Jukka Majava

PRODUCT DEVELOPMENT

DRIVERS, STAKEHOLDERS, AND CUSTOMER REPRESENTATION DURING EARLY DEVELOPMENT
JUKKA MAJAVA

PRODUCT DEVELOPMENT
Drivers, stakeholders, and customer representation during early development

Academic dissertation to be presented, with the assent of the Doctoral Training Committee of Technology and Natural Sciences of the University of Oulu, for public defence in the Wetteri auditorium (IT115), Linnanmaa, on 12 September 2014, at 12 noon

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Abstract
The importance of product development in companies has increased, as competition in many industries has turned global and product life cycles have become shorter. Despite the rich literature and the significance of product development in businesses, many organisations still struggle to develop products that meet market and customer needs. Furthermore, product development for a large number of international customers involves various stakeholders with conflicting needs. Thus, product development is increasingly complex to manage.

This doctoral dissertation aims to improve the outcome of product development by clarifying the factors that initiate product development in companies, the relations of different external and internal stakeholders to these drivers, and how the needs of key stakeholders are obtained. The study focuses on the early product development phases of new product development (NPD) intensive companies that are based in Finland, but have major international operations and large customer bases.

The research was carried out by collecting and analysing data from companies representing product development practices in both business-to-business (B2B) and business-to-consumer (B2C) markets. The experiences of managers across different industries are utilised. This dissertation adopts a qualitative research approach, and surveys and interviews are utilised as the main data collection methods.

This dissertation shows that many significant drivers for product development exist in companies. In addition, these drivers differ significantly between projects, companies, and even individuals. Based on the results, companies should clarify their product development drivers and align them among the relevant stakeholders to enhance the decision-making and focus of product development efforts. The study also reveals the relations between different external and internal stakeholders and the product development drivers, and the key stakeholders for the individual drivers. The results indicate that companies should identify the most important stakeholders based on the project drivers and allocate managerial attention appropriately. As expected, the research findings support previous studies by identifying customers as the most important external stakeholders in product development. On the other hand, the significance of product management among internal stakeholders is highlighted in the results.

This dissertation indicates that companies should enable product management to lead collaboration with stakeholders close to customers in product development projects. The role of product management involves leading customer definition, representation, and customer needs identification for R&D. However, product management must also collaborate with many customer-related stakeholders in product development efforts. The main implication of this dissertation is a new managerial framework that, if successfully implemented, can significantly enhance product development outcomes by providing appropriate focus on customers and reducing unnecessary complexities through the clarification of the project drivers, the key stakeholders, and customer needs.

Keywords: customer, customer needs, new product development (NPD), product development, product development driver, product management, research & development (R&D), stakeholder
Majava, Jukka, Tuotekehitys. Ajurit, sidosryhmät ja asiakkaan edustus kehityksen alkuvaiheessa
Oulun yliopiston tutkijakoulu; Oulun yliopisto, Teknillinen tiedekunta, Tuotantotalous
Oulun yliopisto, PL 8000, 90201 Oulun yliopisto

Tiivistelmä
Tuotekehityksen merkitys yrityksille on kasvanut globaalin kilpailun ja tuote-elinkaarenihen-
nymistien myötä. Lukuisista tutkimuksista ja tuotekehitystoiminnan tärkeydestä liiketoiminnalle
huolimatta useilla organisaatioilla on edelleen happeita kehittää markkinoiden ja asiakkaiden
 tarpeita vastaavia tuotteita. Lisäksi tuotekehityksessä isolle, kansainväliselle, asiakaskunnalle on
mukana useita erilaisia sidosryhmiä, joiden tarpeet ovat riistiriidassa keskenään. Tämän takia
tuotekehityksen johtamisesta on tullut entistä monimutkaisempaa.

Tämä väitöskirja pyrkii parantamaan tuotekehityksen tulosta selventämällä tekijät, jotka ovat
syytä tuotekehityksen aloittamiseen yrityksissä, erilaisten ulkoisten ja sisäisten sidosryhmien
suhteet näihin tuotekehitysajureihin sekä miten tärkeimpien sidosryhmien tarpeet selvitetään.

Tutkimus keskittyy tuotekehityksen alkuvaiheisiin Suomessa toimivissa yrityksissä, joilla on
voimakas panostus tuotekehitykseen ja lisäksi merkittävä kansainvälistä toimintaa sekä suuri
määrä asiakkaita.

Tutkimus tehtiin keräämällä ja analysoimalla tietoa yritysten tuotekehityskäytännöistä sekä
tuotantohöyryemarkkinoilla että kuluttajamarkkinoilla. Tietoa kerättiin myös eri teollisuuden-
aloilta. Tämä väitöskirja perustuu laadulliseen tutkimukseen ja tutkimusaineiston keräämisessä
on hyödynnetty kyselytutkimuksia sekä haastatteluita.

Tämä väitöskirja osoittaa, että yritysten tuotekehityksen löytyy useita merkittäviä ajureita.

Tämän lisäksi nämä ajurit eroavat merkittävästi projektien, yritysten ja joita yksittäisten henki-
löiden välillä. Tulosten perusteella yritysten pitäisi selvittää, mitkä ajurit ovat niiden liiketoiminn-
nan kannalta olemaan. Tämä tarkentaa niitä tuotekehityksen pääohjelmanteon ja painopisteen
parantamiseksi. Tutkimus paljastaa myös ulkoisten ja sisäisten sidosryhmien suhteet tuotekehitys-
ajureihin sekä tärkeimmät sidosryhmät yksittäisille ajureille. Tulokset osoittavat, että yritys-
ten pitäisi tunnistaa tärkeimmät sidosryhmät projektien ajureiden perusteella ja ottaa ajurin
huomioon sidosryhmäjohtamisessa. Tutkimuksen löydöksiä tukevat aiempia tutkimuksia osoit-
taan asiakkaiden olevan tärkein ulkohenkin sidosryhmä tuotekehityksessä, kun taas sisäisistä sidos-
ryhmistä nousee esille tuotehallinta.

Tämä väitöskirja osoittaa, että yritysten tuotekehityspyynnöissä tuotehallinnan tulisi johtaa
asiakkaita lähellä oleviin sidosryhmiihin liittyviä sidosryhmäyhteistyööitä. Tuotehallinnan tehtäviin
kuuluu asiakkaan määrittely, edustus ja asiakastarpeiden tunnistaminen. Tuotehallinnan pitää
myös tehdä yhteistyötä useiden asiakkaisiin liittyvien sidosryhmien kanssa tuotekehityksen aikaa.

Tämä väitöskirja tarjoaa uuden johtamisen viitekehyksen, joka oikein toteutettuna voi
parantaa merkittävästi tuotekehityksen lopputulosta. Projektin ajurien, tärkeimpien sidosryhmien
ja asiakastarpeiden selventäminen varmistaa oikeanlaisen keskittymisen asiakkaisiin ja
vähentää tarpeettomia monimuutoksiin tuotekehityksessä.

Asiakas, asiakastarve, sidosryhmä, tuotehallinta, tuotekehitys, tuotekehitysajuri, tutkimus & kehitys (T&K)
Acknowledgements

Getting a doctoral degree has been one of my goals since graduation. After thirteen interesting years at Nokia, my job was transferred to Beijing, and I had to seek new opportunities – either inside or outside the company. I chose to look outside and applied for a doctoral student position at the University of Oulu’s Industrial Engineering and Management department. Professor Pekka Kess called me in August 2011 and offered me the position; the chain of events leading to the doctoral degree had begun. I started my job at the university in January 2012.

Many people have helped me in my research project. First of all, I would like to express my gratitude to my supervisor, Professor Harri Haapasalo, for his guidance during the whole process and for raising the bar to ensure a quality dissertation. Second, I would like to thank my doctoral training follow-up group: Professor Pekka Kess, Dr Hanna Kropsu-Vehkaperä, and Dr Mirja Väänänen. I am also grateful to Pekka for offering me opportunities to work with other interesting projects and tasks during the research. I would also like to thank the dissertation pre-examiners, Dr Jussi Autere and Professor Hans Georg Gemünden, whose comments helped me to improve the quality of the dissertation.

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Everyone who worked in the Industrial Engineering and Management research group during my project should also be acknowledged. I am grateful for the good spirit, supportive work environment, and informal discussions over
lunch and coffee breaks – all of the aforementioned helped me to complete my dissertation on time.

Finally, in my personal life I am blessed with many special people: family, relatives, and friends who have supported me over the years. I would especially like to thank my wife Katriina and my daughters Eeva and Elli. Achieving the doctoral degree without you would not be the same. At the end of the day, it is you who make my life meaningful.

San Diego, California, USA, June 2014  Jukka Majava
## List of abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>AHP</td>
<td>Analytic Hierarchy Process</td>
</tr>
<tr>
<td>B2B</td>
<td>Business-to-Business</td>
</tr>
<tr>
<td>B2C</td>
<td>Business-to-Consumer</td>
</tr>
<tr>
<td>CV</td>
<td>Cumulative Voting</td>
</tr>
<tr>
<td>CVCA</td>
<td>Customer Value Chain Analysis</td>
</tr>
<tr>
<td>DfX</td>
<td>Design for Excellence</td>
</tr>
<tr>
<td>HCV</td>
<td>Hierarchical Cumulative Voting</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and Communications Technology</td>
</tr>
<tr>
<td>NPD</td>
<td>New Product Development</td>
</tr>
<tr>
<td>PD</td>
<td>Product Development</td>
</tr>
<tr>
<td>QFD</td>
<td>Quality Function Deployment</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
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<tr>
<td>RE</td>
<td>Requirements Engineering</td>
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List of original publications

This dissertation is based on the following publications:


The author of this dissertation was the primary author of all of the original publications. The role of the co-authors included reviewing and commenting on the article manuscripts. In addition, the author of this dissertation has participated in broader research in industrial engineering and management at the University of Oulu, which has resulted in other publications as an author and co-author.
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1 Introduction

1.1 Background and research environment

This dissertation studies product development drivers and stakeholders of companies that create products for a large international customer base. In recent years, many significant changes have taken place in the operating environment of companies. Globalisation has typically been considered one of the major trends in many businesses today, as markets, production, financial systems, technologies, industries, and competition have become increasingly international (OECD 2013). Globalisation has various effects in many markets, including an increased number of available choices for customers, decreasing prices, and heavily intensified competition (Cooper 2011). In addition, major advances have been achieved in information and communication technologies, which make it easier for companies to manage international operations (Eppinger & Chitkara 2006). Furthermore, product life cycles have become shorter, which has increased the importance of innovation and product development in many industries (Hamm 2006). Other factors, such as sustainability requirements, also require companies to increase their product development investments in today’s business (Nidumolu et al. 2009).

Issues related to innovation and product development have intrigued both academia and businesses during recent decades, and various contributions have been made in the literature. These include, for example, the importance of innovation and new products to economic growth (Schumpeter 1939), a literature review on product development decisions by Krishnan & Ulrich (2001), and discussion of open innovation (Chesbrough 2003). Yet, uncovering how to acquire and utilise knowledge and apply it to new product development remains one of the most persistent management problems in today’s business; new products often fail (Berggren & Nacher 2001, Trott 2012). In many cases, the failure is due to the product’s inability to meet customer requirements (Cooper 2011). Customer orientation and cross-functional integration have been claimed to improve product development performance (Brettel et al. 2011, Narver & Slater 1990). In addition, new trends like open innovation (Chesbrough 2003) and customer co-creation (Prahalad & Ramaswamy 2004) have emerged. Many companies increasingly aim to utilise customer involvement through, for example, online communities (Antikainen 2011). However, most product
development organisations still struggle in obtaining and, perhaps more importantly, understanding customer needs and requirements, and projects often fail to achieve commercial success (Jantunen 2012, Simula 2012). Furthermore, global markets, where customer needs diverge, make meeting market and customer requirements challenging. The basic issue still persists: how should companies manage product development to create successful new products.

A product is any offering – a physical product, service, or even an idea – that a company provides to customers (Kahn 2001, Kahn 2006). It can be anything provided for sale, use, or consumption (Cooper 2011). Product development, in turn, is a set of activities that transform market opportunities into products that can be sold (Krishnan & Ulrich 2001). In this dissertation, the term product refers to tangible and intangible offerings and their combinations. Product development, in turn, is considered to include the development of completely or partially new products beginning from the market opportunity definition and ending with product commercialisation and delivery.

The real motives for initiating the product development effort affect decision-making and the outcome of the project. The Oxford Dictionaries (2014a) define driver as “a factor which causes a particular phenomenon to happen or develop”. In other words, the driver can be described as an initiating reason for something to take place. In this dissertation, the driver is defined as a reason for a company to conduct product development.

Due to its cross-functional nature, product development involves various stakeholders. Stakeholders are typically divided into internal and external stakeholders (Aaltonen & Kujala 2010). In this dissertation, we apply the stakeholder definitions presented by Freeman (1984) and Mitchell et al. (1997), and define stakeholders as internal and external parties that can affect or are affected by product development. Put differently, stakeholders can be seen as the parties that can affect or are affected by the “transformation of a market opportunity and a set of assumptions about product technology into a product available for sale” (Krishnan & Ulrich 2001). Stakeholders (e.g. customers, marketing, operations) and technology-related factors are typically the key sources of requirements (Lehto et al. 2011, Mottonen 2009). Customer refers to organisations or their parts, which can be business-to-business customers (e.g. buyers, users, or entire companies), end-user consumers, or internal customers (Conduit & Mavondo 2001; Peppers & Rogers 2011). Besides direct customers, intermediary customers also exist. Manufacturing companies typically have at least three customer classes: distributors, retailers, and the individuals who
purchase the products from the retailers’ shops (Caplan 2001). Customers have needs and problems, and may seek either product or service solutions to their problems (Griffin 2005).

Stakeholders may have different objectives, and their requirements often conflict (Bendjenna et al. 2012). Furthermore, when products are developed for a large number of customers, the management of the product development becomes increasingly complex, since the needs of the large customer base diverge and involving the customers is difficult. In addition to customers, other important requirement sources exist. These include, for example, marketing, sales, customer care, customer studies, and product end-users (Gorschek et al. 2012). Product development can be divided into design for, design with, and design by customers based on their involvement (Kaulio 1998). This dissertation focuses on the design for customers type of development, in which customers do not participate constantly, but their views are represented by internal stakeholders in the company. According to the Oxford Dictionaries (2014b), representation is “the action of speaking or acting on behalf of someone”. Customer representation in this dissertation is defined as acting on behalf of the customers in order to ensure that their needs are taken into account appropriately in product development.

Past literature has presented various drivers for product development (Acur et al. 2012, Bossink 2004, Kinkel & Som 2010, Lakemond et al. 2010, Veryzer 1998), but the past studies tend to provide a simplified view of the drivers and address company- and project-specific differences inadequately. The stakeholder literature has also addressed many important topics, such as the role of stakeholders in requirements engineering (Freeman & Reed 1983, Glinz & Wieringa, 2007, Lehto 2011, Mitchell et al. 1997, Peters et al. 2009). However, the driver-stakeholder relations have been defined insufficiently in the literature. In addition, many studies have been conducted on market and customer orientation, the customer’s voice in product development, and cross-functional integration (Alam 2005, Brettel et al. 2011, Ernst et al. 2010, Griffin 2005, Rafiq & Saxon 2000), but the past literature insufficiently distinguishes the role of product management in companies with a large international customer base.

In spite of the rich literature (e.g. Krishnan & Ulrich 2001, Alam 2005, Cooper 2011), developing products that meet market and customer needs continues to be a challenge for companies. The past studies on product development drivers (e.g. Kinkel & Som 2010, Lakemond et al. 2010, Veryzer 1998) insufficiently address the complexities that managers dealing with product development encounter. In addition, the relations between stakeholders and
product development drivers have not been adequately addressed. Furthermore, despite many studies on the customer’s voice in product development and cross-functional integration (e.g. Brettel et al. 2011, Ernst et al. 2010, Rafiq & Saxon 2000), the past research mainly focuses on research and development (R&D) and marketing integration, and inadequately distinguishes other related stakeholders, particularly in companies that develop products for a large customer base. The aforementioned is the justification and motivation for this dissertation. Product development involves a lot of complexities, and creating successful products is difficult. In addition, the number of parties whose needs companies must consider can be very high when a broad definition of stakeholders is used. Product development teams must manage conflicting objectives, and design-related decisions have various dependencies. In order for companies to meet the market and customer needs with a competitive offering, it is important to identify the real motives for the product development efforts, the key stakeholders, and their needs. This dissertation aims to improve the outcomes of product development in companies by clarifying the product development drivers, the relations of the different external and internal stakeholders to these drivers, and how the needs of key stakeholders are obtained.

1.2 Objectives and scope

In order for companies to succeed in increasingly complex international markets, more information is needed on the real drivers, realities, and practices of product development. The key motive for this dissertation is the fact that in spite of the rich literature, developing products that meet market and customer needs is still one of the most topical issues in today’s business. Thus, an obvious demand exists for studying product development from another perspective. The main research question of this dissertation is formulated as follows:

What are companies’ product development drivers, the related stakeholders, and how are the key stakeholders’ needs identified?

In this dissertation, the aim was to study the research question from the following points of view: product development drivers, stakeholders’ relations to the drivers, customer definition and representation, and customer needs identification. These four points of view are expressed in the following research questions (Table 1).
Table 1. Research questions.

<table>
<thead>
<tr>
<th>RQ#</th>
<th>Research question</th>
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<tbody>
<tr>
<td>RQ1</td>
<td>What are the main product development drivers in companies?</td>
</tr>
<tr>
<td>RQ2</td>
<td>What are the relations between stakeholders and product development drivers?</td>
</tr>
<tr>
<td>RQ3</td>
<td>How are customers defined and represented in product development?</td>
</tr>
<tr>
<td>RQ4</td>
<td>How are customer needs identified in product development?</td>
</tr>
</tbody>
</table>

The four research questions listed in Table 1 focus on the main research question from four different perspectives. The research questions are strongly connected to each other in order to address the main research question. The central connecting factor is the focus on the earliest phases of product development, including project initiation and customer needs identification. Research question 1 focuses on the factors that initiate a new product development effort in companies. Research question 2, in turn, addresses the stakeholders related to these drivers as initiating factors. These stakeholders can be both external and internal, and the importance of the stakeholders varies. Then, research questions 3 and 4 focus on the earliest phases of the product development process, where customers are defined and their needs are identified. The research framework is illustrated in Figure 1.

![Research framework](image)
Each research question is addressed in detail with a journal article (Table 2). RQ1 is answered by article I, RQ2 is answered by article II, RQ3 is answered by article III, and RQ4 is answered by article IV. This dissertation compiles the key contributions of the articles.

Table 2. Research papers overview.

<table>
<thead>
<tr>
<th>Article</th>
<th>RQ#</th>
<th>Article title</th>
<th>Journal</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>RQ1</td>
<td>Product development drivers in literature and practice</td>
<td>International Journal of Product Development</td>
</tr>
<tr>
<td>II</td>
<td>RQ2</td>
<td>The relations between stakeholders and product development drivers: practitioners’ perspectives</td>
<td>International Journal of Innovation and Learning</td>
</tr>
<tr>
<td>III</td>
<td>RQ3</td>
<td>Exploring customer definition and representation in market-driven NPD in ICT industry</td>
<td>International Journal of Business Development and Research</td>
</tr>
<tr>
<td>IV</td>
<td>RQ4</td>
<td>Customer needs in market-driven product development: product management and R&amp;D standpoints</td>
<td>Technology and Investment</td>
</tr>
</tbody>
</table>

The research questions presented above are strongly related and support each other. All four articles aim to address the research gaps identified during this dissertation research. Articles I, II, III, and IV supplement each other and provide solutions to this dissertation’s main research problem.

Article I addresses the main product development drivers and their valuation by practicing industry professionals. The purpose of the article was to clarify the key product development drivers in companies. Article I identifies several significant product development drivers and their overall importance. In addition, article I reveals differences in driver importance between companies, project types, and individuals.

Article II discusses the relations between different stakeholders and product development drivers. The relevance and connections of various external and internal stakeholders to the product development drivers are analysed. The key stakeholders for each individual driver are also identified in article II.

Articles III and IV address the key product development stakeholders, of which customers are typically considered to be the most important ones. The analysis is conducted in two phases. Article III analyses how customers are defined and represented in product development from product management and R&D managers’ point of view. The product management and R&D perspective is also taken in article IV, which discusses how customer needs are identified in product development.
This dissertation focuses on the early product development phases of NPD-intensive companies that are based in Finland, but have major international operations. The researched companies are in both business-to-business and business-to-consumer markets, and they have a large number of customers with different needs for product functionalities. The products of the studied companies include tangible and intangible elements. Companies that focus solely on services are not in the research scope.

1.3 Research process and dissertation structure

The nature of research can be discussed from various viewpoints. Different considerations involved in the research process include the relationship between theory and research, epistemological and ontological questions, research methods, values, and practical issues (Bryman & Bell 2007).

Theoretical considerations include the choice between an inductive and a deductive approach. In a deductive approach, existing theory is used as a basis for new observations and findings. An inductive approach, in turn, aims to create new theories based on observations and findings (Bryman & Bell 2007, Saunders et al. 2009). Considering the aforementioned approaches, this study can be positioned to the inductive approach in nature. Although existing theories are utilised in the study, the main aim is to provide in-depth understanding, instead of solely validating the existing theories.

Epistemological questions consider the nature and scope of knowledge; what can be known and how the knowledge can be acquired. The two extremes in epistemological positions are considered to be positivism and interpretivism (Saunders et al. 2009). The former is typically applied in natural sciences, whereas the study conducted in this dissertation is closer to interpretivism in nature, due to the need to understand the differences between humans as social actors in the phenomenon under study.

Ontology, in turn, deals with the deepest substance of being, including questions regarding what exists or can be said to exist. Ontological positions include objectivism and constructionism. Objectivism considers phenomena as being independent of social actors, whereas constructionism assumes that phenomena and meanings are created by the actors (Bryman & Bell 2007). Considering these two ontological positions, the present study can be positioned to constructionism, because the social actors are important in the researched
phenomenon. Furthermore, this dissertation research aims to support normative decision-making in the early phases of product development.

Research can also be divided into qualitative and quantitative categories. Qualitative research refers to the meanings, definitions, concepts, characteristics, symbols, metaphors, and descriptions of things, whereas quantitative research refers to measures and counts of things; the distributions and proportions of subject matter (Berg & Lune 2012). Table 3 presents the typical characteristics of qualitative and quantitative research.

Table 3. Characteristics of qualitative and quantitative research (Bryman & Bell, 2007).

<table>
<thead>
<tr>
<th></th>
<th>Quantitative</th>
<th>Qualitative</th>
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<tr>
<td>Principal theoretical orientation</td>
<td>Deductive</td>
<td>Inductive</td>
</tr>
<tr>
<td>Epistemological orientation</td>
<td>Positivism</td>
<td>Interpretivism</td>
</tr>
<tr>
<td>Ontological orientation</td>
<td>Objectivism</td>
<td>Constructionism</td>
</tr>
</tbody>
</table>

In practice, however, the division is not as unambiguous as shown in Table 3. For instance, an inductive phase follows a deductive process. In this phase, the existing theory is validated or updated, or a new theory is created (Bryman & Bell 2007). The present study can be classified to be mainly qualitative in nature, bringing it closer to an inductive theoretical approach, interpretivism, and constructionism. This is partly due to the complexity of the research topic. This dissertation aims to provide a deep understanding and new knowledge of the studied topics. Thus, the experiences of industry professionals were found to support the research goals best.

Qualitative research and case studies enable the use of several data collection methods, and provide researchers with ways to understand the essential nature of things and create new knowledge (Berg & Lune 2012, Eisenhardt 1989). Research design, data collection, and data analysis are the key phases for improving the quality of case studies (Yin 1989). The validity and reliability of this dissertation research was increased by using the following measures: describing the research process, using multiple data sources, validating the survey designs and study reports, and utilising the perspectives of different industry practitioners and researchers.

The research for this dissertation was carried out in four studies involving enterprises and academic researchers. The researcher was the primary planner of all studies. The role of the researcher also included selecting the relevant informants and collecting the data. Furthermore, the researcher was in charge of
analysing the data and drawing conclusions in all of the studies. The co-authors of the articles included in this dissertation supported all research phases and provided feedback during the writing process. A typical research process used in the individual studies is described in Figure 1.

![Figure 1: Typical research process used in the studies.](image)

Each study began with a literature review to form a theoretical base for the research. Second, a survey structure was designed. The third phase involved the data collection, which included either interviews or web-based surveys. The final research process phases included analysis and drawing conclusions.

In addition to providing a theoretical base for the studied topic, the literature review supported the survey structure design and result analysis. The companies included in the individual studies were selected to include representative cases for the respective study purposes and to support the study targets by providing access to rich information and insights (Saunders et al. 2009). The cases selected for this dissertation include product development intensive companies that create products for a large global customer base, which provided a good match with the study focus and objectives. Furthermore, the case companies have many decades of product development experience and are recognised as being among the leading innovators in their businesses. Therefore, their product development practices are assumed to represent good practices in their industries. In order to enable sufficient access to information and face-to-face discussions with the informants, companies in Finland were selected. The studies in articles I and II were carried out among experienced managers of product development intensive companies across different industries in order to gain versatile insights into generic and company-specific issues. Studies III and IV focused on firms conducting market-driven product development in the information and communications technology (ICT) industry. The company and industry selection were targeted to provide the researcher with the best possible information on the phenomenon under study.

The data collection phase in articles I and II included web-based surveys, whereas interviews were utilised in articles III and IV. In addition to using the
literature review as a basis for the survey and interview questionnaire design, industry experts were utilised in validating the survey content in articles I and II. For the interviews, a semi-structured process was used, which enabled gaining additional insights into the studied topics. A summary of the companies’ involvement and the number of informants used in this dissertation is presented in Table 4.

Table 4. Companies and informants involved in the research.

<table>
<thead>
<tr>
<th>Article</th>
<th>Nr. of companies</th>
<th>Nr. of informants</th>
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<tbody>
<tr>
<td>I</td>
<td>7</td>
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<td>II</td>
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<td>III</td>
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<td>IV</td>
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The survey and interview results were analysed according to the respective research focus in each study. Statistical analyses were applied to the results of the web-based surveys, when appropriate. The interview results were analysed using the qualitative approach of reading the interviews several times, each time going deeper into the data to discover connections, patterns, and comparisons. In all studies, case-specific results were provided to the participating companies, in order to provide an opportunity for feedback. Finally, implications and conclusions were made based on the analysis.

This dissertation includes four unique journal articles and this summary. The structure of this summary is as follows. The research’s theoretical foundation is outlined in chapter 2, the research contribution is described in chapter 3, and the implications and conclusions of the study are presented in chapter 4.
2 Literature review

2.1 Theoretical foundation

The theoretical foundation of this dissertation is based on new product development, stakeholder management, and customer involvement literature. The chosen theories are considered to be the most relevant found in the literature, and they have been applied to enhance the focus of product development efforts in companies, which is the goal of this study. Due to the restricted scope of a doctoral dissertation, some related theories are not specifically addressed in this research. These theories, which are related to product development drivers and stakeholders (e.g. Trott 2012, Mitchell et al. 1997), include, for example, strategic management (e.g. Mintzberg et al. 2009), innovation management (e.g. Ettlie 2006), requirements engineering (e.g. Sommerville 2005), knowledge management (e.g. Nonaka & Takeuchi 1995), and supply chain management (e.g. Rungtusanatham & Forza 2004). Figure 3 illustrates the theoretical foundation of this dissertation.

Fig. 3. The dissertation’s theoretical foundation.

As Figure 3 illustrates, the literature on product development, stakeholder management, and customer involvement are the central elements of this dissertation’s theoretical foundation. With regard to other related elements, the strategic management literature is utilised in terms of new product development
strategy and the factors affecting it. These include, for example, changes in the external environment, and internal organisation inputs driving product development efforts (e.g. Trott 2012). However, many other topics related to strategic management, such as strategic planning and analysis (e.g. Mintzberg et al. 2009), are excluded. The requirements engineering literature (Damlan 2007, Sommerville & Sawyer 1997), and especially requirement elicitation, including stakeholder identification and requirement discovery, is also closely related to this dissertation. Yet, other requirements engineering topics, such as requirement validation, negotiation, documentation, and management (Mottonen 2009, Sommerville 2005), are mainly excluded from this study. Knowledge management may also provide insights into the research topic by addressing organisational knowledge and how it can be captured, shared, and utilised (e.g. Nonaka & Takeuchi 1995). While the importance of knowledge management is acknowledged, this dissertation does not apply the theories in this field, such as knowledge management systems (e.g. Alavi & Leidner 2001), per se. Supply chain management, in turn, is related to the theoretical foundation of this dissertation in terms of supply chain and product development coordination (Rungtusanatham & Forza 2004, Skjott-Larsen et al. 2007). For instance, the Design for Excellence (DFX) literature (e.g. Bralla 1996) has been utilised in identifying the key product development stakeholders. Other supply chain management topics, including, for example, the planning and management of sourcing, production, and logistics (e.g. Thomas & Griffin 1996), are not included in this study. Finally, the innovation management literature is also related to the dissertation’s theoretical basis. Product innovation and new product development are closely related, and these terms are also mixed often, especially in early product development phases. However, the researcher sees innovation management as a broader subject that covers many topics, which enable the creation of the conditions that are required for innovations to occur (Ettlie 2006, Trott 2012).

2.2 Product development

Product development is one of the key functions for companies, and it has received a lot of attention, both in practice and theory (e.g. Shani et al. 2003). Over the years, several solutions, such as concurrent engineering (Belay 2013), have been proposed to improve product development performance. In order to understand the nature of product development and the targets of this dissertation
study better, product development and its relation to innovation management must be defined. The new product development process is often considered as a subprocess of innovation process. Innovation management, in turn, “concerns the conditions that have to be in place to ensure that the organisation as a whole is given the opportunity to develop new products” (Trott 2012). Innovation is not just a new idea, invention, new technology, or market development; it is the management of all activities involved in creating new or improved products or processes (Myers & Marquis 1969, Trott 2002).

Various definitions exist for product development in the literature. Krishnan & Ulrich (2001) define product development as the “transformation of market opportunity into a product available for sale”. According to Ulrich & Eppinger (2012), “product development is the set of activities beginning with perception of a market opportunity and ending in the production, sale, and delivery of a product.” On the other hand, the Product Development & Management Association (2012) defines product development as “the overall process of strategy, organisation, concept generation, product and marketing plan creation and evaluation, and commercialisation of a new product.”

### 2.2.1 Products and product development project types

The nature of product development and how the development should be managed depend on the product being created. Thus, it is important to understand that product development covers various types of products and projects. First of all, products can be defined as outputs of productional activity. Broadly defined, a “product can describe any company offering, be it a product, service or even an idea” (Kahn 2006). A product can also be considered as “something sold by an enterprise to its customers” (Ulrich & Eppinger 2000). Cooper (2011), on the other hand, sees a product as “anything referred to as an external marketplace for sale, use, or consumption. This includes physical products as well as services, and combinations of services and products.”

New products can be divided into categories, such as new-to-the-world products, new product lines, additions to existing product lines, improvements and revisions of existing products, repositionings, cost reductions, market pull, technology push, platform products, process intensive, and customised products (Booz et al. 1982, Cooper 2004, Ulrich & Eppinger 2012). Most new products are not entirely new, but only imitations that are quite similar to existing products (Ettlie 2006, Trott 2002).
Product development projects can also be divided into various categories, which all have different types of drivers and stakeholders. The project categories include pure R&D, breakthrough, platform, and derivative projects, incremental improvements, and fundamentally new products (Schilling & Hill 1998, Ulrich & Eppinger 2012). On the other hand, the two extremes of service development include incremental innovation and radical innovation (Ettlie 2006). Established companies typically focus on incremental innovations, which enable them to expand to new markets by offering product modifications (Kotler & Keller 2009).

2.2.2 Product development drivers

Various reasons exist for a company to conduct product development. These drivers of product development include strategy, business environment, financial, marketing, customer, technology, internal, resource, and supply chain related reasons.

Strategy is typically considered one of the key product development drivers (Acur et al. 2012, Ansoff, 1957, Kahn 2001, Trott 2002). As part of strategic planning activities, companies must assess technologies and markets, and examine the fit between intended new products and a company’s strategy (Acur et al. 2012). A company’s product strategy can be considered as the foundation of product development initiatives (Ansoff 1957). New product strategy is linked to, and its goals are derived from, other related strategies. These include corporate, marketing, and technology strategies, which provide the role, context, push, and the scope definition for the new product strategy. (Trott 2012). The implementation of new product strategy is carried out in product development programmes (Kahn 2001).

The external environment provides many drivers for product development. These include a competitive environment (Hassanien & Dale 2012, Kahn 2001) and shorter product life cycles (Cooper 2011, Hamm 2006, Lantos et al. 2009). Increasing competition drives up consumer expectations. In industries like retailing, consumer goods, electronics, and automobiles, the time to bring a product to the market has been cut in half (Hamm 2006). In addition, new trends, such as sustainability and globalisation, increase the need for product development (Cooper 2011, Hassanien & Dale 2012, Nidumolu et al. 2009). The external environment also includes new opportunities and product change needs related to, for example, technology and legislation (Kahn 2001, Trott 2002).
Financial reasons are an essential driver for product development. New products can increase revenues, share prices, market shares, and net results (Cooper 2011, Hassanien & Dale 2012, Kahn 2011, Lantos et al. 2009). Cooper (2011) claims that new products are the key to company prosperity. Kahn (2001), in turn, argues that profitability and market share are the key targets when a company provides its offering to the market. Product development has a key role in enhancing company growth, profit margins, and stock price (Lantos et al. 2009). Product development can also sustain and improve profit margins through the cost reductions of an existing product.

Marketing- and customer-related factors also stimulate product development. The marketing-related drivers of product development include the need to enhance company’s and brand’s image and awareness, leverage brand equity, offer an appropriate product mix, and capitalise on brand halo effects (Kahn 2001, Lantos et al. 2009). Moreover, customer-related factors are very important drivers for product development. Customer needs and attitudes are constantly changing, and consumers are used to getting new offerings (Cooper 2011, Kahn 2001). Customers, their ideas, and feedback are sources for product development opportunities and improvements (Hassanien & Dale 2012, Trott 2002). On the other hand, too close relationships with customers can also be harmful, because they may limit a company’s ability to respond to market changes (Sull 1999).

Technology-push and market-pull are often considered as alternative approaches for product development (Hart et al. 2003, Isoherranen & Kess 2011). Customer and market needs are the basis for market-pull development, whereas for technology-push products, technology is the key driver (Ulrich & Eppinger, 2012). Technology advancements form an important product development driver, because these advancements enable the creation of new types of products and solutions (Bossink 2004, Cooper 2011). New product opportunities can also be discovered from existing products, technology, and unexploited patents (Trott 2002). Moreover, the development of really new products can often be seen as “probing and learning”, which provides a way of building new competencies in a company (Song & Montoya-Weiss 1998, Trott 2002).

Product development drivers can also be related to company resources and internal factors. Organisations may have underused or new resources due to, for example, excess capacity or an acquisition, which can become drivers for product development (Hassanien & Dale 2012, Kahn 2001). Suppliers, distribution channels, and partners can be sources for product development opportunities or drivers for product modification (Kinkel & Som 2010, Trott 2002). Companies
also need their own foresight in product development (Hamel & Phalahad 1994). Opportunity and idea sources include companies’ existing products, individual employees, and senior and top management (Kahn 2001, Trott 2002).

Finally, drivers differ between product and project types. Key drivers for radical projects include technology convergence, contextual and environmental factors, and individuals with a strong vision. On the other hand, customer input benefits more incremental development than radical projects (Veryzer 1998). Existing production capability is typically the basis for the development of process-intensive products. For customised products, in turn, the driver is often a response to a customer-specific order. (Ulrich & Eppinger 2012).

2.3 Stakeholders

Stakeholders can be seen as groups or individuals that can affect or are affected by the accomplishment of the organisation’s objectives (Freeman 1984). Stakeholders have been studied from many perspectives (Mitchell et al. 1997). Depending on the project, stakeholders can include, for example, end-users, clients, consultants, labour unions, company line organisations, authorities, financial institutions, regulators, media, and competitors (Karlsen 2002). In complex projects, stakeholder integration often requires dedicated resources (Martinsuo & Ahola 2010). In a product development context, the interest in stakeholders has been most evident in the requirements engineering field, where requirement elicitation and prioritisation are among the key issues (Sommerville 2005). The term *stakeholder* appeared in the requirements engineering literature in the 90s, because the terms *client*, *customer*, and *user* were too specific (Glinz & Wieringa 2007). Stakeholders affect product demand, and they enable product delivery and support to the end-users throughout the product’s life cycle (Ulrich & Eppinger 2000). Appropriate level of stakeholder participation in product development projects is needed to ensure correct requirements and avoid problems during the development (Razali & Anwar 2011, McManus 2004).

2.3.1 Defining stakeholders

Stakeholders have been defined in various ways in the literature (Aaltonen & Kujala 2010, Freeman & Reed 1983, Freeman 1984, Glinz & Wieringa 2007, Mitchell et al. 1997). One of the earliest definitions can be found in an internal memorandum at the Stanford Research Institute in 1963, where stakeholder refers
to “those groups without whose support the organisation would cease to exist” (Freeman & Reed 1983).

Perhaps the most famous and broadest definition was created by Freeman (1984), who stated that a stakeholder is “any group or individual who can affect or is affected by the achievement of the organisation’s objectives”. Broad definitions aim to specify the reality where almost everyone can affect or be affected by an organisation’s actions. On the other hand, narrow definitions in the stakeholder literature aim to specify the reality where managers must focus on only some of the actual and potential claims; these narrow definitions propose various priorities for managerial attention. Narrow views aim to define stakeholder groups in terms of their direct relevance to the company’s core economic interests. (Mitchell et al. 1997).

Freeman & Reed (1983) propose two stakeholder definitions. In a wide sense, a stakeholder is “any identifiable group or individual who can affect the achievement of an organisation’s objectives or who is affected by the achievement of an organisation’s objectives.” These groups and individuals include, for example, public interest groups, protest groups, trade associations, competitors, employees, customer segments, and shareowners. In a narrow sense, a stakeholder can be considered “any identifiable group or individual on which the organisation is dependent for its continued survival.” Examples of the latter definition include employees, customer segments, certain suppliers, key government agencies, and shareowners. (Freeman & Reed 1983). A stakeholder can also be seen as a person or group that has an interest or share in a business or enterprise. In a more technical sense, a stakeholder is a person or organisation who affects a system’s requirements or who is impacted by the system. (Glinz & Wieringa 2007).

### 2.3.2 Stakeholder types

The stakeholder literature describes various types of stakeholders. Stakeholders can be identified as primary or secondary, owners and non-owners of the company, owners of capital or less tangible aspects, actors or those acted upon, right-holders, those in a voluntary or involuntary relationship with the company, moral claimants or contractors, resource providers to or dependents of the firm, risk-takers or influencers, and legal principals (Mitchell et al. 1997). In a typical classification, stakeholders are divided into internal and external groups. Internal stakeholders, often referred to as primary stakeholders, can be seen as formal organisation or project members. External stakeholders, also known as secondary
stakeholders, are not formal members, but may affect or be affected by the organisation or project. (Aaltonen & Kujala 2010).

Stakeholders can also be divided into primary, secondary, external, and extended stakeholders. Primary stakeholders consist of “those who, because of power, authority, responsibilities or claims over the resources, are central to any project initiative.” (McManus 2004). Primary stakeholders have formal, official, or contractual relationships, and have a direct and necessary economic effect on the company. Secondary stakeholders include those who are not directly engaged in the company’s economic activities, but can influence or are affected by the company. Stakeholders depend on the situation and the issues. (Savage et al. 1991). The primary stakeholders’ participation in a project is critical, because the outcome of any action will have a direct effect on them. On the other hand, secondary stakeholders have an indirect interest in the project outcome. The secondary stakeholders can include, for example, a consumer whose interest is the product or service availability, and a company employee whose concern is job security. External stakeholders, in turn, are not part of the project team and will expect something from it. The fourth group, extended stakeholders, includes parties that do not belong to the previous three groups. These parties can be, for example, opinion groups and voluntary agencies. (McManus 2004).

Stakeholders have an interest in the outcome or are impacted by a project, service, or decision. Stakeholders also include people and organisations that pose constraints (e.g. regulators), or are negatively affected by the project. The latter are known as negative stakeholders. (Glinz & Wieringa 2007). In a product development project, the stakeholders include all groups of people who are impacted by the product’s success or failure. These include end-users, other external parties affecting the buying decisions, and also internal functions, such as sales, customer service, and so forth. (Ulrich & Eppinger 2012). On the other hand, typical stakeholder roles in software development include the end-user, client, developer, architect, tester, quality engineer, project manager, product manager, maintainer, and operator (Glinz & Wieringa 2007). In the case of medical industry compliance, stakeholders could include manufacturers, brand owners, doctors, insurance companies, pharmacies, and caregivers. Although the target customer for compliance is the end-user, all stakeholders have different roles and needs that must be taken into account. (Goodrich & Aiman-Smith 2007).
2.3.3 Stakeholder identification and involvement

Various issues have to be considered in stakeholder identification. These include, for example, the company-stakeholder relationship, power dependence, the legitimacy of the relationship, a stakeholder’s claim on the company, a stakeholder’s risk, and a stakeholder’s interest. Stakeholder theory aims to systematically address “which groups are stakeholders deserving or requiring management attention, and which are not”. (Mitchell et al. 1997).

Stakeholders have a big impact on product development projects; they affect the product demand, and are needed to enable product deliveries and services. Customers and internal stakeholders should be involved in product development early enough (Cooper 2011). Furthermore, from a requirements engineering perspective, appropriate stakeholder participation is needed to ensure correct requirements (Razali & Anwar 2011). The primary stakeholders’ participation in a project is critical; failure to involve the primary stakeholders in collaboration from the start can lead to severe problems in achieving the project objectives. However, secondary, external, and extended stakeholders can also play an important role in projects. The involvement of stakeholders must be planned, and changes in their interest and influence should be monitored. (McManus 2004).

Stakeholder salience is defined as “the degree to which managers give priority to competing stakeholder claims” (Mitchell et al. 1997). Stakeholders can be classified based on three attributes: the stakeholder’s power to influence the company, the legitimacy of the stakeholder’s relationship with the company, and the urgency of the stakeholder’s claim on the firm. These three attributes are claimed to define the stakeholders that managers should pay attention to. Salience depends on the number of attributes that a stakeholder has, and it can vary during a project. Latent stakeholders have only one attribute, expectant stakeholders two, and highly salient stakeholders all three attributes. Furthermore, the attributes are variable and socially constructed, and the stakeholder may be unaware of possessing the attribute or unwilling to exercise it. (Mitchell et al. 1997). Both primary (internal) and secondary (external) stakeholders can be key stakeholders if the issue is salient to them (Savage et al. 1991). Different groups can be identified as stakeholders based on their power, legitimacy, and urgency, but the stakeholders that win the attention will be the ones that the managers consider as very salient (Mitchell et al. 1997).

Appropriate stakeholder participation is needed to develop successful products. Requirement elicitation, which is part of requirements engineering,
focuses on identifying information sources and requirement discovery (Sommerville 2005). Requirement elicitation involves two main knowledge flows: one is from the users (outer stakeholders) to the developers (inner stakeholders), and the other is from the developers to the users. The former is typically business domain knowledge and users’ tacit knowledge, whereas the latter is knowledge about the technical domain and requirements. (Wan et al. 2010). Razali & Anwar (2011) propose the following framework for stakeholder selection in requirement elicitation. In the first phase, identification, the project definition is used to recognise the stakeholders’ types and roles: primary, secondary, external, and extended. In the second phase, filtering, the stakeholders’ knowledge and interests are evaluated to assess their influence and competency. The last phase, prioritisation, involves finalising the selection by measuring the chosen stakeholders’ interpersonal skills.

Design for Excellence (DfX) is an integrated approach for designing products and processes. DfX enables systematic early involvement and functional integration, and aims to address the needs of stakeholders through the entire product life cycle (Bralla 1996, Mottonen 2009). DfX tools can also be used in conjunction with customer value chain analysis (CVCA), which aims to enable design teams to recognise diverse product requirements and their relative priority. CVCA involves defining the initial business model for the product, the relevant parties, and the parties’ relations to and relationships with each other. The resulting value chain is analysed to determine the critical stakeholders and their value propositions, and the gathered information is used in the product definition and design. (Donaldson et al. 2006).

Stakeholder prioritisation is needed in decision-making, since many stakeholders exist, their interests typically conflict, resources are limited, and the requirements must be balanced. The stakeholders must also be prioritised according to the situation. (Bendjenna et al. 2012, Razali & Anwar 2011). Berander & Jönsson (2006) argue that decision support in requirements engineering is an important enabler for delivering value to stakeholders. In ordinal scale prioritisation, ordering exists among elements, and the assigned numbers represent ranks. Ratio scale prioritisation, in turn, applies arithmetic operations, and besides ordering, interval sizes and element ratios are relevant.

The analytic hierarchy process (AHP) is a multi-criteria method that is based on a hierarchical structure and an aggregation process (Saaty 1980). AHP utilises evaluation scales to determine the importance of the alternatives regarding each criterion and the criteria weights. The weights are calculated by using a pair-wise
comparison based on a one to nine scale for quantifying verbal expressions. Criticism focuses on weight ranking that reflects the relative importance of the alternatives. (Contreras et al. 2008).

Another ratio-scale prioritisation technique is cumulative voting (CV), also known as the Hundred Dollar Test. In CV, the stakeholders get a number, such as 100 imaginary units of money, which must be distributed among the prioritised elements. In contrast to AHP, CV also enables a stakeholder to assign an element a zero priority. Hierarchical cumulative voting (HCV) is an extended version of CV. In HCV, elements are prioritised at different levels of a hierarchy, and within different groups in that hierarchy. (Berander & Jönsson 2006).

### 2.4 Customers

The value that a company creates comes ultimately from its customers, either existing or future customers (Peppers & Rogers 2011). A lot of attention in business and academic life has been paid to understanding customers and their needs, but challenges in creating products that satisfy customers still persist. While companies must find an optimal balance between market-pull and technology-push, customer input is claimed to reduce uncertainty and enable the development of foresight that aids meeting customers’ future needs better (Fogelström et al. 2010, Isoherranen & Kess 2011, Rothwell 1992, Un & Cuervo-Cazurra 2009). Furthermore, joint problem solving and bidirectional communication with customers enables companies to understand those needs that are difficult to express, as well as to develop successful products (Bonner 2010). However, too close relationships with customers have also been claimed to restrict a company’s ability to respond to market changes (Sull 1999).

#### 2.4.1 Customer definitions and types

Customers receive products or services from other parties, such as vendors and suppliers. A customer is a person or organisation that a company believes will benefit from the offering it provides (Christ 2009). Customers can be current, competitor’s customers, potential customers, and all others with unsolved problems and unmet needs. They include individual consumers, or people in companies who try to solve their business needs. Customers may seek either product or service solutions to their problems (Griffin 2005). From a
manufacturer’s perspective, customers include distributors, retailers, and people who buy products from retailers (Caplan 2001).

A customer may have a direct or indirect relationship with the vendor. For instance, some companies’ customers are shoppers, whereas for other companies, customers are downstream companies in the distribution chain, and the shoppers are their end-users or consumers (Peppers & Rogers 2011). In addition to paying customers, there are also non-paying ones, and customers may also participate in value creation. Prahalad & Ramaswamy (2004) argue that customers and their roles are changing from passive to active; there is a shift in power from the companies that determine what customers need to networks of customers and producers who create value jointly.

Besides immediate customers, an expanded customer base and the context in which the product is used should be considered, as success requires that the product is adopted by the entire supply chain (Berggren & Nacher 2001, Jones & Ritz 1991). Describing an expanded customer base and analysing the whole value chain provides an understanding beyond the direct customers, which may enable value innovation (Donaldson et al. 2006, Goodrich & Aiman-Smith 2007, Kim & Mauborgne 1997). Product end-users should always be taken into account, but other types of customers may also need to be considered (Griffin 2005, Ulrich & Eppinger, 2012). A customer selection matrix with different segments and types of customers, such as lead users with close relationships to the company, has been proposed for selecting which customers to focus on (Alam 2005, Ulrich & Eppinger, 2012, von Hippel 1986).

In addition to external customers, companies can also be considered to have internal customers. According to Lukas & Maignan (1996), quality is dependent on each actor in the production chain; to provide a quality product to an external customer, employees should get the best quality possible from the preceding employees in the chain. Internal customers are important, especially for companies operating in international markets, since contact with the external customers in foreign markets may be limited (Conduit & Mavondo 2001).

### 2.4.2 Customer involvement in product development

Customers are an important source for product development projects, and their input is needed to ensure product success (Alam 2005, Cohen et al. 2002, Griffin 2005). There is growing interest in customer empowerment and integration in product development in both business and academia (Fuchs & Schreier 2011,
Schaarschmidt & Kilian 2013). However, mixed results have been reported, and success has been found to depend on the type of customers involved. For example, the development of new products with new customers and lead users may improve the success rate (Bartl et al. 2012, Lau et al. 2010).

Acquiring useful knowledge from customers is considered to be challenging (Un et al. 2010). Challenges vary across industries. In the business-to-business (B2B) market, a large number of parties are involved in the relationships, and downstream customers are often considered to be outside the company’s control (Hillebrand & Biemans 2011, Tikkanen et al. 2000). Typical challenges in business-to-consumer (B2C) markets, in turn, include a large number of individual customers with different needs. Understanding the behaviour of different consumer segments is difficult (Kotler & Keller 2009). Thus, marketing research can have a significant role in the B2C markets (Suwannaporn & Speece 2010).

Customer involvement in product development varies among project types. In small change product development projects, interaction with customers aims for acquiring tacit knowledge about their needs and current product deficiencies. On the other hand, NPD for existing markets involves translating customers’ tacit unmet needs into product features without having an existing product. In NPD for completely new markets, customer interaction often takes place only when a prototype exists. (Un & Cuervo-Cazurra 2009).

Product development can be divided into design for, design with, and design by customers based on their involvement. In the design for customers approach, products are designed on their behalf. Customer studies that include interviews and focus groups, for example, are often utilised in the design for approach. On the other hand, in the design with approach, customers can also give feedback on the proposed design. In the design by approach, customers actively participate in the product design. (Kaulio 1998).

The customers’ role is also active in customer co-creation and open innovation (Chesbrough 2003, Prahalad & Ramaswamy 2004). Besides external customers’ involvement, cross-functional integration and continuous learning among R&D, marketing, sales, and manufacturing functions have been claimed to improve the performance of product development (Brettel et al. 2011, Ernst et al. 2010, Suwannaporn & Speece 2000).
2.4.3 Customer needs identification

Griffin (2005) argues that “customer needs are the problems that a product or service solves and the functions it performs. They describe what products let you do, not how you do it”. Needs are situation specific, have different priorities, and can be identified without knowing how to address them. For instance, two consumers may buy the same product to satisfy different needs, and the needs might also change from event to event. (Griffin & Hauser 1993, Peppers & Rogers 2011, Ulrich & Eppinger 2012).

In quality function deployment (QFD), a customer’s need is the customer’s own description of a desired product benefit. Needs in QFD are divided into primary (strategic), secondary (tactical), and tertiary (operational) needs (Griffin & Hauser 1993). Customer needs often correlate with the customer’s values and behaviour; thus, the needs are important to identify (Peppers & Rogers 2011). A deep understanding of needs helps the companies to choose the best technologies and features for the products (Griffin 2005).

In the marketing literature, information is typically divided into primary and secondary data. The former is collected for a specific purpose, whereas the latter refers to existing information that can be used to improve one’s knowledge about the market. (Birn 2002, Hutt & Speh 1998). Various methods exist for gathering customer needs. These include, for instance, interviews, observations, becoming a user, focus groups, customer advisory boards, panels, websites, and user groups. In addition, brainstorming, innovation summits, customer integration into a product development team, discussions with customers, ethnography, identifying lead users, and market surveys are used for identifying needs in product development. (Alam 2005, Chisnall 1995, Cooper 2011, Griffin 2005, Griffin & Hauser 1993, Hutt & Speh 1998, Kotler & Keller 2009, Ulrich & Eppinger 2000, von Hippel 1986).

Customer needs studies can be quantitative or qualitative. The benefits of quantitative research include possibilities for numerical analysis and presentation, as well as good resistance to bias. Qualitative research, in turn, provides ideas, insights, and deep understanding about problems. (Birn 2002, Chisnall 1995). Qualitative research techniques are common in customer needs identification. A typical customer needs study includes interviewing between ten and fifty customers (Griffin & Hauser 1993, Ulrich & Eppinger 2012). The expressions of needs and problems should be documented in the customer’s language, clearly, concisely, and in a contextually specific way (Griffin 2005). In addition, it is
beneficial if more than one person interprets the data, because customer needs can be translated in several ways (Griffin & Hauser 1993, Ulrich & Eppinger 2012).

Several challenges are involved in identifying and obtaining customer needs. Obtaining tacit and complex knowledge from customers is hard, and organisational boundaries make it even harder (Nonaka & Takeuchi 1995, Un et al. 2010). Real customer needs cannot be understood without understanding customers’ real problems and what products enable them to do (Cooper 2011). Customers typically cannot articulate their requirements and may ask for unprofitable things. They can also be unaware of possibilities and suggest incremental improvements they believe suppliers will implement. Furthermore, customers may present the same requests to competitors. (Berggren & Nacher 2001).

2.5 Synthesis

The product development, stakeholder, and customer involvement literature provide the theoretical foundation for this dissertation. This theoretical synthesis consists of the definition of the key concepts and the research theoretical framework.

A product development driver can be defined as a reason for a company to conduct product development. The development of new products can be analysed from multiple perspectives, including financial, marketing, design, engineering, and production management (Trott 2002). With regard to product development drivers, one needs to consider a variety of factors that make companies initiate and perform product development activities. In addition to financial and marketing reasons, various drivers exist that can be related to strategy, business environment, customers, technology, supply chain, and company internal factors.

Stakeholders, in turn, are parties that can affect or are affected by the project. Stakeholders can be internal, i.e. formal organisation or project members, or external, i.e. non-formal members, and their importance varies. In a product development context, stakeholders can be considered as the parties that can affect or are affected by the “transformation of a market opportunity and a set of assumptions about product technology into a product available for sale” (Krishnan & Ulrich 2001).

Finally, a company can have various types of customers, whose needs must be taken into account in product development. These include any number of direct customers with different priorities. The direct customers may also have
customers that can be intermediary or final customers, consumers, or product end-users. The companies’ internal stakeholders may represent some customers, whereas other customers and their needs must be identified in other ways. Both internal and external stakeholders affect customer needs and should be considered in product development efforts.

This dissertation focuses on analysing product development drivers, related stakeholders, and how the key stakeholders’ needs are identified. Figure 4 illustrates the theoretical framework used for the purpose of this dissertation.

Fig. 4. Research theoretical framework.

The research theoretical framework consists of four main elements. These include integrated product development, cross-functional integration, customer involvement, and stakeholder management. First of all, finding the right balance between technology-push and market-pull has traditionally been one of the most fundamental issues in product development. In addition, various other drivers and different stakeholders with diverging requirements affect the project goal definition.

Second, product development is a cross-functional effort. Cross-functional integration is very important to ensure the right requirements, and in particular,
involving the relevant stakeholders in the project early enough has a big impact on the project outcomes. However, due to the large number of stakeholders that can affect or be affected by a project, identifying the key stakeholders is difficult in practice. The importance and influence of different stakeholders also vary during a project. The aforementioned issue significantly complicates requirement handling and cannot be resolved solely by utilising requirements engineering tools.

The third main element of the research framework is customer involvement, which deals with focusing on the right customers and how their needs can be identified. The customer involvement literature proposes various ways to achieve the appropriate involvement of customers in product development projects. However, business- and project-specific differences should also be considered. Direct involvement may not always be possible, especially if the customer base is large and global.

Integrated product development, cross-functional integration, and customer involvement are well-known concepts in the literature and in practice. Nevertheless, in order to fully address the complexities involved in product development, the fourth element, stakeholder management, has been added into the research framework. The stakeholder management literature can provide insights into how various external and internal stakeholders with different requirements affect product development and the goals of a product development project. Moreover, the key stakeholders must be identified and appropriately involved starting from the project’s initiation, otherwise the product under development will be unlikely to meet the market and customer needs. Due to a large number of possible stakeholders and limited available resources, managerial attention should be allocated to the stakeholders appropriately. This requires an analysis of the stakeholders, and classifying them based on their importance. Select stakeholders, including, for example, marketing, sales, and customer care, also represent customers during the product definition and development.

The research theoretical framework presented above provides the basis for this dissertation, and it is utilised to improve product development outcomes by reducing the complexities and improving the focus of the product development projects. In the first phase of this study, product development drivers are clarified. The second phase identifies the relations between the stakeholders and the drivers. In the study’s third phase, customer definition and representation in product development is analysed. Finally, customer needs identification is studied.
3 Research contribution

3.1 Product development drivers

Product development must address the needs of multiple stakeholder groups, whose interests often conflict. Article I addresses research question 1: what are the main product development drivers and how are these drivers valued by industrial managers in practice? The article was based on both a literature review and an empirical study among industrial managers. In total, 18 product development drivers were identified in the literature review (Table 5).

Table 5. List of drivers (Majava et al. 2013, published by permission of Inderscience).

<table>
<thead>
<tr>
<th>Category</th>
<th>Drivers</th>
<th>Literature sources</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Revenue targets</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Competition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>External environment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Offering the right product mix to satisfy customers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Customer request, changing needs, feedback or idea</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Existing technology / new idea based on existing products</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Organisational learning</td>
<td></td>
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<tr>
<td></td>
<td>New resources</td>
<td></td>
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<tr>
<td></td>
<td>Underused resources</td>
<td></td>
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<tr>
<td></td>
<td>Suppliers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Partners</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Distributors</td>
<td></td>
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</tbody>
</table>

The literature review indicated many important drivers for product development. In order to gain insight into the driver priorities, an empirical study was
conducted. Experienced managers in the case companies were asked to evaluate the importance of each driver with the following scale: not important = 0, somewhat important = 1, important = 2, and very important = 3. Figure 5 presents the mean scores for all 18 studied product development drivers given by all 47 survey respondents.

Fig. 5. Product development drivers and their importance in the case companies (Majava et al. 2013, published by permission of Inderscience).

The results of article I indicated six key drivers that were considered to be significantly more important than the others. These included profitability targets, revenue targets, offering the right product mix, brand and image, strategy, and competition. In addition to the six key drivers, another four important drivers were identified. These included external environment, company’s own foresight, customer input, and new technology.

The study also found that production process, existing technology or new ideas based on existing products, organisational learning, and suppliers were only
considered important to some extent. According to the results, the least important drivers included partners, new resources, distributors, and underused resources.

Drivers for different types of product development projects were assumed to vary, and therefore the effect of project type on the driver importance was also analysed. Figure 6 presents the most important drivers for each project type, including radical, typical full-scale, and small change development.

<table>
<thead>
<tr>
<th>Radical development</th>
<th>Typical full-scale development</th>
<th>Small change development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy</td>
<td>Profitability targets</td>
<td>Profitability targets</td>
</tr>
<tr>
<td>Brand and image</td>
<td>Offering the right product mix</td>
<td>Offering the right product mix</td>
</tr>
<tr>
<td>Revenue targets</td>
<td>Revenue targets</td>
<td>Revenue targets</td>
</tr>
<tr>
<td>Profitability targets</td>
<td>Strategy</td>
<td></td>
</tr>
<tr>
<td>Offering the right product mix</td>
<td>Competition</td>
<td></td>
</tr>
<tr>
<td>Competition</td>
<td>Company’s own foresight</td>
<td></td>
</tr>
<tr>
<td>Company’s own foresight</td>
<td>New technology</td>
<td></td>
</tr>
<tr>
<td>New technology</td>
<td>External environment</td>
<td></td>
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<tr>
<td>External environment</td>
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</tr>
</tbody>
</table>

Fig. 6. Most important drivers for product development project types (Majava et al. 2013, published by permission of Inderscience).

Based on the study results, only two drivers clearly exceeded the threshold to be considered important in small change development. These drivers were profitability targets and revenue targets. Interestingly, in typical full-scale development, the number of drivers clearly exceeding the threshold to be considered important grew to six. In addition to profitability targets and revenue targets, the most important drivers in typical full-scale development included offering the right product mix, strategy, competition, and company brand and image. Furthermore, the results showed that nine drivers are key for radical development. Besides the aforementioned drivers, the company’s own foresight, new technology, and external environment were found to be among the most important factors in radical development.

In addition to the significant differences between project types, the results of article I revealed dissimilarities in driver importance among companies. The biggest differences were found in the following drivers: distributors, underused resources, external environment, partners, and production process. On the other hand, the biggest consistency was found in profitability targets, which was considered a very important product development driver by all companies. Finally, the study results indicated differences in individual opinions inside the case companies. Some of these differences in individual opinions could relate to
the informants’ roles and positions. However, the individual differences also indicate that companies should clarify their key product development drivers and align them among the different stakeholders to improve decision-making and reduce unnecessary ambiguities in product development projects.

3.2 Relations between stakeholders and product development drivers

Article II focuses on research question 2, the relations between stakeholders and product development drivers. In this study, various drivers and multiple stakeholders involved with product creation, delivery, and support were assumed to influence or be influenced by product development in companies. Experienced managers in the case companies were asked which external and internal stakeholders they connect with each product development driver. The managers could select many stakeholders for an individual driver. Eighteen product development drivers, which were identified in article I, were included in the study. The results of the study are illustrated in Figure 7, which describes the relationships between different external and internal stakeholders and product development drivers.

![Fig. 7. Relationships between stakeholders and product development drivers (Majava et al. (In press), published by permission of Inderscience).](image-url)
According to the study results, the external and internal stakeholders were divided into three different tiers to illustrate their relative importance. The results indicated that three external stakeholders were most frequently seen as those who can influence or are influenced by product development drivers. These stakeholders were customers, suppliers, and partners. Besides the three key external stakeholders, seven other stakeholders formed another significant group: competitors, distributors, end-users, retailers, service providers, shareholders and investors, and application developers. Financial institutions, regulators and legislators, and universities and research institutes were seen least often connected with the product development drivers in this study.

In addition to the external stakeholders, the internal stakeholders were also analysed. The results showed three internal stakeholders that were most frequently seen as those who can influence or are influenced by product development drivers. These key internal stakeholders were product management, engineering, and management. The next most important group of internal stakeholders included marketing, sourcing, sales, operations, and quality. Finally, legal, customer care, and logistics were identified as least often connected with product development drivers.

Article II also analysed the key stakeholders for individual product development drivers. For instance, the key external stakeholders for profitability targets were identified as shareholders and investors, customers, suppliers, and distributors, whereas the key internal stakeholders included management, product management, sourcing, operations, sales, logistics, marketing, and engineering.

The study results showed that customers were a key external stakeholder for six product development drivers. Unsurprisingly, customers were most frequently connected with customer input. Suppliers were identified as a key external stakeholder for five product development drivers, and they were mostly connected with new technologies. Partners, in turn, were identified as a key external stakeholder for four product development drivers, including, for example, strategy and production process.

Overall, internal stakeholders were more frequently connected with product development drivers than external stakeholders. This finding indicates that internal stakeholders may receive more managerial attention than external stakeholders. The results also highlighted the importance of product management, which was found to be a key internal stakeholder for 12 drivers. Product management was most frequently connected with profitability targets. Management was identified as a key internal stakeholder for 11 product
development drivers, which also included profitability targets as the most often connected one. Engineering, in turn, was found to be a key internal stakeholder for seven product development drivers. Interestingly, engineering was considered to be even more strongly connected with production process than new technology.

Finally, article II also points out that views on product development drivers and the related stakeholders differ among companies and individuals. While the drivers and stakeholders can be company specific and individual differences may exist, properly aligned views could result in improved decision-making and prioritisation. Thus, companies should systematically clarify their key product development stakeholders to improve the outcomes of their development efforts.

### 3.3 Customer definition and representation in product development

Customers are usually seen as the most important external stakeholders in product development. However, customer definition and representation becomes complex in a context where a large number of customers with different needs and priorities exist. Article III addresses research question 3. It explores customer definition and representation in market-driven product development. In a market-driven context, many customers exist, and the customers have different priorities. Select customers may drive the product development efforts, but individual customers neither directly participate in the development nor dictate the product functionalities. The viewpoint chosen in the article is from a product management and R&D perspective. These two functions were identified as key internal stakeholders in article II.

Article III was based on the study of two product development case projects in the information and communications technology (ICT) industry; one from the business-to-consumer (B2C) market and the other from the business-to-business (B2B) market. The B2C case represented radical development and the B2B case typical full-scale development. In the B2C case, various project stakeholders were identified, and the informants presented many viewpoints about customer definition. Figure 8 illustrates the key stakeholders and customer definition in the B2C case.
The results indicated that the most important external stakeholders for product management included consumers, direct customers, and competitors. Key internal stakeholders, in turn, included the R&I organisation, sales units, customer account teams, and product programmes. Marketing, other consumer data and competitor information providers, and other company units were also considered as important stakeholders. The analysis conducted in the study highlighted product management’s dialogues with marketing, sales units, and regions to guide the customer definition, along with a business unit strategy. In addition, key direct customers affected the customer definition. On the other hand, consumers were identified as the most important customer group, and the definition of consumer customer was aided by collecting and analysing user databases and studies. Furthermore, a company-wide market understanding and consumer segmentation were valuable, according to the results.

Article III also presented the key external stakeholders for R&I in the B2C case. These included direct customers, consumers, and third-party application developers. The key internal stakeholders, in turn, were identified to include product management, product programmes, sales units, marketing, and the internal organisation managing third-party application developers. In addition, company management, development teams at different sites, and the user
experience team were seen as important internal stakeholders. Based on the results, the customer definition for R&D came from product management, marketing, and consumer insight teams. In addition, the product programme was considered to affect the customer definition.

Customer representation in product development was also analysed in the study. In the B2C case, both product management and R&D informants saw that product management represents customers to R&D. Customer inputs to product management, in turn, came from marketing, sales units, customer account teams, and other regional contacts who were in direct contact with customers. The results also showed that user experience teams represented the end-user view to R&D during development.

The second case project analysed in the study was from the B2B market. Figure 9 describes the key stakeholders and customer definition in the B2B case project.

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**Fig. 9. Key stakeholders and customer definition in the B2B case (Majava et al. 2013, published by permission of ToKnowPress).**

The analysis of this project indicated that the most important external stakeholders for product management consisted of direct customers and third parties that complemented the company’s offerings. Key internal stakeholders, in turn, included business lines, the R&D organisation, customer account teams, management, customer operations team, and production. Based on the results, product management’s customer definition included both customers and internal
stakeholders. Three business lines existed in the case company, and these key internal stakeholders were prioritised based on sales volumes and growth potential. The company had hundreds of direct customers, and the management had defined the priority markets and key customers.

The results of the interviews with the R&D informants in the B2B case proved that direct customers were the key external stakeholders, whereas the key internal stakeholders for R&D included product management, business lines, and business line management. The R&D informants acknowledged that business-based customer prioritisation existed, but technical aspects also impacted the R&D priorities. For example, technology adoption schedules affected the importance of business lines.

Article III also included the analysis of customer representation in the B2B case project. Similarly to the B2C case project, both product management and R&D informants saw that product management represents customers to R&D. For product management, the customer representatives included business lines, their product managers, and key customer account teams. Internal stakeholder representation was ensured with the business lines’ participation in the project organisation.

Overall, the results of the study indicated that company management and strategy shape the customer definition in market-driven product development. The results also showed the importance of product management in customer definition for R&D, since product management collaborates with various stakeholders, including marketing, sales, management, and direct customers. Despite the existence of many customer information sources, product management was identified as the most significant customer representative for R&D.

3.4 Customer needs in product development

Meeting customer needs is often acknowledged as a prerequisite for a new product’s success. Article IV focuses on research question 4: how customer needs are identified in market-driven product development. The article describes a study of two product development case projects in the information and communications technology (ICT) industry. These projects were also explored in article III, but article IV focuses specifically on customer needs. The first case was a radical development project in the business-to-consumer (B2C) market, and the second case was a typical full-scale development project in the business-to-business (B2B) market.
The results of the study indicated that customer needs identification in market-driven product development involves many internal stakeholders, the utilisation of various methods, and several challenges. Table 6 presents a summary of the key findings from the case projects.


<table>
<thead>
<tr>
<th>Business and product natures</th>
<th>B2C case</th>
<th>B2B case</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B2C market in NPD-intensive ICT industry, tangible products for which software plays a key role</td>
<td>B2B market in NPD-intensive ICT industry, tangible products with both hardware and software</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key internal stakeholders for customer needs and their roles</th>
<th>B2C case</th>
<th>B2B case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product management: combines customer needs from the stakeholders and information sources into customer voice supported by own vision;</td>
<td></td>
<td>Product management: combines customer needs from the stakeholders and information sources into customer voice supported by own vision;</td>
</tr>
<tr>
<td>R&amp;D: turns customer needs and requirements into technical solutions and features;</td>
<td></td>
<td>R&amp;D: turns customer needs and requirements into technical solutions and features;</td>
</tr>
<tr>
<td>Marketing: organises market and consumer studies and creates target user profiles;</td>
<td></td>
<td>Business line: provides internal and external customers’ needs;</td>
</tr>
<tr>
<td>Sales unit: provides customer needs from local markets;</td>
<td></td>
<td>Customer account team: provides customer needs from local markets, direct customers’ needs and facilitates collecting them;</td>
</tr>
<tr>
<td>Customer account team: provides direct customers’ needs and facilitates collecting them;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>User experience team: provides end-user usability aspect and research</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Customer need identification methods</th>
<th>B2C case</th>
<th>B2B case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interviews; market surveys; user studies; observations; web sites; focus groups; workshops; lead users; becoming a user</td>
<td></td>
<td>In-depth interviews; customer meetings; workshops; customer visits to the company; market reports</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key challenges faced by product management</th>
<th>B2C case</th>
<th>B2B case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diverse needs of target customers and larger customer base; Interpreting information on customer needs provided by stakeholders; Anticipating future customer needs</td>
<td></td>
<td>Diverse needs of target customers and larger customer base; Information on customer needs is lost and changed inside the organisation; Customers are short-term focused and cannot articulate their long-term needs</td>
</tr>
</tbody>
</table>
As Table 6 indicates, customer needs identification in market-driven product development involves several stakeholders and many information sources. In both of the studied case projects, product management collaborated with various stakeholders, interpreted the acquired customer information, and worked together with R&D in processing the needs into requirements and product features. The results also indicated that product management’s own vision was needed to turn tacit information into explicit requirements. Some differences were also identified between the cases. In the B2C case, marketing was defined as the organiser of the market and consumer studies and the designer of the target user profiles. Sales units acquired local customer needs, customer account teams provided direct customers’ needs and facilitated gathering them, and the user experience team provided end-user usability aspects and research to support product development. In the B2B case, business lines provided internal and external customers’ needs, whereas customer account teams delivered and facilitated collecting the local market and direct customers’ needs.

The customer needs identification methods were also analysed in article IV. Interviews were identified as the most important customer needs identification method in both case projects; direct customer contacts were found to be valuable. Market surveys, reports, and customer workshops were also utilised in both cases. In addition, the B2C case involved many other customer needs identification methods to ensure a sufficient understanding about consumers. These methods included user studies, observations, websites, focus groups, identifying lead users, and becoming a user of the product under development. On the other hand, in the B2B case, meetings with select customers were found to be very important.

The results of the study indicated many challenges related to customer needs. The main issues faced by product management in both case projects included the diverse needs of the target customers and a larger customer base and anticipating and understanding the customers’ long-term needs. In the B2C case, the product management informants felt that interpreting the customer needs as provided by the stakeholders was difficult. A similar challenge was identified in the B2B case,
and it applied to product management and R&D. Customer needs information was lost and changed inside the organisation. Furthermore, the results showed that identifying the critical needs that a solution must fulfil was a key challenge from the R&D perspective in both cases. In the B2C case, the key challenges faced by R&D also included a large number of people being involved in processing the needs and requirements, and the fact that the R&D team’s needs and product use differed from the target consumers’ needs and use, which made “becoming a user” difficult. The analysis of the B2B case, in turn, indicated that the differences in needs within and between customer organisations posed significant challenges for R&D.

Finally, the results presented in article IV showed differences in customer needs identification in market-driven product development between B2B and B2C markets. However, the analysis of both cases indicated that product management has a key role in obtaining customer needs. According to the results, R&D relied on product management to acquire the needed information. Product management, in turn, worked with various stakeholders and used several information sources to gather and interpret diverging needs from the large customer bases.

### 3.5 Results synthesis

The main objective of this dissertation is to improve the outcomes of product development in companies by clarifying the product development drivers, the relations of different external and internal stakeholders to these drivers, and how the needs of key stakeholders are obtained. The research for this dissertation involved four main phases. First of all, key product development drivers were identified. Second, the relations between stakeholders and product development drivers were clarified. In the last phases, key internal stakeholders’ views on customer definition and representation and customer needs identification were studied to find ways to improve product development outcomes. Table 7 summarises the research contributions.
Table 7. Research contributions.

<table>
<thead>
<tr>
<th>RQ</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product development drivers</td>
<td>Key drivers according to the literature and industrial managers</td>
</tr>
<tr>
<td>Relations between stakeholders and drivers</td>
<td>Identification of differences between project types, companies, and individuals</td>
</tr>
<tr>
<td>Customer definition and representation</td>
<td>Three tiers of external and internal stakeholders for drivers</td>
</tr>
<tr>
<td>Customer needs</td>
<td>Key stakeholders for each driver</td>
</tr>
<tr>
<td>Customer needs</td>
<td>Describing product management and R&amp;D views of customer definition</td>
</tr>
<tr>
<td>identification</td>
<td>Identification of key challenges</td>
</tr>
</tbody>
</table>

The results indicated many significant drivers for product development in companies. The most important drivers included profitability targets, revenue targets, offering the right product mix, company brand and image, strategy, and competition. According to the results, managers dealing with product development face various complexities, because many drivers exist and they differ significantly between projects, companies, and even individuals. The results indicated that companies should clarify their product development drivers and align them with the relevant stakeholders in order to improve decision-making and ensure the right focus in product development efforts.

In addition to drivers, the stakeholders that affect and are affected by the drivers were analysed in this dissertation. Based on the results, different external and internal stakeholders were divided into three tiers to indicate their relevance to the product development drivers. The results showed that the key external stakeholders included customers, suppliers, and partners, whereas the most relevant internal stakeholders included product management, management, and engineering (R&D). Additionally, the key stakeholders for all 18 individual drivers were identified. These findings can be utilised to focus attention on the most relevant stakeholders in product development projects. Potential benefits include enhanced prioritisation and the reduction of unnecessary ambiguities in the development initiatives.

Once the key stakeholders were identified, the research of this dissertation focused on customer definition and representation in product development. The key internal stakeholders identified in the previous research phase included product management and R&D; thus, the topic was studied from these points of view. Furthermore, the research focused on market-driven product development, where offerings are created for a large number of customers. The results showed that company management and strategy outline customer definition. Product
management was found to collaborate with various stakeholders, including marketing, sales, management, and direct customers, in customer definition. In addition, product management was identified as the most important customer representative for R&D.

The fourth phase of this dissertation research analysed customer needs identification in product development. While customer needs identification is considered to be vital for a new product’s success and the topic has been widely researched, companies still face significant challenges in meeting customer needs. This especially applies to a market-driven context with a large number of customers. In this dissertation, customer needs identification was studied from product management and R&D managers’ perspectives. Despite some differences that were observed between practices in the business-to-business (B2B) and business-to-consumer (B2C) markets, the results showed that product management has a vital role in customer needs identification. Product management was found to collaborate with various stakeholders and utilise many information sources to obtain and interpret diverging customer needs. Figure 10 presents the synthesis of the dissertation results.
Fig. 10. Results synthesis.

Product development involves a lot of complexities, including both technical- and business-related issues. Managers dealing with product development must also consider the requirements of various stakeholders, and these requirements often conflict. The aforementioned issues make decision-making and prioritisation difficult in product development. Furthermore, meeting market and customer needs becomes challenging, because the needs of different types of stakeholders diverge. Potential root causes of the aforementioned problems include imprecise objectives, unclear stakeholders, and unsystematic customer needs gathering. This dissertation aims to provide solutions to these product development problems by identifying the real motives for product development efforts, the key stakeholders, and how their needs are obtained.
The research theoretical framework developed in the theory synthesis addresses the issues involved in product development via integrated product development, stakeholder management, customer involvement, and cross-functional integration. However, improving product development outcomes has proven to be difficult in practice. In order to address the underlying issues, this dissertation proposes the following. First of all, there is a need to clarify product development drivers and align them with the relevant stakeholders who participate in the development efforts. The type of product development project, including small change, typical full-scale, and radical development, must be considered when clarifying the drivers. Next, the key stakeholders related to the drivers should be identified. The project drivers can be utilised in identifying the most important stakeholders, and managerial attention must be allocated to the stakeholders based on the different tiers of importance. With regard to the internal stakeholders in product development, product management should have a clear mandate, appropriate resources, and the right competencies to lead collaboration with stakeholders who are close to customers. Moreover, product management must be capable of leading customer definition and representation to R&D. Obviously, product management is not the only function responsible for customers; thus, product management must collaborate with many internal stakeholders to define and represent customers in the product development efforts. Product management must also be responsible for obtaining and interpreting customer needs for R&D in the project.

If successfully implemented, the framework described in Figure 10 can significantly improve product development outcomes by providing the appropriate focus on the most important customers and reducing unnecessary complexities through the identification and clarification of the project drivers, the key stakeholders, and customer needs.

Finally, this dissertation also highlighted various challenges in customer needs identification. The results showed a need for good cooperation between internal stakeholders; the importance of product management and R&D cooperation was especially stressed. Furthermore, this dissertation indicated that product management and R&D practitioners should also aim for some direct contact with selected customers. This would enable clarifying the real needs and enhance customer understanding overall. While this dissertation focused on select technology industries and a limited number of companies, other companies operating in similar contexts may also benefit from the research findings.
4 Discussion

4.1 Theoretical implications

This dissertation focuses on product development drivers and stakeholders. Many authors have studied product development, its stakeholders, and customer needs identification in NPD. The results of this dissertation can be summarised as follows. First, this dissertation identifies key product development drivers according to the literature and industrial managers, and describes the differences in drivers between project types, companies, and individuals. Second, this study identifies three tiers of external and internal stakeholders for the drivers and driver-specific key stakeholders. Third, this dissertation describes product management and R&D views of customer definition, and identifies customer representatives in product development. Fourth, this research defines customer needs identification in product management and R&D, and identifies the key challenges.

This dissertation complements the previous literature on product development drivers (e.g. Acur et al. 2012, Bossink 2004, Kinkel & Som 2010, Lakemond et al. 2010, Nidumolu et al. 2009) by synthesising a list of key product development drivers. Moreover, the research clarifies the importance of the identified drivers. This research also indicates that, since many important product development drivers exist, a common technology-push vs. market-pull classification (Hart et al. 2003, Rothwell 1992) may provide a view of the real drivers of product development that is too simplified. New knowledge is also provided by clarifying the key drivers for different types of projects. The results of this dissertation are in line with previous research (e.g. Veryzer 1998) by finding that drivers for small change and radical product development projects are significantly different.

This dissertation also contributes to the stakeholder literature (e.g. Aaltonen & Kujala 2010, Glinz & Wieringa 2007, Mitchell et al. 1997) by providing new knowledge on the relations between stakeholders and product development drivers, and identifying the key stakeholders for each driver. The results of this dissertation indicate that the key external stakeholders include customers, suppliers, and partners. While past research highlights the importance of customers (e.g. Cooper 2011), the present study indicates that suppliers are almost as frequently related as customers to product development drivers. In addition, key product development functions have typically been considered to include
marketing, design (R&D), and manufacturing (Ulrich & Eppinger 2000). This dissertation is in line with the previous findings by highlighting the relevance of marketing and operations. On the other hand, the results of this dissertation indicate that product management, management, and R&D are the most strongly related internal stakeholders to product development drivers.

The role of product management is also stressed in the other findings of this dissertation. Previous studies on market and customer orientation, the customer’s voice in product development, cross-functional integration, and customer needs identification have mainly focused on the R&D and marketing interface, and have not adequately distinguished between the product management and marketing functions (e.g. Brettel et al. 2011, Cohen et al. 2002, Ernst et al. 2010, Griffin & Hauser 1993, Griffin 2005, Rafiq & Saxon 2000). As a contribution to the existing body of knowledge, this dissertation highlights the role of product management in customer definition and representation in product development. In addition, cooperation with many internal stakeholders is emphasised in this research, which is in line with cross-functional integration (e.g. Kakar 2012, Narver & Slater 1990).

Customer needs identification in product development has proven difficult, according to the past literature (e.g. Berggren & Nacher 2001, Un et al. 2010). This dissertation complements past research by indicating various challenges in identifying customer needs. In addition, this study highlights the importance of R&D and product management cooperation in customer needs identification. The results of this dissertation indicate that product management must collaborate with various stakeholders to identify customer needs and work together with R&D, in order to transform the needs into the correct requirements and product features. The research also highlights different product development practices in the business-to-business (B2B) and business-to-consumer (B2C) markets. In the B2C market, several common methods are utilised for identifying customer needs (e.g. Alam 2005, Griffin 2005, von Hippel 1986), and the information comes mainly from internal stakeholders. The B2B market, in turn, involved fewer methods for gathering information, and direct contacts with customers are more frequent.

In conclusion, the present study clarifies the main product development drivers, identifies their relations to different external and internal stakeholders, and describes how the needs of key stakeholders (i.e. customers) are identified. By doing this, this dissertation provides valuable contributions to the existing
body of knowledge on how companies can enhance the outcomes of their product development efforts, and create products that meet market and customer needs.

4.2 Practical implications

In spite of many studies and development efforts in companies, creating products that meet market and customer needs is still one of the most topical issues in today’s business. The results of this dissertation indicate that various drivers initiate product development in companies. In addition, the drivers are valued differently in different types of projects and by individual companies. Thus, managers should consider drivers to be company and project specific. Furthermore, the study results show differences in the individual opinions inside the companies. This indicates a need for companies to clarify their key drivers and ensure that individual opinions are aligned, which could enhance decision-making and help companies to successfully implement their product strategies. Interestingly, this dissertation also indicates that while many companies state that they are customer-oriented, customer input as a driver for product development has a rather low priority.

In addition to various drivers, companies have many external and internal stakeholders that can influence and are influenced by product development. These stakeholders must be adequately involved in product development efforts in order for companies to meet their objectives. As this dissertation highlights, the drivers for different product development projects vary, which means that the key stakeholders can also be different. This dissertation identifies the relations between stakeholders and product development drivers, and the key stakeholders for each driver. While many stakeholders must be considered to ensure project success, managers should focus their attention on the most important stakeholders.

This dissertation shows that, in terms of product development drivers, the most important external stakeholders include customers, suppliers, and partners, whereas product management, management, and R&D are the key internal stakeholders. The results of this dissertation also indicate that internal stakeholders may receive more managerial attention in companies than external stakeholders. Therefore, companies should consider whether their external stakeholders deserve more attention. Furthermore, views on product development drivers and the related stakeholders differ among companies and individuals, according to this dissertation. The drivers and stakeholders should be clarified in
different product development projects in companies, since properly aligned views can enhance decision-making, prioritisation, and the project outcomes.

A successful product must meet the needs of the key stakeholders. Thus, the target customer of the product must be clearly defined. This dissertation shows that product management plays a key role in defining customers in product development. Companies should invest in their product management teams to ensure their proper resourcing and competencies. This dissertation also indicates that company and business unit level strategies should be clearly defined in terms of target customers to ensure the right focus and priorities in product development projects.

In addition, collaboration between product management and customer-related stakeholders, including marketing, sales, and management, is important. The results of this dissertation stress the importance of internal stakeholders and cross-functional integration. Companies should aim for systematic working practices and cooperation among internal stakeholders to ensure that customer views are appropriately considered in product development. Defining customers should be carried out as a dialogue between product management and customer-related stakeholders. Furthermore, this dissertation shows that product management is the most important customer representative for R&D, and the research highlights the importance of effective cooperation between product management and R&D. However, other customer-related information sources, such as user experience teams, can also be used to ensure the right design decisions.

In today’s extremely competitive markets, it is vitally important to understand customer needs to ensure product success. This dissertation shows that product management collaborates with many stakeholders and utilises several information sources in customer needs identification. In a global customer base, a large number of customers with conflicting needs affect product functionalities. These diverse requirements cannot be addressed without understanding the real needs of the customers. In addition, many people across the organisation are involved in processing the needs and requirements, and the information on customer needs may be lost or changed inside the organisation. While the role of documentation is important, companies should understand that requirements engineering software tools alone will not solve the problems. The results of this dissertation indicate that companies should aim for effective cooperation among product management, R&D, and other internal stakeholders dealing with customer needs. Moreover, a constant dialogue between product management and R&D is needed.
in order for product developers to provide technical solutions that can meet diverging customer needs.

To sum up, this dissertation provides companies with the following recommendations. Project-specific drivers and stakeholders should be clarified immediately at the beginning of the project. It is beneficial to start product definition in small cross-functional teams, and avoid early handovers between product management and R&D. Furthermore, at the beginning of a project, working in small teams ensures clear responsibilities and a real investigation of customer needs instead of just assuming them. In addition to clarifying the customer definition and representatives, it may also be necessary to consider various types of customers with different profiles and needs to ensure that the technical solutions can meet the diverging needs. Requirements should also sometimes be challenged to reveal the real customer needs. Finally, this dissertation indicates that product management and R&D professionals can benefit from some direct contact with customers to tackle issues related to conflicting internal stakeholder views.

4.3 Reliability and validity

This dissertation research is mainly qualitative in nature, and utilises the experiences of industry practitioners. According to Bryman & Bell (2007), the most applicable criteria for evaluating business research include reliability and validity. Reliability deals with concerns about whether the results of the study can be repeated. Validity addresses the integrity of the conclusions, which are generated from the research. The nature of qualitative research requires specific criteria for evaluating reliability and validity. These criteria include the credibility of the findings, their transferability to other contexts, the likelihood that the findings apply at other times, and objectivity.

The credibility of the findings means the degree to which research results correspond with reality (Bryman & Bell 2007). The following measures were used to increase the validity and reliability of this dissertation research: describing the research process, using multiple data sources, validating the survey designs and study reports, and utilising the perspectives of different industry practitioners and researchers. The surveys were carefully planned and industry experts were utilised in validating their content. In addition, the semi-structured interviews enabled the researcher and interviewees to interact, and provided the interviewees with opportunities to comment on the issues under study.
Case selection is an important aspect in case study research (Eisenhardt 1989). In order to match the study’s focus and objectives, the cases selected for this dissertation represent product development intensive companies that create products for a large customer base in global markets. The case companies are based in Finland, which enabled the researcher to have sufficient access to information and face-to-face discussions with the informants. The case companies have many decades of product development experience and are recognised as among the leading innovators in their businesses. Therefore, their product development practices are assumed to represent good practices in their industries. However, the selected companies may not represent all aspects of the studied issues. The credibility of the findings from each case is further increased by involving informants with different backgrounds.

With regard to the transferability of the findings to other contexts, it must be emphasised that the studied issues are mostly relevant for product development intensive medium-size and large companies that have a large international customer base. The studied issues become more complicated when the company size and number of stakeholders increase. However, some of the dissertation findings may also apply to other types of companies. The aforementioned issues also apply to the generalisability of this dissertation’s findings, which is a typical issue in qualitative research (Berg & Lune 2012, Eisenhardt 1989). As discussed earlier, product development drivers and stakeholders are company and project specific. Furthermore, customer definition, representation, and customer needs identification practices may differ among businesses. Thus, further research is required to generalise the findings.

Objectivity in qualitative research means the degree to which the researcher’s own values have influenced the results (Bryman & Bell 2007). It must be considered whether another researcher would reach the same findings. This would require that another researcher would be able to repeat the research procedures exactly, conduct the same case study again, and arrive at the same findings and conclusions (Yin 1989). Due to the study’s nature and constant changes in companies and their business environments, it is unlikely that another researcher could be provided with the same research setting. Furthermore, despite the fact that the collected data has been stored for analysis, it is improbable that another researcher would reach exactly the same findings and conclusions. Thus, to increase the objectivity of this dissertation research, the perspectives of several researchers were utilised in the data analysis.
4.4 Recommendations for further research

During the research process of this dissertation, several issues requiring further study were identified. First of all, this study focused on product development intensive companies with a large international customer base. The companies under study were medium-size and large, and mostly from technology intensive industries. Studying a larger number of companies is a potential future research topic that would enable comparisons between companies. Recommended future study topics include how well the findings of this dissertation apply to different types of companies, such as small size companies, service businesses, or subcontractors. Future research should also be carried out in different industries.

Other interesting research topics, which are related to requirements engineering and stakeholders, include the prioritisation of the unique needs and relationships between requirements and stakeholders. Furthermore, the influence of stakeholders changes during projects. Therefore, future research should address the stakeholders’ roles and influence during product development projects.

Finally, during the research, it became evident that the field of product management requires more attention from academic research. While product management’s importance seems to be well-recognised among industry practitioners, it is insufficiently addressed in the contemporary product development and marketing literature.
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Original publications


Reprinted with the permission of Inderscience (I and II), ToKnowPress (III), and Scientific Research Publishing (IV). The named journals are the original sources of publication for the above-mentioned four articles.

The original publications are not included in the electronic version of the dissertation.

480. Ukkonen, Kaisa (2014) Improvement of recombinant protein production in shaken cultures: focus on aeration and enzyme-controlled glucose feeding

481. Peschl, Michael (2014) An architecture for flexible manufacturing systems based on task-driven agents

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