015). Thus, one of the key issues in the studies on managing collaborative innovation has been the selection of the right collaboration partner. Compared to collaborating with suppliers, customers are seen as collaboration partners that may hamper the innovativeness of the new product (Al-Za’bi & Tsinopoulos, 2012; Lau et al., 2010). Thus, the research has suggested that when collaborating with customers, the customer type is selected on the basis of the type of innovation to be developed. Close customers have proven to be more effective for the development of incremental innovations, whereas the development of radical innovations seems to require more heterogeneous customer partners (Bonner & Walker, 2004).

Besides the typical alliance management dimensions, the management of customer involvement process includes also other dimensions that the supplier needs to consider. The existing literature on the topic suggests that the management of co-development alliances with customers is challenging and concerns also the management of the intellectual property and knowledge flows (Hoyer et al., 2010). In addition, the customer’s role in the development process needs to be managed (Ostrom et al., 2010). Thus, the co-development process with customers involves phases that are not included in the traditional firm internal innovation process models.
2.4 Theoretical lenses used for studying co-development

While the business marketing literature provides understanding on customer co-development and the innovation literature delivers the perspective of managing development processes, the seminal organization theories provide understanding on the overall topic of managing relationships and collaboration within relationships. These seminal, grand theories of organizations, management and economics have been extensively deployed in studying co-development between supplier and customer. Table 2 lists the most often used theoretical lenses for studying co-development, and their key issues.

Co-development can be seen as a process of combining resources so that both sides act as resource providers and resource users (Cantù et al., 2012). Thus, it is not surprising that the resource-based view, knowledge-based theory of the firm, and resource dependence theory are commonly used in studying co-development. While the resource-based view focuses on the role of resources as the source of competitive advantage in general (Barney, 1991), the knowledge-based view focuses on knowledge as a key resource (Grant, 1996), and resource dependence theory describes the role of resources in creating power constellations in relationships and networks (Pfeffer & Salancik, 1978). The new product development process can be seen as one of knowledge management (Joshi & Sharma, 2004), but here customer involvement is viewed as a far-reaching phenomenon that involves sharing not only knowledge but also other types of resource.

Also transaction cost analysis has been extensively used as the theoretical background for co-development. From the transaction cost perspective, co-development implies using governance mechanisms to shield the firm from transaction costs that in co-development are related to a partner’s opportunistic behavior and the uncertainty of the process outcome (Noordhoff et al., 2011; Fang, 2015). In both transaction cost economics and game theory, opportunism is a central concept explaining each actor’s aim to maximize its own gains (Hill, 1990; Parkhe, 1993). According to game theory, an actor’s opportunism in co-development complicates value appropriation and knowledge sharing (Ritala & Hurmelinna-Laukkanen, 2009). However, studies have shown that under some conditions co-development with customers is beneficial for both the supplier and the customer, as the customer gains a solution to meet its needs and the supplier gains the required customer perspective on the development (Harhoff et al., 2003).

In addition to the theoretical approaches listed in Table 2, there are many others that the existing research has employed to provide certain theoretical perspectives on co-development between a supplier and customer. Examples of these theories, and the studies, include agency theory (Athaide et al., 2003), configuration theory (Fang et al., 2011), institutional arrangements (Fang et al., 2008), social capital theory (Nambisan & Baron, 2009), socio-technical system theory (Ngo & O’Cass, 2013), social network theory (Lin & Huang, 2012), and contingency theory (Carbonell & Rodriguez-Escudero, 2014). However, given that these theories focus on a single, rather narrow perspective on
customer involvement, they are not applied in this study which aims to understand the management of customer involvement as a holistic phenomenon.

Table 2. Key Theoretical approaches to co-development between supplier and customer.

<table>
<thead>
<tr>
<th>Theoretical approach</th>
<th>Key issues</th>
<th>Examples of studies that use the theoretical approach</th>
</tr>
</thead>
</table>
| Resource-based view               | Firms are bundles of resources that together with capabilities determine the success of the firm (Penrose, 1959; Wernerfelt, 1984; Barney, 1991; Peteraf, 1993; Teece & Pisano, 1994) | - Links incremental and radical innovation capability to customer involvement (Menguc et al., 2014)  
- Effect of acquiring external resources from customers and suppliers on competitive advantage (Lau et al., 2010; Feng et al., 2010) |
| Knowledge-based theory of the firm | Extends the resource-based view by arguing that knowledge is the most significant resource for the firm (Grant, 1996; Spender 1996; Conner & Prahalad, 1996; Kogut & Zander, 1992) | - Three approaches to customer knowledge management, building on knowledge-based theory of the firm to understand customer involvement as knowledge management (Cui & Wu, 2016)  
- Customer involvement affects competitive advantage, as suppliers get access to the customer’s knowledge, which is critical especially in dynamic environments (Feng et al., 2010) |
| Transaction cost economics        | Transaction cost determines whether the firm conducts economic exchange in the market (Coase, 1937; Williamson, 1985) | - Transaction-specific investments such as product customization have a positive impact on co-development (Athaide et al., 2003)  
- Based on product and performance uncertainty, the benefits of co-development depend on the partner’s position in the value chain (Fang et al., 2015)  
- Buyer-seller interactions and management approaches to relationships during new product |
Any of the theoretical approaches listed in Table 2 could provide the theoretical background to customer involvement in co-development. However, the *resource-based view and transaction cost economics are selected as the theoretical background for this study* because they help explain the nature of the collaboration and provide insights on its management, which are the key topics in this study. In addition, most of the other theoretical approaches used to study customer involvement, such as knowledge-based theory of the firm or game theory, also have links to the resource-based view and transaction cost economics, which adopt a more far-reaching perspective on the topic. Further, the two selected theoretical approaches are the most commonly used for studying co-development. Next, these two approaches are explained in greater detail.
2.4 Theoretical lenses used for studying co-development

2.4.1 Resource-based view of the firm

The resource-based view has been the foundation for multiple organizational approaches that argue a firm’s success is based on resources, knowledge and capabilities (Wernerfelt, 1984; Peteraf, 1993). According to the resource-based view, firms are bundles of resources separated from the market by boundaries (Penrose, 1959). As these resources are distributed heterogeneously in the market, the resource-based view argues that a firm’s competitive advantage is based on resources that are valuable, rare, inimitable, and nonsubstitutable (i.e. VRIN attributes) (Barney, 1991). Resources are “stocks of available factors that are owned and controlled by the firm” and capabilities are the “firm’s capacity to deploy resources” (Amit & Schoemaker, 1993; 35). While resources can be transferable, capabilities are firm-specific and developed over time within the firm (Amit & Schoemaker, 1993).

While the seminal articles on resource-based theory viewed resources as the source of competitive advantage, the more recent research on the topic has emphasized the role of capabilities in creating competitive advantage. Nowadays, it is believed that not only resources but also capabilities and especially dynamic capabilities play a central role in creating sustained growth for the firm (Teece et al., 1997; Eisenhardt & Martin, 2000; Helfat & Peteraf, 2003). Dynamic capabilities are “the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments” (Teece et al., 1997; 516). They are often described as the opposite of operational (or ordinary) capabilities that enable the firm to perform routines and maintain the status quo (Helfat & Winter, 2011).

Thus, the firm’s dynamic capability is to evolve by seeking external resources and integrating them into its internal resource base (Winter, 2003). This extends the more static resource-based view by acknowledging the changes in the environment, and also by emphasizing that the key is not to have access to the resources but to integrate them in a manner that creates competitive advantage (Teece & Pisano, 1994). Thus, dynamic capabilities are closely linked to organizational processes that attempt to respond to the changes in the environment (Helfat et al., 2007).

The resource-based view is broadly used in the marketing and innovation literature. In recent years, marketing scholars have emphasized marketing capabilities that are essential to the firm’s success (Day, 2011). In addition, the resource-based view has been applied for example in explaining how resources and capabilities can create customer value (Srivastava et al., 2001). In the innovation literature, product development itself is a process that can be regarded as a dynamic capability for the firm (Eisenhardt & Martin, 2000). In the management literature, the resource-based view has provided the theoretical background to alliance management capability, for example. The literature shows that R&D alliances can improve a firm’s innovation performance but alliance management plays a central role in the effects of innovation performance (Sampson, 2007). Thus, alliance management is seen as an important capability with which a firm can create competitive advantage (Ireland, 2002; Wang & Rajagopalan, 2015).
In the context of co-development between a supplier and customer, several articles have used the resource-based view as their theoretical background. These articles build on the idea that suppliers collaborate with customers to gain access to resources external to the firm (Lau et al., 2010). The existing literature has shown that customer knowledge is critical to the success of the innovation. For example, Joshi & Sharma (2004) argued that access to knowledge on customer needs enhances the new product development process.

In this thesis, the resource-based view furnishes the theoretical background for the capability to manage customer co-development. This kind of capability resembles that of alliance management, which in the existing literature is seen as a dynamic capability (Schilke & Goerzen, 2010), so the management of customer involvement in co-development is also viewed here as a dynamic capability. Further, paradox management capability, which is central to managing uncertainty in co-development, is understood here as a dynamic capability, since it resembles conflict management, which in the recent studies has been regarded as part of the dynamic alliance management capabilities (Wang, & Rajagopalan, 2015). Next, the background of transaction cost economics that increases understanding on uncertainty in collaboration is explained in more detail.

### 2.4.2 Transaction cost economics

The idea of transaction costs was introduced by Coase in 1937 when he published his work on why and when firms engage in exchange with the market. However, it was Williamson (1975; 1985) who published the seminal works on transaction cost economics which determine the firm’s behavior in exchange situations. While the resource-based view sees firms as a bundle of resources, transaction cost economics views them as a governance structure that can conduct economic exchange. The two key sources of transaction costs are opportunism and uncertainty, against which firms need to shield themselves using governance mechanisms (Rindfleisch & Heide, 1997). Uncertainty stems from not having all the relevant information and from environmental uncertainties that make it impossible to predict the transaction outcome (Williamson, 1975). Opportunism can be defined as “self-interest seeking with guile” (Williamson, 1985; 47).

The transaction cost economics approach has been applied in many marketing studies as it focuses on exchange, a typical marketing phenomenon (Rindfleisch & Heide, 1997). In marketing, transaction cost economics increases understanding on managing customer relationships, and especially the uncertainty in customer relationships. This latter often stems from the opportunism that can be seen for example in situations where actors hide information from each other or customers exaggerate competing suppliers’ bids in order to extract lower offers (Wathne & Heide, 2000).

Also collaborative innovation has been studied using transaction cost economics as the theoretical approach to the phenomenon. These studies have focused, for example, on the governance mechanisms that can reduce the transaction costs related to co-development (Tracey et al., 2014) or ease the fear of a customer’s potential opportunistic behavior in
2.5 Theoretical framework for the study

The theoretical framework for the study is presented in Figure 3. The phenomenon is situated at the intersection of the marketing, innovation, and management literatures, and each of these fields contributes to the topic.

First, the business marketing literature directs the research questions. It provides understanding on topics such as managing customer relationships and co-creation between the supplier and customer. Thus, it relates to all the research questions and in particular RQ1 on the characteristics of value co-creation.

Second, the innovation literature delineates the special characteristics of managing collaboration in development activities. Combined with the marketing and innovation literatures, it provides understanding on co-development with customers and on the co-development process. Thus, the innovation literature links directly to RQ2 on the co-development process, and also provides insights for RQ3 on managing paradoxes in co-development.

Third, the management literature and the seminal theories on the resource-based approach and transaction cost economics support interpretations from the business marketing literature. The management literature provides insights into alliance management, which combined with the innovation literature helps support our understanding of the management of customer co-development.

In the context of this thesis, the resource-based view offers insights into the management of customer relationships and co-development with customers. The resource-based view suggests that firms seek resources also outside their boundaries. The existing research has shown that complementary resources have a positive impact on performance (Harrison et al., 2001; Lin et al., 2009), and the value of complementary capabilities and competences has been acknowledged also for collaborative innovation activities (Corsaro et al., 2012). In addition, the resource-based view, and in particular dynamic capabilities, suggests that firms gain competitive advantage from dynamic capabilities that enable the organization to change. Thus, dynamic capabilities help to explain what kinds of capability are needed in managing customer involvement. As noted earlier, customer involvement capability is
seen as a dynamic capability that resembles alliance management capabilities (Wang & Rajagopalan, 2015), and is essential to successful co-development.

Transaction cost economics provides the basis for managing the customer relationship and co-development with customers. Transaction cost analysis suggests governance for transaction costs, and thus practices for firms to shield themselves from the uncertainty and opportunism that are the key sources of transaction costs in co-development. The existing literature has suggested several approaches to governance which help firms shield themselves from uncertainty. Examples of these include, for example, contracts and relational governance (Poppo & Zenger, 2002).

**Figure 3. Theoretical framework on the key concepts in management of customer co-development and the research questions for the thesis.**
3 RESEARCH DESIGN

This section discusses the philosophical and methodological choices that have guided this research. The section starts by introducing the research approach. Next, the selected research methods are discussed and the data collection and analysis methods presented. The section ends with an evaluation of the quality of the research.

3.1 Research approach

The research focuses on customer involvement in co-development. As noted in the previous section, there is some existing literature on the topic but the management of customer involvement in co-development has been narrowly addressed. Thus, the stream lacks existing models and frameworks that can be further tested and validated. This thesis aims to develop frameworks to understand the management of customer involvement. The research process is largely exploratory and the study employs qualitative methods that are explained later in the chapter. First, the philosophical assumptions underlying the research are introduced.

All choices related to the research design are guided by assumptions and beliefs based on particular philosophical aspects. They steer the research process and the selection of an appropriate research design. Ontology, epistemology and methodology are the key philosophical concepts in the social sciences (Burrell & Morgan, 1979, 1; Guba & Lincoln, 1994, 108) and are discussed in the following.

Ontology focuses on the existence of the world and the social entities within it (Eriksson & Kovalainen, 2008, 13; Bryman & Bell, 2003, 20). The two key ontological perspectives are objectivism and subjectivism. The latter is often referred to in studies on social actors as constructionism (Eriksson & Kovalainen, 2008, 13). This thesis leans on constructionism, according to which reality is constructed in social interactions (Berger & Luckmann, 1966, 13-15). This is evident for example in the first research question, which assumes suppliers and customers perceive the co-development process differently. Thus, supplier and customer are seen to create reality in their interaction as they collaborate in development.

Epistemology focuses on the question of what is knowledge and what are its limitations (Eriksson & Kovalainen, 2008, 14; Bryman & Bell, 2003, 15). Similarly to ontology, epistemology can be divided into an objectivist and subjectivist view, and further into several directions that have different perspectives on reality (Eriksson & Kovalainen, 2008, 14-15). This study is based on social constructivism that suggests each actor creates its own reality and gives meaning to its experiences (Creswell, 2013, 25). This is evident here for example in the data collection methods, which rely mostly on interviews that capture the meanings people have created for customer involvement and the co-development process.
Methodology refers to “organizing principles, which provide the procedure for guiding the research process and research design” (Eriksson & Kovalainen, 2008, 16). In practice, methodology also guides the selection of methods, referring to specific ways of collecting and analyzing data (Eriksson & Kovalainen, 2008; 16). Both methodology and methods are explained in more detail later in this section.

According to Bryman & Bell (2003, 29), besides the philosophical aspects, also theory and personal values affect research approach selection. One aspect of the theory is research field maturity, as qualitative methods are suggested for the study of topics and phenomena not that well addressed in the existing literature, while quantitative research is suggested for application in more mature research fields (Edmondson & McManus 2007). Personal values are often referred to as axiological assumptions that the researcher brings to the study (Creswell, 2013, 20). These may cause bias and affect the quality of the study. The potential biases related to this study are discussed at the end of the section.

3.2 Methodological choices of the research

Qualitative research methods were selected for this study as they support theory building on topics that lack existing models. Qualitative research is difficult to define but can be understood as a collection of different research approaches which aim to create a holistic understanding on a topic (Eriksson & Kovalainen, 2008, 4-5). The benefit of qualitative research is that it aims to generate rather than test a theory and to gain in-depth understanding of a particular topic (Bonoma, 1985). The downsides of qualitative research include its difficulties in showing causal relationships, and the low generalizability of the results (Bryman & Bell, 2003). As causal relationships were not the focus of this research, the causality weakness was not a problem and the study aimed to increase the generalizability of the results for example by collecting data from multiple different industries.

The study is exploratory in nature as it aims to increase understanding on a topic that lacks a well-structured problem (Ghauri & Gronhaug, 2005; 202). The study uses two main methods: case study method (Publications I, II and III) and expert interviews (Publications III and IV). While all these different methods have their own weaknesses, combining multiple methods helps to improve research quality. Thus, this research uses method triangulation to increase the validity of the results (Silvermann, 2011; 269-370)

Case studies focus on either one or multiple cases, for example actor, event or process, and the method is adept at grasping complex issues in a simple form (Eriksson & Kovalainen, 2008; 115-116). Case study is often employed to study phenomena in business markets (Piekkari et al., 2010; Beverland & Lindgreen, 2010). Case studies are sometimes considered challenging for theory building because, for example, in single case studies it is difficult to present the rich data that are needed (Eisenhardt & Graebner, 2007). In addition, cases offer limited generalizability (Eriksson & Kovalainen, 2008). This study answers those challenges by employing both the single (Publication I) and multiple (Publication II) case study method. Single case study method offers the potential
for deep analysis (Yin, 2003; pp. 40), whereas multiple case study is beneficial in building theory on multiple cases (Woodside & Wilson, 2003; Eisenhardt & Graebner, 2007).

Case selection is a critical phase in conducting case studies. The selected cases must be representative, so that they represent the phenomena being studied, and there also needs to be variety between the cases (Seawright & Gerring, 2008). Multiple criteria exist for case selection, such as opportunities to extend a theory, fill theoretical categories, provide examples of extreme cases, or replicate previously selected cases (Eriksson & Kovalainen, 2008, 124). In Publication I, the studied case was illustrative, and selected to provide access to different levels of the studied collaboration. For Publication II, the cases were selected by focusing on a global supplier of mining technology, since the mining industry is known for co-development with customers (Biggemann et al., 2013).

Besides case studies, this research also uses the discovery-oriented, theory-in-use approach, in Publication II (Zaltman et al., 1982; 113). A similar type of approach relying on interviews with key informants has been employed, for example, in studies focused on identifying the nature of customer solutions (Tuli et al., 2007; Töllner et al., 2011). The theory-in-use approach relies on the basic principle that a researcher creating a theory needs to understand what the practitioners think about the topic (Zaltman, et al., 1982; 114). In addition, expert interviews were used in Publication III to support and extend the findings of a pilot study based on case studies, and in Publication IV to create a holistic understanding of the current state of customer involvement. The following introduces the different data collection methods for both the case studies and expert interviews.

3.3 Data collection

The research process can be divided into three data collection phases (see Figure 4). The pre-study phase focused on describing the value co-creation and was used to help guide the main study. In the pre-study, a total of 14 persons representing the suppliers, a customer and end users were interviewed. The data of the main study comprise interviews with a total of 46 persons representing 22 different organizations. These interviews were conducted between autumn 2011 and autumn 2014.
The pre-study focused on an illustrative single case study that was used to increase understanding on co-creation. As extensive single cases do not offer the potential to generalize the results (Kovalainen & Eriksson, 2008), the single case was used to increase understanding on the topic and direct the research in the studies that followed.

The studied case was value creation around the provision and use of an RFID enabled social media marketing system. The interviews in the companies focused on the key informants (Kumar et al., 1993) who in each company had the most information on the studied system. The sampling process for end users followed the principles of purposive sampling (Miles & Huberman, 1994; 27), aiming to select those end users that best represented the typical group of end users. Semi-structured interviews (Ghauri & Grønhaug, 2005, 123) were conducted with a total of 14 persons; one representative from each of the software provider, hardware provider, and customer – a sports center – plus 11 end users. The interview sample is presented in Appendix A and the interview guide in Appendix B. The sports industry was selected for the study because the first application of the system was targeted at sports centers. The interviews were conducted in December 2010 and January 2011. They lasted from one to two hours and extensive notes were taken during the interviews. Besides the interview data, also marketing materials and phone calls to suppliers’ representatives were used to support the analysis.

<table>
<thead>
<tr>
<th>PRE-STUDY:</th>
<th>MAIN STUDY - PHASE 1:</th>
<th>MAIN STUDY - PHASE 2:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single case study</strong></td>
<td><strong>Multiple case study</strong></td>
<td><strong>Expert interviews</strong></td>
</tr>
<tr>
<td>• A value network</td>
<td>• 10 co-development processes</td>
<td>• 24 interviewed persons</td>
</tr>
<tr>
<td>• 14 interviewed persons</td>
<td>• 2 suppliers</td>
<td>• 16 companies</td>
</tr>
<tr>
<td>➢ 2 suppliers: software and hardware providers</td>
<td>• 3 customers</td>
<td>➢ Multiple industries, e.g. manufacturing, construction, transportation and services</td>
</tr>
<tr>
<td>➢ 1 customer: sport center</td>
<td>• 2 expert partners</td>
<td>• Sampling: Theoretical</td>
</tr>
<tr>
<td>➢ 11 end users</td>
<td>• 2 industries: mining &amp; industrial measurement technology</td>
<td>• Secondary material: annual reports, company web pages</td>
</tr>
<tr>
<td>• Sampling: Purposive</td>
<td>• Sampling: Snowball</td>
<td></td>
</tr>
<tr>
<td>• Secondary material: marketing materials, phone calls, discussions with CEO of the software provider</td>
<td>• Secondary material: product brochures, process descriptions, memos from customer meetings</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 4. Data collection phases.**
3.3 Data collection

The first phase of the main study focused on data collection for the cases. Each case was a co-development process that involved at least one customer. The focus was trained on key informants who had been closely involved in co-development projects. The data collection process started with contacting the automation director in the studied mining company that was known to have years of experience in co-development with customers. After that, snowball sampling was employed (Biernacki & Waldorf, 1981), with each informant asked to point out new potential informants who had either been involved in the same co-development process or in some other co-development processes. Even though this kind of sampling process is not systematic, it enabled data collection from people who were central to the studied development processes. The aim was to gather multiple informants for each studied process but this was not always possible. Thus, data were collected from the supplier’s perspective for each of the studied processes, from the customer’s perspective for three of the studied processes, and from the expert partner’s perspective for two of the studied cases.

The first eight co-development processes studied were collected from the mining industry, and to better understand the phenomenon, two additional cases were selected from the industrial measurement technology supplier. This supplier was selected for the study as it had experience of involving customers and guaranteed access to multiple cases. Of the possible measurement technology cases, two were selected in particular because four different persons from the measurement technology company were able to provide insights on them, and there was variety in the process outcome. The two interviews with four managers from the industrial measurement system company were group interviews that involved two persons simultaneously. The data from the measurement technology industry are used only in Publication III. The detailed sample for Publications II-III is presented in Appendix C.

The interviews were semi-structured and each informant was asked open-ended questions on one co-development process in which they had participated. The questions concerned for example the activities in the process, the interaction with the customer, and the outcome of the process. A detailed interview schema for Publications II-III is presented in Appendix D. The interviews lasted from 26 to 146 minutes. They were conducted face-to-face except for four phone interviews, and all were recorded and transcribed verbatim. In addition to the interviews, secondary data were collected whenever possible. Secondary data included for example product brochures, process descriptions, memos from customer meetings and conference papers that the supplier and customer had co-authored. Thus, whenever possible, triangulation of different data sources was applied.

The second data collection phase of the main study focused on expert interviews. The aim was to analyze whether the findings of the case studies can be applied to multiple industries. Furthermore, these interviews did not focus on certain co-development processes but on co-development as a general phenomenon. As random sampling was identified as a weakness for the first data collection phase, in the second phase this weakness was overcome using theoretical sampling.
Thus, the 100 largest companies in Finland (based on turnover) were selected for the study as Finland is known for its strong business-to-business sector. A total of 88 companies were contacted, as 12 on the list were holding companies so had no development activities. The contact person was typically an innovation or R&D director and was asked to forward the invitation to the study to staff with experience in customer involvement in development activities. A total of 20 companies agreed to join the study but the interviews showed that four of these focused solely on business-to-consumer markets, so the final sample was 16 business-to-business companies. The studied companies represent mining, construction, manufacturing, wholesale trade, transportation & public utilities and services, as defined in the SIC industry classification. The aim, albeit not always fulfilled, was to interview as many persons from the industry as possible to avoid informant bias. Thus, 1-3 persons in each company were interviewed, amounting to a final sample of 24 interviewees. The informants were, for example, directors, R&D managers, development managers and project managers. The sample is detailed in Appendix E.

Open-ended questions again addressed the firms’ practices on involving customers, as well as the informants’ experiences when involving their customers in development. A detailed interview schema is presented in Appendix F. The interviews lasted from 34 to 112 minutes. All but one of the interviews were conducted face-to-face (one telephone interview), and all but one were recorded and transcribed verbatim. Extensive notes were written on the one interview that was not recorded. One of the interviews was a group interview involving two persons.

In addition to the interviews, data in the second phase were collected from the companies’ web pages and annual reports. These provided information on the companies’ strategies and perceived importance of collaborating with customers within the company.

### 3.4 Data analysis

The study employs inductive and deductive reasoning. The main emphasis lies on inductive reasoning which means the theory is the outcome of the research, whereas in deductive reasoning, theory guides observations and findings (Bryman & Bell, 2003; 13). Only in Publication III is inductive reasoning in the pilot study followed by deductive reasoning in the main study. Next, the steps for analyzing data in each publication are briefly described.

The main method of analysis in Publication I was thematic, meaning the identification of themes or patterns in the data and then searching for illustrative quotes that support the themes (Silverman, 2011). The unit of analysis was the value network. As data were collected at three different levels, namely supplier, customer and end user, the analysis enabled the comparison of the views that different actors held on value creation and, thus, a holistic understanding of value creation in the studied case was created.
Grounded theory coding was used as the main method of analysis in Publication II for the eight studied cases. While the use of grounded theory as an overall research methodology has sometimes been seen as no more than a method for reporting case studies, here grounded theory coding is used to systematically analyze data to build theory (Wagner et al., 2010b). The unit of analysis is the co-development process between a supplier and a customer. The purpose of Publication I was to create an empirically grounded framework on supplier-customer co-development processes, so grounded theory coding, which is beneficial for building theory from data (Glaser & Strauss, 1967; Creswell, 2013, 84). A similar kind of approach has also been used in studies related to solution business to identify the different perspectives on customer solutions (Tuli et al., 2007) or the nature of hybrid offerings (Ulaga & Reinartz, 2011).

Grounded theory can be utilized as an overall research method in which the principles of theoretical sampling, constant comparison, theoretical coding, theoretical saturation, and theoretical sensitivity guide the research process (Charmaz, 2006), or as an approach to coding the analysis. Here, grounded theory was used for the purposes of analysis. Grounded theory provides a framework on coding procedures which helps increase the trustworthiness of the study (Eriksson & Kovalainen, 2008; 159). The coding process followed the three phases of open, axial and selective coding (Corbin & Strauss, 2015). The open coding focused on in vivo coding in which the topics emerging from the data were coded with names the informants employed in the interviews (Corbin & Strauss, 2015). At the axial coding phase, the emerging patterns were combined and more abstract labels given to the themes appearing in the data, and finally at the selective coding phase, the findings were organized into a framework (Corbin & Strauss, 2015).

In Publication III, the data analysis included both inductive and deductive reasoning. The pilot study for Publication III employed the Gioia method, comprising three phases of analysis (Gioia et al., 2013). The first phase focused on coding each interview in vivo using the informants’ articulations, and allowing themes to emerge from the data by focusing on potential paradoxes and their management processes. The second phase focused on grouping the emerged similar codes, and in the third phase, the relationships between codes were analyzed and the initial framework of the findings was formed.

The main study of Publication III lent on deductive reasoning and the data analysis was guided by the findings of the pilot study. This meant the four identified co-development paradoxes and a theoretical framework on paradox management capability were used to identify patterns in the data. Thus, the analysis process was based on pattern matching (Saunders, et al., 2009). The findings were also validated by conducting two further interviews and presenting the results in managerial workshops in the pilot companies, and no new findings emerged during the validation of the results.

In Publication IV, the data analysis followed qualitative content analysis (Silverman, 2011). First, each interview was open-coded by allowing codes to emerge from the data. Whenever there were multiple interviews from the same organization, the interviews were compared to build the overall picture of customer involvement within the company. Then,
similar codes were grouped together and patterns emerging from the data were identified. This meant that, for example, different kinds of involvement method for different kinds of collaboration, such as ideation, testing and collecting feedback, were grouped together, and different involvement modes were identified based on the involvement practices that companies used. Finally, the findings were organized as frameworks of customer involvement methods which embraces the different involvement types and modes of customer involvement that include firm-specific practices for customer involvement.

3.5 Quality of the research

The typical measures for research quality are reliability and validity. However, there is a shared understanding that these measures as such are poorly suited to measuring the quality of qualitative research (Bryman & Bell, 2003; 395). Thus, several different concepts are used to measure the validity and reliability of qualitative research. Guba & Lincoln (1994; 114) suggest two criteria: trustworthiness and authenticity. Trustworthiness can be further divided into four components, namely credibility, transferability, dependability and confirmability; and authenticity into fairness, ontological, educative, catalytic and tactical authenticity (Guba & Lincoln, 1994; 114).

While trustworthiness is often used to measure research quality, less credence has been given to the application of authenticity as a measure for the wider political impact of research (Miles & Huberman, 1994; 278; Bryman & Bell, 2003; 398-399). Thus, the focus here is on trustworthiness. Nowadays, authors have extended trustworthiness to encompass multiple different criteria in addition to the four components introduced above, and for example pre-understanding, integrity, understanding, utilization, and usefulness are used to measure trustworthiness (Miles & Huberman, 1994; 277; Storbacka, 2011). However, the focus here is on the four most commonly used components: credibility, transferability, dependability and confirmability.

Credibility measures the degree to which the findings make sense (Miles & Huberman, 1994; 278-279; Bryman & Bell., 2003, 396). One way to improve credibility is respondent validation, which means checking the conclusions with the informants (Bryman & Bell, 2003; 396). This was employed in all the Publications to some extent by presenting the emerging results in managerial workshops, and in Publications I, III and IV all informants were able to comment on the findings. The findings of Publication III were also verified with company representatives from the pilot study.

Transferability refers to “the extent to which the findings can be applied to other contexts” (Storbacka, 2011; 701). Some of the findings of this study focus on a single industry, mining technology, and thus the findings from Publications I and II cannot be generalized to multiple industries. However, that was not the purpose of the research questions concerned, as they aimed to increase understanding on the topic in a specific context. Publications III and IV involve multiple industries and these findings can be better transferred to different contexts.
3.5 Quality of the research

Dependability refers to whether the research is consistent for example in terms of the research questions and methods employed (Miles & Huberman, 1994, 278). In this study, the research design with data collection and analysis methods was derived from the research questions, so that research questions and methods are consistent. Furthermore, the research process is clearly depicted so that its consistency can be evaluated.

Confirmability refers to the objectivity of the research and focuses on how well the study is freed from researcher bias (Miles & Huberman, 1994; 278). In this study, the confirmability of the research is achieved by explaining the data collection and analysis methods clearly.
4 THE PUBLICATIONS AND A REVIEW OF THE RESULTS

This chapter introduces the objectives, findings and main contributions of the four publications comprising the second part of the thesis. At the end of the chapter, the proposed framework on management of customer involvement is presented.

4.1 Publication 1 - Combining RFID technology with social media marketing – a value network analysis

Objectives

The study analyzed value creation in an RFID enabled social media marketing system. The existing literature had shown that RFID technology and social media can offer tools for marketing and customer relationship management, but the value of these kinds of system was unknown as few applications existed. Thus, the purpose of this study was to explore value creation in the provision and use of the RFID enabled social media marketing system, and analyze the value created for each actor.

Findings

The findings show that each actor involved in the production and use of the RFID enabled social media marketing system played an important role in value creation. The software supplier and hardware supplier were each able to expand their business through collaboration, and the sports center adopting the system used it for more efficient marketing and customer relationship management. The end users could employ the system to optimize their visits to the sports center, but at the same time their reluctance to fully implement the system was seen as a challenge to its success.

Main contribution

The main findings contributed to the literature on RFID technology and social media marketing. However, the broader contributions of the study for this thesis lay in the characteristics of collaborative value creation that involves suppliers and customers at different levels of the value chain.

Thus, the study focuses on the thesis’ first research question on the characteristics of value creation between suppliers, their customers, and end users. The findings show, for example, that co-creation is challenging if end users are not fully motivated to implement the developed system. The findings also shed light on the potential challenges related to value sharing between actors collaborating in the production of a high technology system. Thus, the findings emphasize the importance of managing co-development between suppliers and customers.
4.2 Publication 2 - Divergent Goals in Supplier-Customer Co-development Process: An Integrated Framework

Objective

The study focused on the co-development process between a supplier and customer. The main objective was to shed light on the phases and activities in the supplier-customer co-development process. The existing literature had assumed the co-development process resembles the traditional development process, and focused on the supplier’s perspective on the co-development process. Thus, this study focused on analyzing the different actors’ perspectives on the process, identified their activities in different phases of the process, and built a framework depicting the supplier-customer co-development process.

Findings

According to the findings, the co-development process differs from internal development as it is emergent and iterative by nature and requires the balancing of actors’ divergent goals. The study shows that supplier-customer co-development comprises need-matching dialogue, seeking governance consensus, interactive ideation, iterative co-development and testing, and commercialization co-preparation. Each actor perceives the process differently as each perceives those phases that support the achievement of their goals. Thus, the supplier developing the innovation and aiming to commercialize it perceives co-development as a far-reaching process, while the customer aiming to improve its process efficiency perceives the process as focusing on testing and implementation.

Main contribution

The study contributes to the literature on customer involvement in co-development by suggesting a framework on supplier-customer co-development that challenges the existing models on co-development. The developed framework shows that the supplier-customer co-development process is characterized by phases that aim to find common goals for the development process. In doing so, the study highlights the management efforts needed for successful co-development.

In terms of this thesis, the study focuses on the thesis’ second research question on key phases in co-development processes. Thus, the findings contribute to the management of a co-development process between a supplier and customer. Furthermore, the findings increase understanding on the tensions inherent in the co-development process that are based on the actor’s divergent goals for the process.
4.3 Publication 3 - In search of paradox management capability in supplier–customer co-development

Objectives

The existing literature on customer involvement in co-development had focused on the positive and negative effects of collaboration. However, co-development is also characterized by paradoxes that are grounded deeper in the nature of co-development. Thus, the purpose of this study was to shed light on the co-development paradoxes and find processes to manage them.

Findings

The findings show three co-development paradoxes that are related to 1) contractual and relational governance, 2) knowledge sharing and protection, and 3) customer-specific and general development goals. The empirical findings demonstrate how companies manage these paradoxes either by focusing on one pole of the paradox, which is known as polarizing, or addressing both poles, which is termed juxtaposing. Polarizing can be enacted in terms of time, so that the company first focuses on one pole and then switches focus to the other, or in terms of function, so that the company focuses on one pole in one function and the other pole in another function. Thus, the findings show three processes for managing paradoxes: full polarizing, polarizing over time or function, or juxtaposing.

Main contribution

The findings contribute to the literature on customer involvement in co-development by increasing understanding on instabilities related to co-development. Furthermore, the findings contribute to the literature on paradox management by suggesting a framework on paradox management capability.

In terms of this thesis, the study focuses on the third research question on paradoxes and their management. Thus, the research increases understanding on the management challenges faced when customers are involved in co-development, and suggests management processes for the identified paradoxes. This shapes the current view of management of co-development, which is focused on managing the co-development risks before engaging in co-development, by showing how companies can manage the challenges always inherent in supplier-customer co-development. Thus, the findings contribute to the literature on firms’ capabilities in managing interfirm collaboration, and shows how paradox management capability is central to the collaboration between supplier and customer.
4.4 Publication 4 - Co-development as win-win strategy – Co-development practices in industrial companies operating in Finland

**Objectives**

The existing literature has suggested that customer involvement in development is beneficial only if customers are involved in an appropriate manner. However, there is little understanding on how firms actually involve their customers in the development of new products and services. Thus, the study aimed to shed light on customer involvement practices in large business-to-business companies operating in Finland.

**Findings**

The findings show that companies use both traditional and interactive practices to involve customers in the identification of customer needs, developing new products and services, and collecting feedback on current offerings. Based on these practices, the study identified four customer involvement modes: passive involvement, sales-based involvement, customer insight expert based involvement, and customer-orientation as an organizational mindset.

**Main contribution**

The findings contribute to the literature on customer involvement in development by identifying the practices for customer involvement. Based on the customer involvement practices, the findings also show modes for the creation of customer knowledge.

In terms of this thesis, the study focuses on the fourth research question on customer involvement practices. Thus, the study sheds light on the actual practices for involving customers and the challenges and benefits related to different involvement modes. Thus, it contributes to the management of the supplier’s internal process in involving customers.

4.5 Summary of publications 1-4

All four publications play their own role in the contribution of this study. Table 3 offers a brief summary of each publication’s objective, research questions, method, data, findings and contribution to this thesis. All offer grounds for their contributions here.
Table 3. A summary of publications and their main contributions to the thesis.

<table>
<thead>
<tr>
<th>Publication</th>
<th>Title</th>
<th>Objectives</th>
<th>Research questions</th>
<th>Objectives</th>
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<tbody>
<tr>
<td>Publication I</td>
<td>Combining RFID technology with social media marketing – a value network analysis</td>
<td>To analyze value creation in an RFID technology enabled social media marketing system to show possibilities and challenges for collaborative value creation.</td>
<td>What are the characteristics of value creation in a value network that deploys RFID technology in social media marketing?</td>
<td>How does the potential heterogeneity in actors’ goals reflect on their perceptions of the co-development process? What types of phase can be identified in the actors’ joint perception of the co-development process?</td>
</tr>
<tr>
<td>Publication II</td>
<td>Divergent Goals in Supplier-Customer Co-development Process: An Integrated Framework</td>
<td>To study the actors’ perceptions of the supplier-customer co-development process and build an empirically grounded framework of co-development.</td>
<td>What paradoxes can be identified in supplier-customer co-development in business-to-business markets? What kinds of process do companies use for managing these paradoxes?</td>
<td>What kinds of practice for customer involvement can be identified within industrial companies? What kinds of customer involvement mode do the companies use?</td>
</tr>
<tr>
<td>Publication III</td>
<td>In search of paradox management capability in supplier-customer co-development</td>
<td>To study paradoxes in supplier-customer co-development and create a framework of paradox management capability.</td>
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<tr>
<td>Publication IV</td>
<td>Customer involvement practices in business-to-business companies operating in Finland</td>
<td>To shed light on the customer involvement practices in large business-to-business companies operating in Finland.</td>
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## Method

<table>
<thead>
<tr>
<th>Publication I</th>
<th>Publication II</th>
<th>Publication III</th>
<th>Publication IV</th>
</tr>
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<tbody>
<tr>
<td>Method</td>
<td>Single case study</td>
<td>Multiple case study of eight cases, and grounded theory coding</td>
<td>Pilot study with ten co-development processes and main study with expert interviews</td>
</tr>
<tr>
<td>Primary data</td>
<td>A total of 14 interviewed persons in three organizations, and with 11 end customers</td>
<td>16 interviewed persons in four organizations</td>
<td>48 interviewed persons in 22 organizations</td>
</tr>
<tr>
<td>Main findings</td>
<td>The study shows that value creation between a technology provider, software supplier, sports center adopting the system, and end customers requires each actor’s engagement in the collaboration. The study also shows that a customer’s reluctance to implement a system based on new technology can damage value creation.</td>
<td>The study shows that supplier-customer co-development comprises the phases of: need matching dialogue, seeking governance consensus, interactive ideation, iterative co-development and testing, and commercialization co-preparation.</td>
<td>The findings show three co-development paradoxes related to 1) contractual and relational governance, 2) knowledge sharing and protection, and 3) customer-specific and general development goals. Furthermore, the study illustrates how companies manage these paradoxes either by focusing on one pole of the paradox (polarizing) or addressing both poles (juxtaposing).</td>
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</table>
### 4.5 Summary of publications 1-4

<table>
<thead>
<tr>
<th>Related research question in the thesis</th>
<th>Publication I</th>
<th>Publication II</th>
<th>Publication III</th>
<th>Publication IV</th>
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<tr>
<td>RQ 1: What are the characteristics of value creation between suppliers, their customer and end users?</td>
<td>The study increases understanding on collaborative value creation and stresses the end user’s role in the value creation process. The study also offers insights on potential challenges related to value sharing when a new system is co-developed between companies.</td>
<td>The study provides a framework on supplier-customer co-development which suggests that the co-development process entails multiple phases that focus on balancing actors’ divergent goals.</td>
<td>The study provides a framework on paradox management capability, and demonstrates how companies can manage paradoxes related to customer involvement by full polarizing, polarizing over time or function, or juxtaposing.</td>
<td>RQ 4: What kinds of practice for customer involvement can be identified within companies?</td>
</tr>
<tr>
<td>Main contribution to the thesis</td>
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<tr>
<td>The study increases understanding on collaborative value creation and stresses the end user’s role in the value creation process. The study also offers insights on potential challenges related to value sharing when a new system is co-developed between companies.</td>
<td>The study provides a framework on supplier-customer co-development which suggests that the co-development process entails multiple phases that focus on balancing actors’ divergent goals.</td>
<td>The study provides a framework on paradox management capability, and demonstrates how companies can manage paradoxes related to customer involvement by full polarizing, polarizing over time or function, or juxtaposing.</td>
<td>The study increases understanding on practices for customer involvement and points out challenges related to different involvement modes.</td>
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Figure 5. The findings of the thesis – Three dimensions of the management of customer co-development.
The overall findings of the thesis are shown in Figure 5. The findings answer the main research question by describing the management of customer co-development through three dimensions. Each of the three dimensions is further discussed in the publications so that each publication focuses on one research question and one dimension. Thus, the publications deepen understanding of the management dimensions.
5 CONCLUSIONS

The main purpose of the research was to shed light on the management of customer involvement in business-to-business markets. The main research question for the thesis was:

*How do firms manage customer involvement in their development activities in the business-to-business context?*

This was further divided into the following four research sub-questions:

1) *What are the characteristics of value creation between suppliers, their customer and end users?*
2) *What are the key phases of the co-development process?*
3) *What paradoxes does supplier-customer co-development involve and how do firms in business-to-business markets manage these paradoxes?*
4) *What kinds of practice for customer involvement can be identified within companies?*

Each of the sub-questions was answered in a separate publication and the findings are summarized in section four of this thesis. In answering the research questions, the findings increase understanding on the management of customer co-development.

First, the thesis provides a framework for the co-development process that illustrates the characteristic of co-development as balancing between the actors’ divergent goals. Second, the thesis suggests a framework for managing co-development paradoxes. Third, the findings increase understanding on the different modes and practices for customer involvement. The study also details implications for theory and managers, which are explained in more detail in the following.

5.1 Theoretical contributions

This thesis conceptualizes the management of customer involvement in co-development in three dimensions: management of 1) the relational processes, 2) challenges and paradoxes, and 3) internal customer involvement processes. In doing so, the thesis makes three key theoretical contributions.

First, the thesis contributes to the *management of the relational processes* in customer co-development. The existing research has examined these processes quite narrowly, and the research on the topic has been based largely on firm internal development process models. While the existing research has identified the downsides of actors’ heterogeneity in co-development e.g. in terms of goal misalignment (e.g. Corsaro et al., 2012), there has been only a narrow understanding of how balancing the actors’ divergent goals shapes the co-development process. This thesis emphasizes the management of the relational processes
between the supplier and customer in all phases of the co-development process, as it helps smoothen the process and avoid lengthy negotiations on conflicts that may arise.

Second, the thesis contributes to the management of challenges and paradoxes of customer co-development from the supplier side. We know that customer co-development is challenging and often unsuccessful (Chang & Taylor, 2016), but to date there has been a lack of in-depth understanding on the source of the co-development paradoxes and their management processes. This thesis adopts a paradox perspective (e.g. Lewis, 2000; Smith, 2014) to identify three co-development paradoxes inherent to all co-development processes and suggests management approaches based on polarizing one pole of a paradox or juxtaposing both poles.

Third, the thesis contributes to the management of the internal customer involvement processes in the supplier organization and examines how customer involvement occurs in practice. While the existing literature has listed some customer involvement practices (e.g. Alam, 2002; Edvardsson et al., 2012), this thesis increases understanding on how customers can be involved in different phases of the development process and what modes firms have for customer involvement. Making these three different contributions, the thesis has implications for three separate literature streams, which are discussed next.

5.1.1 Implications for the customer-supplier relationship management literature

This thesis contributes to understanding on managing the relational processes between the supplier and customer during co-development. The existing research on relational processes has shown that suppliers and customers may have divergent perceptions on their collaboration process (e.g. Tuli et al., 2007). This extends that view by increasing understanding on how the misalignment in supplier and customer goals shapes the process and creates tensions. While the existing literature on supplier-customer relationships in business markets has stressed the value of long-term and close customer relationships (Håkansson, 1982; Gounaris, 2005), this thesis shows that those kinds of relationship have dark sides and paradoxes that require management on the part of the supplier.

The thesis supports the existing research that emphasizes the role of atmosphere in supplier-customer relationships (e.g. Wong et al., 2010; Håkansson 1982) by showing how the conflicting goals hamper the co-development process. The existing literature on supplier-customer relationships has emphasized the following dimensions in relationship atmosphere: 1) power/dependence, 2) cooperativeness/competitiveness, 3) trust/opportunism, 4) understanding/non-understanding, 5) closeness/distance, and 6) commitment/non-commitment (Hallén & Sandström, 1991). This thesis brings in an additional dimension, namely goal congruence/divergence. In general, the study directs attention towards aligning the divergent goals of customers and suppliers and opens up the dangers of over-collaborative relationships from the supplier’s perspective.

The identification of the customer co-development management dimension also adds to the current literature on customer relationship management. That literature has focused
5.1 Theoretical contributions

mostly on the initiation, maintenance and termination of customer relationships (Reinartz et al., 2004). These are also key processes for managing co-development but in addition to the customer relationship management processes, the study adds new management dimensions related to the co-development process, paradoxes within it, and actual co-development practices. These help to extend the literature that has already acknowledged co-creation with customers as part of customer relationship management (Payne & Frow, 2005).

One extension to the current literature is the new capabilities needed for customer relationship management. The existing research has identified relationship management capability as critical to the firm’s success (Möller & Halinen, 1999). However, this capability has not taken into account the special nature of managing customer relationships in the co-development context. Thus, this research suggests a capability for managing customer involvement in co-development. In doing so, the findings also bring the customer-supplier relationship management literature closer to the general management literature, which has already identified alliance management as a dynamic capability (Wang & Rajagopalan, 2015).

The literature on the management of supplier-customer relationships has mostly focused on identifying in advance the risks related to deeper collaboration, and finding ways to avoid these risks (e.g. Stone & Gronhaug, 1993; Palmatier et al., 2007). This thesis challenges the view by suggesting that co-development with customers always entails risks, tensions and paradoxes that cannot be anticipated or managed in advance. For example, the literature has shown that customer selection can be used to manage the risks of creating only incremental innovations (Bonner & Walker, 2004), but this research shows that co-development entails paradoxes independent of customer type and suggests management processes for the paradoxes. Thus, the thesis encourages a shift in focus regarding customer relationship management from planning and preventing risks to managing the opportunities and tensions as they arise.

5.1.2 Implications for the innovation management literature

This thesis contributes to the innovation management literature in two ways. First, it increases understanding on the management of the co-development process. And second, it contributes to the supplier side management of challenges and paradoxes inherent to customer co-development.

While the management of interfirm development has attracted an increasing amount of academic interest from the innovation scholars, this thesis adds to the literature by studying customer involvement in the context of business markets. Thus, it provides new phases for the existing co-development process models that have focused on activities which customers perform in co-development (e.g. Alam, 2002). The thesis argues that customer involvement changes the nature of the process and complicates its management due to the actors’ divergent goals.
The findings of the thesis support and extend the paradoxical nature of co-development. The existing research on managing innovation collaboration has for example pointed out the benefits of co-developing with lead users but at the same time raised the problem of identifying lead users (Urban & Von Hippel, 1988; Franke et al., 2006). The existing research has also identified several negative effects of involving customers, such as creating less innovative new products (Fang, 2008). This research extends these views by identifying paradoxes related to co-development and offering management processes for the paradoxes. The paradoxes presented in the thesis support a better understanding of the challenging nature of collaboration with customers, which involves tensions that are deeply grounded in the collaboration and independent of the type of collaboration customer or developed innovation.

The thesis adopts a paradox management perspective on the management of collaborative innovations. The existing innovation management literature has studied innovation paradoxes, such as exploring new innovations and exploiting existing opportunities (Andriopoulos & Lewis, 2010; Knight & Harvey, 2015). This thesis extends the view by identifying co-development paradoxes, provides a paradox management framework, and also illustrates the hybrid paradox management approaches in which companies try to find a synthesis that accommodates both sides of the paradox (Smith, 2014).

5.1.3 Implications for the marketing literature

The marketing literature has pointed out the benefits of customer involvement in co-development (Fang, 2008; Coviello & Joseph, 2012). Also, the existing literature has shown that market orientation has positive impacts on the innovation process and for the firm (Atuahene-Gima, 1996; Rajala et al., 2012). However, the studies have been lacking in practices on how customers are involved, as the few studies on the topic have focused on the roles that customers play in the development process (Alam, 2002; Öberg, 2010; Coviello & Joseph, 2012). This thesis extends the literature by clarifying the supplier’s and customer’s tasks during a co-development process and providing practices for how customers are actually involved in different phases of the co-development.

Furthermore, the marketing literature has identified different kinds of marketing capability that include for example market sensing, market learning, open marketing, pricing, product development and distribution capabilities (Day, 1994; Vohrhe & Morgan, 2005; Day 2011). The possession of marketing capabilities is important to the firm, as they are proven to drive firm performance together with market orientation (Morgan et al., 2009). This thesis extends the discussion on marketing capabilities and market orientation by suggesting a new capability for managing tensions in collaborative customer relationships. Also the existing studies have identified a customer-linking capability that refers to the firm’s capability to establish collaborative relationships with customers (Day, 1994). However, this research extends the understanding on capabilities related to collaboration with customers by showing how the tensions inherent to co-development can be managed. As the new kinds of more collaborative business model
5.2 Managerial implications

have generalized (Prahalad & Ramaswamy, 2004), this kind of capability is even more valuable to companies.

Finally, marketing and innovation departments were traditionally seen as separate organizational units and their collaboration was limited to the handover period of commercializing new innovations. Nowadays, however, the benefits of deeper integration between marketing and innovation have been identified (e.g. Hurley & Hult, 1998; Moenaert et al., 1994). This research brings the two literature streams on marketing and innovation closer by opening up the nature and phases of the co-development process and management challenges and processes related to co-development with customers.

5.2 Managerial implications

Both practice and research have shown that customer involvement in co-development is a challenging process that requires careful management. The study helps illuminate the nature of customer involvement in co-development and the required managerial efforts to succeed in managing customer co-development. This thesis concludes that the management of customer involvement in co-development can be divided into three dimensions that focus on managing the relational co-development processes, paradoxes, and internal customer involvement. These findings improve firms’ capability to manage customer involvement in co-development as they suggest that firms should allocate resources to these dimensions. In addition, the research suggests key managerial actions for each dimension (See Table 4).

Table 4. Key managerial actions for the identified management dimensions.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Key managerial actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing the relational processes</td>
<td>- Selecting suitable partners based on mutual orientation and complementary input</td>
</tr>
<tr>
<td></td>
<td>- Setting congruent goals for the process</td>
</tr>
<tr>
<td></td>
<td>- Committing the customer</td>
</tr>
<tr>
<td></td>
<td>- Agreeing on responsibilities and intellectual property rights</td>
</tr>
<tr>
<td></td>
<td>- Delivering on the customer’s goals (e.g. by further developing a customized version)</td>
</tr>
<tr>
<td></td>
<td>- Providing extra support</td>
</tr>
<tr>
<td>Managing paradoxes</td>
<td>Selecting the approach</td>
</tr>
<tr>
<td></td>
<td>- relational governance by building trust</td>
</tr>
<tr>
<td></td>
<td>- contractual governance by creating contracts</td>
</tr>
</tbody>
</table>
**5 Conclusions**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Key managerial actions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- knowledge sharing by encouraging free knowledge sharing</td>
</tr>
<tr>
<td></td>
<td>- knowledge protection by requiring non-disclosure agreements and limiting the shared knowledge</td>
</tr>
<tr>
<td></td>
<td>- customer-specific development by developing highly customized solutions and providing exclusive rights for certain customers</td>
</tr>
<tr>
<td></td>
<td>- general development goals by selecting partners that represent the market needs</td>
</tr>
<tr>
<td>Managing internal customer involvement processes</td>
<td>- Using customers in</td>
</tr>
<tr>
<td></td>
<td>• identification of customer needs e.g. through interviews, workshops and observation</td>
</tr>
<tr>
<td></td>
<td>• development e.g. through field tests, interviews and narratives</td>
</tr>
<tr>
<td></td>
<td>• collecting feedback e.g. through feedback questionnaires, interviews, observation and videos of the actual user environment</td>
</tr>
<tr>
<td></td>
<td>- Guaranteeing the knowledge flow of customer needs within the organization e.g. by hiring customer insight experts and involving multiple staff in the identification of customer needs.</td>
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</table>

*First, this thesis offers practices to manage the relational co-development process.* The findings show that customer co-development is characterized by goal misalignment between the supplier and customer. The findings of Publication II show that any goal misalignment that is not resolved at the beginning of the co-development process seems to lengthen the later stages of the process. Thus, the key actions in managing the relational processes during co-development focus on managing the potential conflicts that may arise during the co-development process. As balancing actors’ divergent goals is a risk for the development process, the study encourages suppliers to select partners that have a mutual orientation and negotiate on goal congruence.

The study also shows that customers that have achieved their own goals and feel rewarded for their role are more eager to participate also in the commercialization phase. Thus, key managerial actions during the co-development process include ensuring the customer achieves its objectives for the co-development and providing extra support for the customer. This can, for example, mean that the supplier creates a customized version of the developed solution for the collaboration customer. As the findings of Publication I show, end user reluctance to implement the developed system may hamper the customer
5.3 Limitations

in capturing all the benefits of co-creation. Thus, the supplier could for example invest extra effort in guaranteeing the smooth implementation of the system and thereby increase customer satisfaction with the co-development process.

Second, this thesis offers mechanisms to manage the paradoxes inherent to customer co-development. The study identified three paradoxes related to relational and contractual governance, knowledge sharing and protection, and customer-specific and general development. All these paradoxes can be managed either by polarizing one end of the paradox, e.g. focusing on knowledge protection, or by juxtaposing both ends of the paradox, e.g. protecting only the most critical knowledge and addressing knowledge sharing for less critical knowledge.

The key managerial actions include selecting the approach to the paradox and then managing the selected approach. Selecting the approach means focusing either on one end of a paradox or both ends. The thesis suggests that a company’s competitive advantage and resources are determinant factors when it selects its approach to the paradoxes. After selecting the approach, the firm can select the managerial actions. For example, when selecting relational governance, the firm’s key action is to build trust, whereas in focusing on contractual governance a key action is to negotiate and sign contracts. Firms can also combine the focuses by doing both, which in this study means adopting the juxtaposing approach to the paradox.

Third, this thesis offers practices for customer involvement. The study shows that customers can be used to identify customer needs, developing new products and services and collecting feedback on the developed systems. The findings suggest several managerial actions for all these activities as customers can be involved in multiple ways. Those firms that aimed to listen to their customers followed a philosophy that suggests you need to spend time with the customer in order to be able to understand them and the environment in which they operate. This can be achieved for example through interviews and observations that help the firm involve customers in the identification of customer needs and development activities.

The findings of Publication IV show that one challenge for a truly customer-oriented organization is to guarantee the knowledge flow of customer needs and preferences within the organization. Thus, a key managerial action is to place emphasis on sharing customer knowledge within the organization. This can be achieved e.g. by hiring customer insight experts who ensure that customer feedback flows from one department to another. Another way to guarantee the knowledge flow within the organization is to involve many people in collecting the customer insight information. One studied company for example educated its personnel who visit customers to observe customer insights.

5.3 Limitations

First, there are some limitations to generalizing the results due to the methodological choices. As mentioned in section three, the use of qualitative methods limits the potential
for generalization. Also the data collection sets some limitations as most of the studied companies represented manufacturing and a large part of the data was collected from process technology providers. This means that the findings are more biased towards manufacturing and might not be generalizable for example to service industries. Also, almost all the data were collected in large companies so the findings cannot be generalized to small- or mid-size companies, or start-ups that may have more revolutionary practices for customer involvement.

However, this kind of focus was necessary to collect sufficiently rich data from one field and extend at least some generalizations to manufacturing companies. In addition, the aim was to collect data from multiple companies and this was achieved with data from a total of 25 companies. Future studies could adopt quantitative methods and large sample sizes from different industries to validate the results beyond the studied context.

Second, the study was conducted from the supplier’s perspective. This has been acknowledged as a limitation also in the existing studies on the topic (Coviello & Joseph, 2012). Even though some data were collected also from the customer’s perspective, the analysis focused on how the supplier can manage customer involvement. This approach does not take into account the fact that also the customer has a role in managing the co-development. However, the decision to focus on the supplier’s perspective was grounded in the fact that the supplier commercializing the product, service or process being developed also has the primary interest in managing the process. Also, the supplier side focus was required because the scope of the study did not allow broad enough data collection to draw conclusions also on the customer perspective for managing co-development. This could also be a fruitful topic for further research.

Third, the study does not take into account several contextual factors that shape the nature of co-development and therefore also the management of customer involvement. The contextual factors were not addressed due to the lack of knowledge on the management processes, on which the study therefore focused so that further studies can look deeper into the contextual factors. Potential factors that may affect the management aspect are, for example, the type of innovation (product, service or process), innovativeness of the outcome (radical versus incremental), and type of customer (lead user, heterogeneous or homogeneous). As noted earlier, these limitations also offer fruitful avenues for future research, which are discussed next.

### 5.4 Suggestions for future research

The focus of this research was the co-development process and management of the process from the supplier firm’s perspective. The findings conceptualize the management of customer co-development, and in doing so deepen the understanding of managing its paradoxical nature. The findings offer multiple avenues for fruitful research.

Several studies have focused on the effects of customer involvement and measured its performance through the efficiency of the development process or the developed product
5.4 Suggestions for future research

or service (Fang, 2008; Carbonell et al., 2009). While this study offers suggestions on how customer co-development can be managed, these findings can be extended by studying how different kinds of customer involvement management affect the performance of customer co-development. For instance, what types of paradox management mechanism lead to successful new product development processes? As the management of customer co-development is crucial to the future of the customer relationship, it would be beneficial to measure the performance of customer co-development also through the relationship factors. For example, what kind of customer co-development management processes lead to a closer customer relationship? An understanding of the performance effects of different management mechanisms would also help firms in selecting the most appropriate management mechanisms.

The effects of contingent factors, such as type of innovation (e.g. Menguc et al., 2014), could be further studied also in the context of managing customer co-development. For instance, while this study suggests management mechanisms for paradoxes concerning customer involvement, future studies could consider the contingent factors and suggest which kind of contingent factors support the selection of certain management mechanisms. Furthermore, this study suggests that firms select customer involvement practices based on the resources they possess, but contingent factors may also shape the process of how firms involve their customers. For example, does a certain type of environment or industry favor the use of certain types of customer involvement practice? Answering these questions would also help firms in selecting their mechanisms for managing customer co-development.

Also, the customer’s perspective on the management of customer involvement would offer further research avenues. Essentially, customer involvement in the supplier’s development process and supplier involvement in customer’s development process are similar phenomena, in which the perspective of the phenomenon changes. Supplier involvement in the customer’s development process and also the management of that process have been addressed in several studies (e.g. Song & Di Benedetto, 2008; Johnsen, 2009; Melander & Lakemond, 2015). However, even though customer involvement and supplier involvement both describe collaboration between supplier and customer, several studies have shown that the effects of supplier and customer involvement are different (Lau et al., 2010; Menguc et al., 2014). Also, it is likely that the actor that is going to commercialize the outcome of the process is the one that is actually managing the process, and the roles the supplier and customer play in these two forms of co-development are different. Thus, future studies should focus on the process of customer involvement in the supplier’s development process also from the customer’s perspective.

In sum, this research stresses the importance of managing customer involvement and increases understanding on the management of the customer co-development process, the co-development paradoxes and their management processes, and the firm’s approach to co-development strategy. In doing so, it opens up possibilities for research that can explain how the management of customer involvement affects the performance of customer co-development.
REFERENCES


References


References


References


References


APPENDIX A: PILOT STUDY INTERVIEW SAMPLE
(PUBLICATION I)

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<td>End user</td>
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</table>

*duration was not measured
APPENDIX B: PILOT STUDY INTERVIEW SCHEMA
(PUBLICATION I)

Interview schema for the suppliers (hardware and software provider)

1. Value network
   1.1. Could you describe the collaboration partners related to the system?
   1.2. What is your position in the network?
   1.3. What kind of relationships have you with other actors in the network?
   1.4. How are decisions made in the network?
   1.5. Is someone managing the value network?
   1.6. How do you see the future of the network?

2. The developed system
   2.1. What components do you offer to the developed system?
   2.2. What are your main capabilities that you offer for the network?
   2.3. How you see the value that you provide in the network?
   2.4. Could someone else replace you in the value network?

3. The value of the developed system
   3.1. What kind of value the system creates?
   3.2. What benefits the developed system has?
   3.3. What challenges are related to the system and its implementation?
   3.4. How can you facilitate the implementation of the system?

Interview schema for the customer (sports centre)

1. Value network
   1.1. Could you describe the collaboration partners related to the system?
   1.2. What is your position in the network?
   1.3. What kind of relationships have you with other actors in the network?
   1.4. How are decisions made in the network?
   1.5. Is someone managing the value network?
   1.6. How do you see the future of the network?

2. The value of the developed system
   3.5. What kind of value the system creates?
   3.6. What benefits the developed system has?
   3.7. What challenges are related to the system and its implementation?
3.8. How can you facilitate the implementation of the system?
3.9. What services provided by the system would you use?

Interview questions for end user

1. What do you think about this new system?
2. Would you use the developed system?
3. Why would use the developed system? Why not?
4. Would you give the system access to your social media account?
5. Would you use the system if you would get rewards from using it?
6. What kinds of rewards would motivate you to use the system?
7. What kinds of benefits the system has in your opinion?
8. Would you use additional features such as reminders?
9. Do you use any other similar kind of systems?
## APPENDIX C: CASE STUDY INTERVIEW SAMPLE  
(PUBLICATIONS II-III)

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## Appendix C: Case study interview sample (Publications II-III)

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*) Not used in Publication II.

**) Telephone interview, all others are face-to-face interviews

***) Used only in Publication III

****) Group interview with two persons
APPENDIX D: CASE STUDY INTERVIEW SCHEMA (PUBLICATIONS II-III)

1. Background information
   1.1. What is your current title?
   1.2. How long have you been working for the company?

2. The collaboration partner(s)
   2.1. How was/were the collaboration partner(s) selected?
   2.2. Could you describe the collaboration partner(s)?
   2.3. Which kind of relationship did you have with the collaboration partner(s) before the project (sales, previous collaboration)?

3. The developed product
   3.1. Could you describe what was developed in the project?
   3.2. How did the developed system differ from other existing systems that served the same need?
   3.3. Who came up with the idea for the system?
   3.4. Why were you involved in the process?
   3.5. Which goals did you have for the development process?

4. The development process
   4.1. When did the development project begin?
   4.2. How did the process begin?
   4.3. Can you divide the process in different phases?
   4.4. Which activities occurred during the phases?
   4.5. In which of the phases or activities were you involved?
   4.6. Did positive or negative critical events occur during the process?
   4.7. Did you face challenges during the process?
   4.8. When did the development process end?
   4.9. What was ready when the project ended?

5. Interaction during the development process
   5.1. Through which means did you share information during the process? (e.g. meetings, virtual meetings, phone calls, e-mail…)
   5.2. How often were you in touch with the co-development team?
   5.3. Was interaction more intensive in some of the phases of the project? If it was, in what of the phases?

6. Resources
   6.1. How knowledgeable were you about the developed systems if you for example compare yourself with your competitors?
6.2. How knowledgeable do you regard the customer?
6.3. What resources were required from you?
6.4. What kind of competence did you provide for the development project?
6.5. Which competence did other actors provide?

7. Project team
7.1. How many persons were involved in the project team?
7.2. How many persons were involved in the project team?
7.3. Were there other actors besides supplier and customer involved in the project?
7.4. How were tasks divided between team members?
7.5. Did changes occur in the project team during the development? Did they affect to the project?
7.6. Who was managing the project?
7.7. Did project manager change during the process?
7.8. Who made decisions in the project?

8. Collaboration
8.1. Did you trust that the partner is able to finish the development project?
8.2. Were you afraid that the partner uses inappropriately the information that you share with them?
8.3. Which kind of contract was negotiated/signed?
8.4. At which phase was the contract negotiated/signed?
8.5. How was intellectual property rights (IPR) divided?
8.6. How committed were you to the project?
8.7. How committed was the supplier?
8.8. How would you describe the supplier as a development partner?
8.9. How would you describe the atmosphere for the development in your organization?
8.10. Did your organization support you in your tasks related to the development project?
8.11. How did the relationship between the supplier and the customer evolve during the process?

9. Result
9.1. Were you satisfied with the developed end product?
9.2. Are you satisfied with the project?
9.3. Did you reach the goals that you had for the project?
9.4. How did you personally benefit from the project (if you did)?
9.5. How did the development process affect to the relationship between the supplier and customer?
9.6. Would you join a similar kind of development project now when you know what it requires from you?
9.7. Would you do something differently now if you would end up in a similar kind of project?
## APPENDIX E: EXPERT INTERVIEW SAMPLE
(PUBLICATIONS III-IV)

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<td>9.10.2014</td>
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<td>Product Manager</td>
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<td>12</td>
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<td>23.10.2014</td>
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<td>8</td>
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<td>16</td>
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<td>19</td>
<td>12</td>
<td>Account Manager</td>
<td>7.11.2014</td>
<td>64 min</td>
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### Appendix E: Expert interview sample (Publications III-IV)

<table>
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<th>Duration</th>
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<td>24</td>
<td>16</td>
<td>Head of Solutions Business Unit</td>
<td>25.11.2014</td>
<td>50 min</td>
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</tbody>
</table>

*) Telephone interview, all other face-to-face interviews

**) Group interview with two persons

***) No recording, only notes
APPENDIX F: EXPERT INTERVIEW SCHEMA
(PUBLICATIONS III-IV)

1. Background information
   1.1. Could you first tell me something about your background and current role in the company?
   1.2. What do you think co-development with customers means?

2. Co-development in your organization
   2.1. How often do you co-develop products and services with customers?
   2.2. How do you generally consider customers’ needs and preferences in the development of new products and services?
   2.3. How does your company encourage or support customer orientation in the development of new products and services?
   2.4. Do you have any tools for co-development or customer-centric design? (e.g. platforms for collecting and documenting customer feedback). If yes, which kind of tools do you use?
   2.5. Could you give examples on products or services that have been co-developed with customers?
   2.6. In which phases and activities of the co-development process customers typically are involved?
   2.7. What kind of benefits can be achieved by co-developing with customers?
   2.8. In which kind of situations co-development is suitable?
   2.9. Can you figure out some situations in which co-development might not be beneficial?

3. Problems and success factors of co-development
   3.1. Which kind of risks or problems co-development has? Which risks or problems have you encountered?
   3.2. How can you avoid risks or problems related to co-development?
   3.3. What factors do you consider as critical in the successful co-development?
   3.4. How do you avoid the risk of co-developing overcustomized products or services?
   3.5. How do you make sure that co-development does not lead into knowledge leakages?
   3.6. How do you make sure that co-development does not prolong the process?
   3.7. What kinds of contractual arrangement do you use in co-development (e.g. sharing responsibilities, non-disclosure agreements, intellectual property rights)?

Do you know other persons who have experience in co-development and might want to share their opinions about co-development?
PART II: PUBLICATIONS
ACTA UNIVERSITATIS LAPPEENRANTAENSIS

662. ALKKIOMÄKI, VILLE. Role of service and data reuse in enterprises. 2015. Diss.

663. VÄNTSI, OLLI. Utilization of recycled mineral wool as filler in wood plastic composites. 2015. Diss.


666. OLABODE, MUYIWA. Weldability of high strength aluminium alloys. 2015. Diss.

667. VANHALA, ERNO. The role of business model in computer game development organizations. 2015. Diss.


669. DE SMET, DIETER. Innovation ecosystem perspectives on financial services innovation. 2015. Diss.

670. PORRAS, PÄIVI. Utilising student profiles in mathematics course arrangements. 2015. Diss.

671. SALMINEN, JUHO. The role of collective intelligence in crowdsourcing innovations. 2015. Diss.

672. ROSAS, SAILA. Co-operative acquisitions – the contextual factors and challenges for co-operatives when acquiring an investor-owned firm. 2015. Diss.

673. SINKKONEN, TIINA. Item-level life-cycle model for maintenance networks – from cost to additional value. 2015. Diss.

674. TUUNANEN, JUSSI. Modelling of changes in electricity end-use and their impacts on electricity distribution. 2015. Diss.

675. MIELONEN, KATRIINA. The effect of cationic-anionic polyelectrolyte multilayer surface treatment on inkjet ink spreading and print quality. 2015. Diss.

676. OMAJENE, JOSHUA. Underwater remote welding technology for offshore structures. 2015. Diss.


678. RUSATSI, DENIS. Bayesian analysis of SEIR epidemic models. 2015. Diss.


681. VALTONEN, PETRI. Distributed energy resources in an electricity retailer’s short-term profit optimization. 2015. Diss.

682. FORSTRÖM-TUOMINEN, HEIDI. Collectiveness within start up-teams – leading the way to initiating and managing collective pursuit of opportunities in organizational contexts. 2015. Diss.

683. MAGUYA, ALMASI. Use of airborne laser scanner data in demanding forest conditions. 2015. Diss.


685. MURASHKO, KIRILL. Thermal modelling of commercial lithium-ion batteries. 2016. Diss.


687. KURVINEN, EMIL. Design and simulation of high-speed rotating electrical machinery. 2016. Diss.


690. BAHARUDIN, EZRAL. Real-time simulation of multibody systems with applications for working mobile vehicles. 2016. Diss.


694. HALMINEN, OSKARI. Multibody models for examination of touchdown bearing systems. 2016. Diss.


699. LAAKSONEN, LAURI. Spectral retinal image processing and analysis for ophthalmology. 2016. Diss.