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Enhancing Absorptive Capacity through Internal Collaboration with Social Media Tools

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ABSTRACT

The present research discusses social media and, in particular, it addresses the impact of the use of social media tool on intra-organizational collaboration. Absorptive capacity (ACAP) theory is used as the theoretical lens to provide the framework and metrics. These are further used to clarify and increase understanding of the impact of new working practices based on utilization of the online collaboration tools. The foundation of the study is qualitative and quantitative measurements of the collaboration practices; the research elaborates from those to analyze the impact of online collaboration tool implementation. Even though the interest in ACAP and social media as separate entities is already extensive, the existing literature combining the two research streams remains scarce. In particular, the combination in the context of new product development (NPD) from the internal collaboration perspective is not a well-studied stream in the literature. The present research focuses on social media tools used in intra-organizational collaboration, perceived and measurable benefits, and connects those to the bodies of the management literature through metrics.

Bodies of the management literature that are synthesized in the current research, in particular the absorptive capacity theory and NPD success factors, build the foundation for the data collection. The research setting is constructed so that organizational practices are studied before and after the wide-scale roll-out of the social media tool utilizing mixed methods in terms of quantitative and qualitative approach. The research combines evidence based on three case organizations to identify the impact of social media tools' utilization.

The results suggest that new working practices inspired by the utilization of social media tools will enhance intra-organizational collaborations, particularly in terms of potential absorptive capacity (PACAP). Increased intra-organizational transparency and awareness about internal knowledge seem to help organizations unite members either to solve existing tasks or to utilize their intrinsic motivation. For example the organization can transfer information and knowledge between individuals easier and the absorptive capacity is greater as the discussions about ideas are stored in the virtual communities. In addition, results also indicate that active use of social media tools will reflect positively on NPD performance.

The findings lead to both theoretical and practical contributions. The research enters the discussion about the nature of the absorptive capacity by offering metrics for measuring PACAP directly. The synthesized metrics connect communication and NPD environment to the PACAP and further to NPD performance through the conceptual model. The practical contribution is concrete findings that indicate, for example, increased transparency as the main driver and benefit for the both individual and organizational level for the adoption of social media tools. In addition, the research includes notes and observations about working practices that managers should be aware of when they decide to guide an organization to the online collaboration in the virtual world.

TIIVISTELMÄ

Väitöstutkimus käsittelee sosiaalista mediaa ja siitä kumpuavia yhteisöllisiä työtapoja ja niiden hyödyntämistä erityisesti organisaation sisällä. Väitöstutkimuksen teoreettisena viitekehyksenä sovelletaan omaksumiskykyteoriaa (absorptive capacity theory), johon pohjautuvaa mittaristoa käytetään datan keräykseen. Tutkimuksessa selvitetään yrityskäyttöön soveltuvien yhteisöllisten työkalujen ja toimintatapojen vaikutuksia organisaation sisäisessä yhteistyössä. Akateeminen kiinnostus sosiaaliseen mediaan on kasvanut, mutta toistaiseksi tuotekehityksen ja organisaation sisäisen yhteistyön tarkastelu on jäänyt vähäiselle huomiolle. Väitöstutkimus nostaa esiin erityisesti yhteisöllisten työkalujen ja toimintatapojen koetut ja mitattavissa olevat hyödyt sekä kytkee nuo olemassa olevaan akateemiseen kirjallisuuteen.

Tämä kirjallisuus käsittelee erityisesti omaksumiskykyteoriaa sekä tuotekehityksen menestystekijöitä. Nämä kirjallisuuden osa-alueet näkyvät selvästi tutkimukseen liittyvässä datan keruussa ja siinä käytettävässä mittaristossa. Datan keräys toteutettiin kaksi kertaa kussakin kolmessa case-organisaatiossa; ensimmäinen kerta ennen laajamittaista yhteisöllisten työkalujen käyttöönottoa ja jälkimmäinen kerta käyttöönoton jälkeen. Dataa kerättiin sekä kvalitatiivisesti että kvantitatiivisesti.

Tutkimuksen tulokset tukevat käsitystä uusien yhteisöllisten työkalujen ja toimintatapojen positiivisista vaikutuksista organisaation sisäiseen yhteistyöhön: organisaation jäsenten potentiaalinen omaksumiskyky (potential absorptive capacity) on korkeampi. Lisääntynyt organisaation sisäinen läpinäkyvyys ja tietoisuus kollegoiden osaamisesta vaikuttaa helpottavan luontaisesti motivoituneiden ryhmien syntyä haasteiden ja ongelmien ratkaisemiseksi. Organisaation kannalta yhteisöllisten työkalujen käyttö on lisäksi hyödyllistä virtuaaliseen yhteisöön tallentuneiden keskusteluiden ja ajatuksien vaihdon takia. Tallentuneita tietoja voidaan käyttää organisatorisen tietopankin muodostamisessa ja näin organisaation jäsenien on helppo palata keskusteluihin jälkeenpäin. Kun tiedonsiirto ja tiedon löytyminen organisaation sisällä helpottuvat, organisaation omaksumiskyky kasvaa. Tämän lisäksi tulokset osoittavat yhteisöllisten työkalujen positiivisen vaikutuksen myös tuotekehitysprosessiin.

Tutkimuksesta nousee teoreettisia ja käytännöllisiä löydöksiä. Tutkimus tukee omaksumiskykyteoriaan liittyvää keskustelua mm. tarjoamalla mittariston, jolla omaksumiskykyä voidaan suoraan mitata. Kirjallisuudesta johdetut mittarit kytkevät eri kommunikaatiomuodot ja keskeiset tuotekehitykseen liittyvät muuttujat potentiaaliseen omaksumiskykyyn ja edelleen tuotekehityksen suorituskykyyn tutkimuksessa esitetyn konseptimallin kautta. Eräänä konkreettisena löydöksenä voidaan pitää sitä, että lisääntynyt läpinäkyvyys toimii yhtenä keskeisenä ohjaimena, jonka kautta hyödyt voidaan kanavoida esiin yhteisöllisten työkalujen omaksumisessa. Tämän lisäksi tutkimus sisältää managereille suunnattuja huomioita ja löydöksiä, joita voidaan hyödyntää organisaation siirtyessä yhteisöllisten työkalujen avulla virtuaalisemmaksi.

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Tero Peltola

Tampere 20.4.2014

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ABBREVIATIONS AND NOTATION

(Adj.) R^2	(Adjusted) coefficient of determination
F value	represent independency between test variables
H_0	Null-hypothesis
ACAP	absorptive capacity
BAH	Booz, Allen and Hamilton Consulting
e.g.	for example
FFE	fuzzy front end
ICT	information and communication technology
i.e.	that is
NPD	new product development
OCT	online collaboration tools
PACAP	potential absorptive capacity
PDMA	Product Development and Management Association
RECAP	realized absorptive capacity
SAP	Systeme, Anwendungen und Produkte
SME	small and medium-sized enterprises
VIF	variance inflation factor
vs.	versus

1. INTRODUCTION

This introductory chapter outlines the genre and point outs the academic interest in the present research. As the chapter moves closer to the research questions, absorptive capacity is explained in general, in the context of new product development (NPD), the importance of communication within the NPD, and how the social media will support the NPD process. And finally, the end of the chapter presents the research questions.

1.1. Motivation

The amount of the information, in terms of words that we observe during the year, is enormous nowadays. The amount of annual communication has surged from around 2000 trillion to around 12000 trillion words no more than in 100 years (McKinsey, 2012). According to the report cited, the change has a logarithmic trend because of the communications revolution during the 20th century. In particular, the most recent 20 years has changed the world entirely from a communication perspective, particularly in terms of the amount of written language (McKinsey, 2012). Written language lacks non-verbal support, resulting in the message being much more vulnerable to misunderstanding. On the other hand, written language is at its best when delivering formal, codified messages, but not cultural or tacit knowledge (Reagans & McEvily, 2003; Szulanski, 2002).

That trend in the amount of communication is not reflected in communication inside organizations. The current situation in organizations is that there are a lot of knowledge barriers (Szulanski, 2002). According to Szulanski (2002), one can identify three kinds of barriers for internal communication: barriers based on organizational levels, business units, and/or culture and location. As a result, an organization is full of small isolated groups of people who may not share many mutual interactions. Increasing collaboration between these isolated groups might not be the easy task. Social media tools are expected to build bridges between these isolated groups, but neither the mechanisms nor the most efficient practices are exhaustively identified yet. The present research joins in the discussion from an information-sharing perspective. Focusing on changes in knowledge gathering by qualitative and quantitative measurements will enable concrete arguments about the influence of social media tools on collaboration and communication.

New product development is a collective effort in companies to produce offerings for the market (Tushman & Anderson, 2004). Scholars share a convergent understanding that success in NPD requires collaboration, cross-functional information sharing, and sufficient resources (Alam, 2006; Brentani & Reid, 2012; Cooper & Kleinschmidt, 2007). Therefore, product development is a fruitful context for discussions of social media tools.

As mentioned previously, sharing ideas and dialogue are the fundaments of communication, particularly in NPD. Technologies of communication have been a driver for many events in the modern history of mankind (Langman, 2005). According to Langman (2005), Gutenberg became well known due to innovations in print media that made it easier to spread one's thoughts to a wider audience. Easier sharing the message with wider audiences changed many aspects of life, not only education, even though that benefited a lot from Gutenberg's innovation due to cheaper books and print media (Habermas, 1991). However, the dialogue aspect of communication is not affected by print media. The need for easy dialogue over long distances resulted in the first telephone call in 19th century. As the phone enabled one-to-one dialogue, radio followed and, supported by TV broadcasts during the 20th century, introduced new media to share ideas to many people (Sussman, 1997). However, utilizing those technologies to share ideas required special expertise and equipment and most people were only receiving the ideas of others without the ability to transfer information of their own. The Internet has changed that dramatically, particularly due to the utilization of social media tools since the beginning of the 21st century (Langman, 2005). At the moment, sharing ideas with a wide audience is not restricted by communication technologies and everyone who has the access to the Internet can share ideas and join in various dialogues.

1.2. Research outline

Absorptive capacity

The individual ability to identify relevance is strongly supported by the individual's background knowledge and intrinsic motivation towards different aspects of life (Foss, Minbaeva, Pedersen, & Reinholt, 2009). Learnt items will help individuals to codify what they will see, hear, and feel. Familiar items are easier to remember because they can be linked with similar items. In addition, background knowledge will help to identify important aspects in information flow (Zahra & George, 2002). This indicates rather intuitively that, the more an individual knows in advance, the easier it will be for him or her to absorb anything new, as there is much that already relates somehow to his

knowledge. The ability to acquire, assimilate, and utilize knowledge is referred to as absorptive capacity (Cohen & Levinthal, 1990). From the absorptive capacity perspective, it is better to know at least something about various areas of expertise than just to be an expert in one focused field (Cohen & Levinthal, 1990).

In addition, when individuals form a group, they can benefit and utilize a group member's individual interactions with third parties. Through collaboration, organizational members have access to different groups and communities, based on their and their peers' individual preferences, characteristics, and history (Bercovitz & Feldman, 2011). The group member builds a bridge from his/hers background knowledge and network to the rest of the group and, according to Bercovitz & Feldman (2011), a group's potential is greater than sum of its individual parts. The amount of absorptive capacity in a group can be, therefore, larger than the individual level when it is based on utilizing group members' varied background knowledge. The potential of the group's absorptive capacity combination is based on the group members' individual absorptive capacity. From a wider perspective, an organization can be described, to some extent, as group or as a group of groups. Organizational absorptive capacity is then related to the individuals' absorptive capacity (Cohen & Levinthal, 1990; Hotho, Becker-Ritterspach, & Saka-Helmhout, 2012).

Furthermore, similarities between organizational members in different internal functions might be smaller between departments than between different companies (Griffin & Hauser, 1996; Szulanski, 2002). The organizational capability to absorb valuable items will be larger if it efficiently utilizes variations in the background knowledge of organizational members in different internal functions. This efficiency can be reached by intra-organizational collaboration and communication. The organization already shares the mutual mission and all organizational members should be aware of the targets. This builds up a foundation for high absorptive capacity that is reached by an organization through its collaborating members. The utilization of various intra-organizational expertise in the development process links absorptive capacity also to NPD (Stock, Greis, & Fischer, 2001).

New product development

The content of new product development might include several kinds of development projects. Ahuja and Lampert discuss different types of projects as new-to the-company (novel), new-to-the-industry (emerging), or new-to-the-world (pioneering) ones (Ahuja & Lampert, 2001). However, new product development can still be understood to have even wider content, as depicted in Figure 1.1. In this study, the new product development is understood to contain the whole new-to-the-firm/market spectrum, from small improvements to radical innovations. Research interest in NPD has (among

others) produced best practices and guidelines for NPD. There are some variations in organizational success factors between studies, but majority of them acknowledge the importance of communication (Barczak, Griffin, & Kahn, 2008; Barczak & Kahn, 2012; Cooper & Kleinschmidt, 1995a; Cooper & Kleinschmidt, 2007; Griffin, 1997).

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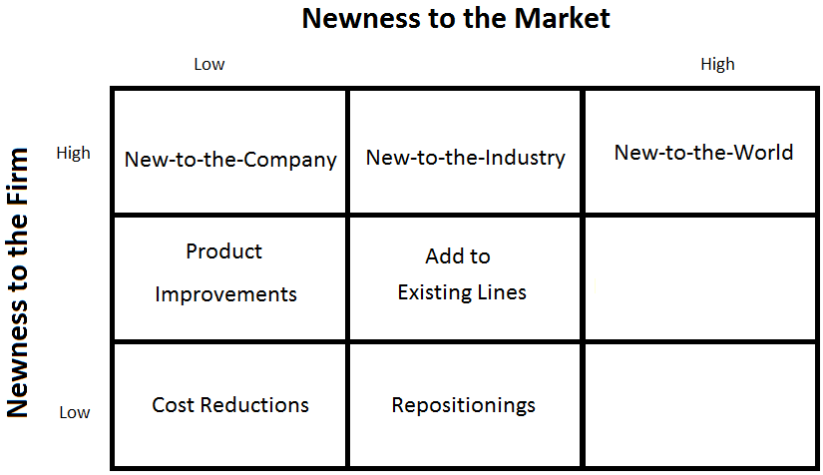


Figure 1.1: Project strategy topology (synthesized from Ahuja & Lampert, 2001; Griffin & Hauser, 1996)

As already mentioned, communication plays a major role in a successful NPD project, and it is also an antecedent of high absorptive capacity (Lane & Lubatkin, 1998; Tsai, 2001; Tushman & Anderson, 2004). Furthermore, in the present study, communication will be described from three perspectives; in-team communication, cross-functional communication, and communication with external parties. Communications based on these three perspectives are to be discussed next.

In-team communication can be understood as something that happens between the closest peers. These peers have the most mutual interactions because they are a part of the same team and they have, therefore, at least partly overlapping targets. Most often they also have similarities in their backgrounds (Griffin & Hauser, 1996). External parties are understood in the present research to contain individuals that are not on the company payroll, but have some interaction with the company. These parties include contacts in supply chain, customers, users, competitors, etc.

The third perspective on communication is cross-functional communication. This has been a highly interesting topic in technology management and it has been one of the success factors for organizations (Tushman & Anderson, 2004).Therefore, it is

connected also in the present research to the utilization of social media tool. Challenges in communication between different internal functions have been pointed out to exist and various scholars have studied the field (for example Gupta & Wilemon, 1990). Employees of different organizations typically have certain specialties and backgrounds, as discussed previously (Bercovitz & Feldman, 2011; Olson, Walker, & Ruekert, 1995). The same background in members of the same internal function might result in a tendency toward those in different functions not sharing the same language. Griffin et al. even described language as being totally different in different functions within the same organization (Griffin & Hauser, 1996).

However, internal functions can communicate with each other if organizational members are willing to invest the time to improve their efforts to work together. Cross-functional teamwork can, on the other hand, be challenged by the strategies that companies have selected (Griffin & Hauser, 1996; Song & Thieme, 2006) and therefore top management should always be aware of the level of internal communication and act accordingly. Cross-functional communication can be one of the key success factors for NPD, especially when ideas are gathered from widespread sources and those ideas are discussed internally (cross-functionally) at the beginning of the NPD process (Tushman, 1977). The clear benefits of dialogues between various experts have been noted also by Ramaswavy and Gouillart (2010), as they concluded that co-creation is the way to build a successful enterprise (Ramaswamy & Gouillart, 2010). In addition, Ramaswavy and Gouillart (2010) underline the importance of the communication between different internal parties.

Cross-functional communication should not be understood to be only between peers from the same organizational level, but it should also include communication between different organizational levels. And, in the ideal case, the communication should be interactive in both directions. It has been pointed out that down-to-up communication is not typically at a sufficient level, and it should be elevated to have the organization perform at its optimum level (Burgelman, Christensen, & Wheelwright, 2008). The elitist perception, that senior managers have the best brains for making all decisions, might easily introduce huge barriers into organizational success in the long run (Tushman & Anderson, 2004).

However, it is argued that the amount of cross-functional communication might not necessarily have a positive impact on performance of innovation (Jalonen, 2011). In some cases, increased communication emphasizes the background differences and the probability of conflicts becomes higher. In addition, the amount of communication does not necessary reflect on the not-invented-here perception, and increased communication might even strengthen the barrier to accept the invention from others (Jalonen, 2011). In addition, there is Condorcet's jury theorem that argues that there is a decrease in the possibility of reaching the correct decision as the number of jurors increases if an average person is most likely wrong (Maclean & Hewitt, 1994). Condorcet's jury

theorem then suggests that maximizing the number of decision-makers is not necessarily always the preferred scenario. Nevertheless, using a panel of experts for finding the solution is widely used practice, referred to as the Delphi method. The Delphi method is considered to improve foresight for development activities (U. G. Gupta & Clarke, 1996). However, individuals might to feel uncertain when they are forced to make a decision if there is a contradiction between innovation and their values or beliefs (Jalonen, 2011). And this contradiction might challenge the objective idea screening. These limitations most probably are not diminished by the use of social media tools and virtual communities. The amount or dimensions of virtuality in the group of organizational members seems to be irrelevant (Zigurs, 2003).

Social media

Social media tools (such as Facebook) are nowadays widely used around the globe (Butler, 2013). For the time being, the structured and managed use of these tools internally in the organizations has not been straightforward because there has been a lack of widely known processes to support employees for finding those tools useful in their daily work (Bondar & Peltola, 2013). But it is forecast (Isokangas & Kankkunen, 2011) that social media tools will play a big role in the future, not only from the marketing or public relations point of view, but also from the point of view of the NPD process and internal communications. Social media tools discussed in the present research are enterprise-level online collaboration tools, such as blueKiwi or SAP Streamwork. Facebook and similar familiar consumer level social media tools are not enterprise-level online collaboration tools, mainly due to the lack of trust and controllability for the implementing organization. In addition, workers are expected to be motivated to use social applications (Moylan & O'Toole, 2011).

Different individuals have scattered social networks from which they adopt ideas and on whom they rely (Reagans & McEvily, 2003). Communication inside a social network has highly informal tendency and its size and shape does not necessarily follow organizational and company borders. It is not uncommon that representatives of potential customers/individuals from various companies are inside the social networks of an employee (Alin, 2010). Therefore, it is beneficial for the company to harvest ideas and feedback widely across organizations about the customer needs but it is equally important to share the ideas from the NPD process company-wide, thus enabling a rich contribution from other organizational members. As collaboration helps an organization to unite intrinsically motivated members to solve tasks or to utilize their intrinsic motivation (Foss et al., 2009; Ryan & Deci, 2000), the impact of social media tools is suggested to favor this kind of collaboration. On the other hand, the social dimension that is naturally present in a traditional team is missing in a virtual team. Therefore the amount of challenges in collaboration within a virtual team might increase and the team might not reach the same performance level as a traditional team. Nevertheless, nowadays the work is typically dispersed and asynchronous (Montoya-Weiss, Massey,

& Song, 2001), and the number of virtual teams is increasing (Dahl, Lawrence, & Pierce, 2011).

Intranet (i.e., a company's internal Internet) in its typical form is an information delivery channel and, even though discussion forums at some level might be integrated into it, the structure might not be optimized or appealing for open discussions (Shayndi, 2012). An intranet in its typical form represents a rather static repository of information. On the other hand, using social media tools as a starting point and building an application for collaboration and information transparency as a more appealing way to communicate might be utilized. The use of social media tools has a part in the lives of most people (Rozgonyi, 2011) and one can suggest that the willing to share ideas and objects and also to contribute to online discussions is not something new to implement in organizations. But, because the working practices need to be altered, the success of adoption depends also on the working culture. According to Shayndi (2012), transparent and informal dialogues between different organizations and levels might be hard to reach with a traditional intranet. Intranet 2.0, addressed as a "social software" (Haefliger, Monteiro, Foray, & von Krogh, 2011), has been understood to include aspects from technological innovation and strategy (Von Krogh & von Hippel, 2006) as they affect an interaction gateway between organizational members through virtual communities: These communities can be used for searching for certain knowledge from the pool of varied expertise, and these profiles can be used for identifying different discussion parties. Traditional email or intranet applications are lacking these identifying possibilities.

Companies are adopting social media tools gradually but the perceived benefits are not convergent (Denyer, Parry, & Flowers, 2011). Social media has not been among the key streams of management literature until recently. Social media has not been discussed before the year 2005 in academic literature, but since then has become a more popular topic than new product development or absorptive capacity. Based on the key word search on Web of Science, interest in social media-related research is rather strong nowadays. The key phrase "social media" was compared with key words "new product development," "NPD," "product development," "absorptive capacity," and "ACAP." The trend in "new product development" has been stabilized around 250-300 records annually and for "absorptive capacity" somewhere around 300, while the number of records for "social media" was still peaking at 840 records in 2012 (Table 1.1).

Table 1.1. How much and when areas if interests have been discussed in the topics of academic literature (ISI Web of Knowledge ; 30.1.2013)

Year	Social media	New product development	Absorptive capacity
2000	-	132	29
2001	-	107	43
2002	-	152	47
2003	-	148	69
2004	-	125	99
2005	2	161	116
2006	2	211	153
2007	25	234	197
2008	45	272	255
2009	154	296	288
2010	296	247	309
2011	634	286	347
2012	840	213	344

1.3. Defining the research focus

Reflecting the previous discussion, academic interest in ACAP and social media as separate streams of literature is already large. However, the overlapping section particularly in the context of NPD and internal collaboration is not an exhaustively studied stream in the literature. The connection of empirical results, perceived benefits, and management literature is not clear or convergent and therefore the focus of this study is to build from the measurements about the new collaboration practices during the NPD process to the utilization of social media tools and contrasting those to the absorptive capacity theory. Enterprise-level applications that are based on social media technologies are referred in the present research as intra-organizationally utilized social

media tools or compactly as online collaboration tools (OCT). These collaboration tools are used to share ideas intra-organizationally and to allow colleagues to contribute ideas.

Studies of the utilization of social media tools share inconsistent indications and the understanding based on management literature is not convergent. Intra-organizational utilization of social media tools is a strategic decision (Haefliger et al., 2011), as is the implementation of communication technology (Dahl et al., 2011). In addition, implementing social media tools affects social interactions and organizational culture because it introduces communal working practices (Von Krogh, 2002). It has been suggested that social media tools reflect positively (Dahl et al., 2011; Kaplan & Haenlein, 2010) but, on the other hand, social media tools might not have a significant impact (Denyer et al., 2011; Migdadi, Zaid, & Hujran, 2012).

To reach the scope of the research, the standing point is the evidence from three case organizations. Inspired by Zahra & George, the present research argues that, without these new collaboration methods, the company's potential absorptive capacity is not fully utilized (Zahra & George, 2002). The research's contribution is not tied to real-time collaboration (Frößler, 2008) and the implications should be appealing to all organizational levels (Haefliger et al., 2011). Information transparency is another perspective in the present research on the use of social media tools. As the discussions about ideas are stored in the virtual community, the organization can transfer information between individuals easier and absorptive capacity is greater (Zahra & George, 2002). Collaboration helps organizations to unite intrinsically motivated members in order to solve tasks or to utilize their intrinsic motivation.

1.3.1. Research framework

Discussion in this study will concentrate on the potential absorptive capacity and how that is altered when internal communication and collaboration are affected with social media tools. With the help of social media tools, the shared and cross-functionally scattered ideas are gathered and a coherent understanding can be generated and transformed to the clear target or update for the NPD process. This study acknowledges the importance of the beginning of the development process because communication is highlighted on that phase (Poskela, 2009) and success in that phase will have a great influence on the further stages of the development process (Kim & Wilemon, 2002).

The main themes in the dissertation are based on the streams of absorptive capacity; they are addressed through branches of management science such as communication and new product development. Dialogues about these themes can be found in various forums, such as the Academy of Management Review (e.g., Zahra & George 2002), Strategic Management Journal (e.g., Lane & Lubatkin 1998), Academy

of Management Journal (e.g., Jansen et al. 2005), Research Technology Management (e.g., Cooper & Kleinschmidt 2007) and Journal of Product Innovation Management (e.g., Griffin & Hauser 1996).

Different management applications are a solid part of the modern management culture. To collect all relevant information and to analyze it has been understood as important tool for leaders to guide the company forward (Hovi, Koistinen, & Ylinen, 2001). The importance of the organization's internal communication will be highlighted in cases where the solution for the customer's problem is yet distance and unveiled and even the specifications are mystery for the customer. These kinds of cases will require that all pieces of information have to be harvested, analyzed and combined quickly, to enable the company to respond rapidly and effectively.

However, existence of these kinds of management and communication tools will not guarantee that all valuable information will float smoothly between internal functions and organizations (Cabrera, Collins, & Salgado, 2006; Migdadi et al., 2012; Song, Thieme, & Xie, 1998). Therefore, online collaboration tools will not generate new working practices by themselves but these working practices also have to be implemented. If new communication and collaboration applications are based on technology innovation, the required new working practices can be addressed in terms of management innovation (Bondar & Peltola, 2013). Without "administrative" innovation (Damanpour, 1991), the impact of technology innovation is limited to the success of the organization.

Prevailing market and technology uncertainty that relate to the development process will generate a mist that will blur clear understanding of the customer's dreams, desires, and delights, but the impact of those uncertainties can be decreased, for example, by cross-functional communication (Bojica & Fuentes, 2012). Uncertainties are like a "white map": There might be something ahead or there might not be anything (Sarasvathy, 2001). The "white map" represents the situation at the beginning of NPD. The linkage of social media tools into a natural part of the development process will help the process to combine different conceptions and knowledge in an organization into one coherent target, decreasing the amount of uncertainties and coloring the white map.

1.3.2. Research question

The main goal for the dissertation is to clarify and measure the impact of the social media tools on collaboration and how that reflects on absorptive capacity. In addition, the present study provides insight into NPD performance and should spark a social media-related discussion. The research question is synthesized from the research goals.

The NPD performance is vague concept because it can be understood to have various manifestations, and in different phases of NPD the criteria for success might even differ (Kim & Wilemon, 2002).

NPD performance can be addressed in terms of idea selection (Cooper & Kleinschmidt, 2007). Idea selection can be performed in the beginning of the NPD process (Kim & Wilemon, 2002) but also in any other place during the development process new knowledge might be a trigger for selection (Barczak & Kahn, 2012). That aspect of NPD performance relates on knowledge acquisition (Bojica & Fuentes, 2012), and as the absorptive capacity is suggested to reflect on the performance of NPD (Hotho et al., 2012; Lane & Lubatkin, 1998; Yli-Renko, Autio, & Sapienza, 2001; Zahra & George, 2002), the present research therefore focuses on PACAP. In consequence, the present research considers knowledge acquisition and assimilation as antecedents for NPD performance. Therefore, the first research question is

RQ1: *How does an enterprise level social media tools usage influence the NPD performance through potential absorptive capacity?*

In addition to addressing the PACAP directly in terms of knowledge acquisition and assimilation, it can also be addressed through communication and the NPD environment (Flatten, Engelen, Zahra, & Brettel, 2011; Tsai, 2001). Utilization of social media tools reflects on communication (Leonardi, 2007) but, as it reflects also on working practices, usage of social media tools also depends on the NPD environment (Denyer et al., 2011). In consequence, variations in communication and NPD environment can be used to indicate PACAP. Therefore, the second research question is

RQ2: *How does the usage of enterprise-level social media tools influence the potential absorptive capacity through communication and NPD environment?*

The challenge in the research is to identify and synthesize the key metrics from the literature that plays the main role in both new product development and social media tools usage. In addition, metrics should not concentrate only on amount (for example communication), but on quality as well (Adams, Bessant, & Phelps, 2006). That dual criterion of the metrics is used in the metrics and in the data collection. Data are used to address the research questions mainly through a conceptual model. The synthesized metrics from the literature is discussed in detail in the following chapter. The

synthesized metrics can be considered as a theoretical and managerial contribution of the research because it can be used to combine social media tools and communal working practices into absorptive capacity theory but can also be used as managerial guidance to point out areas of special attention.

1.4. Structure of the thesis

This chapter briefly presents the outline of the research and the research framework. In the section about absorptive capacity, the main idea of absorptive capacity was explained. Since the seminal works of Cohen & Levinthal (1989, 1990), the theory has spread into one of the most fruitful discussions streams in the management literature. The next section described the context of the present research, new product development. New product development is interpreted to include various kinds of development activities, from small improvements to radical changes. In addition, both software and hardware development activities are included in the content of NPD. In the following section, three different types of communication were discussed. Those three types are communication within a team, cross-functional communication, and communication with external parties. As the content of the present research is internal communication and collaboration, the third type of communication is discussed only briefly and in a tangential way. Before presenting the research framework, social media as a phenomenon was discussed. In addition, the chapter included a discussion about the usable forms of social media technology for organizations as an enable of online collaboration.

After outlining social media in the research perspective, the positioning of the research in the overall scene of management science is going to be presented. The main theory in the present research is absorptive capacity theory, and the main dissertation research focus is to connect that theory into metrics that can be used to justify the implementation of online collaboration tools. Justification is addressed through impacts that can be also benefits. The goals of the present research are to synthesize conceptual models from various streams of management literature and measure the influence of social media technology in the NPD context. In addition, the required new working practices are to be identified and synthesized from case organizations. Empirical data have been collected from three case organizations through surveys and interviews. The research question is to study influences in absorptive capacity after applications based on social media technology have been implemented in the organization. The research questions are discussed from four perspectives, revealing the impact of social media technology on acquired and assimilated knowledge, communication, and the NPD environment. The chapter ends with presentation of the conceptual model and hypothesis.

In Chapter 3, the methodology of the present research is presented. The main data collection methods are semi-structured interviews and online surveys in each case organization. These methods are complemented with observations and informal communications with representatives of the case organization as well as with administrative user statistics for the OCT. The approach based on case organizations is the most suitable in the present research for making implications based on empirical data. The third chapter also includes descriptions of each case organization and how they reflect on research question. Each selected case organization had already decided to utilize social media tools and online collaboration. In addition, these case organizations followed slightly different approaches and applications to develop new working practices.

Chapter 4 discusses the results. The results are conducted according to the various different datasets based on material collected in cases. These datasets include pre- and post-data from each organizations, as well as combined pre- and post-datasets across cases. Interviews were transcribed by external analyst and were further processed and analyzed with the ATLAS.ti application by the researcher. Quantitative analyze for survey data was performed with the SPSS application. Qualitative data analysis was used to support quantitative analysis by providing fruitful insights into the case organizations. Triangulation of the data is based on transcribed interviews, quantitative data, observations, and informal discussions with representatives of each case organization.

The chapter 5 continues discussion about quantitative and qualitative results and connects those to the aspects of the research questions: knowledge acquisition and assimilation, communication, and the NPD environment. In addition, insights for NPD performance are discussed through the altered idea selection capabilities in the organization. The results and findings are connected to existing literature.

The concluding chapter 6 discusses contribution and develops conclusions of the research and presents implications for academia and discusses managerial implications. The chapter includes also the reliability and validity assessment of the research, as well as known limitations and finally further studies are discussed in the last chapter.

2. THEORY AND HYPOTHESES

Absorptive capacity is identified as one antecedent of NPD performance and, according to the literature, high ACAP is the foundation on which successful NPD is built. As discussed in the previous chapter, there is a research gap relating to metrics that combine absorptive capacity with social media tools. The present chapter discusses the related management literature and synthesizes key metrics to address research questions through hypothesis.

2.1. Absorptive capacity

The organizational ability to recognize, absorb, and utilize knowledge has been described and studied in the context of absorptive capacity theory. Absorptive capacity theory has been popular since seminal work of Cohen and Levinthal, who discussed the organizational capacity to absorb new knowledge in 1989 and 1990 (Cohen & Levinthal, 1989; Cohen & Levinthal, 1990). However, organizational absorptive capacity is based on the absorptive capacity of its members (Cohen & Levinthal, 1990; Lane, Koka, & Pathak, 2006). This individual-driven theory has been studied in various areas of interest such as banking (Buzzacchi, Colombo, & Mariotti, 1995), technology licensing (Nicholls-Nixon & Woo, 2003), strategic alliances (Lane & Lubatkin, 1998), organizational learning (Cohen & Levinthal, 1990), and new product development (Stock et al., 2001), and also as a theoretical construct (Lane et al., 2006). Furthermore, ACAP theory has been studied in the context of collaborative (external) networks (Dyer & Singh, 1998; Tsai, 2009), and an organization's financial performance (Kostopoulos, Papalexandris, Papachroni, & Ioannou, 2011). In addition, the theory has been discussed in terms of potential absorptive capacity (PACAP) and realized absorptive capacity (RECAP) after being reconceptualized by Zahra & George (2002). Acquiring and assimilating knowledge were addressed through the concept of PACAP and, on the other hand, the RECAP concept has been used to discuss transformation and exploitation of knowledge. An organization's trajectory for PACAP is typically higher than for RECAP. The gap between them is the possibility for an organization to increase its performance. An important aspect of absorptive capacity theory is that it should not be understood as merely an amount of prior knowledge (that can be measured in tangible outputs), but it also has an intangible side (i.e. working practices to utilize prior knowledge) (Lane et al., 2006). Utilizing knowledge requires going through four dimensions (acquire, assimilate, transform, exploit) that are used to describe an

organization's ability to survive in a dynamic business environment (Zahra & George, 2002).

Knowledge acquisition

Knowledge has to be acquired before it can be utilized (Cohen & Levinthal, 1990; Zahra & George, 2002). Furthermore and according to the literature, knowledge acquisition can be passive, active, or interactive (Lane & Lubatkin, 1998). Passive and active knowledge acquisition can take place when acquiring observable knowledge, and Lane and Lubatkin (1998) suggest also that knowledge acquisition is greater between similar organizations because they have common ground in terms of knowledge and expertise. They also acknowledge the importance of face-to-face interactions and interactivity that are required for cross-functional assimilation. Furthermore, inter-organizational relationships that can be used to utilize expertise in various functions have been confirmed to reflect positively on knowledge acquisition (Yli-Renko et al., 2001). Even though findings by Yli-Renko et al. (2011) are about knowledge acquisition between different companies, there are analogies to the context of intra-organizational knowledge acquisition from the organizational member perspective, because peers in another internal function can be considered external for that organizational member as there are many barriers among them (Szulanski, 2002). Increased awareness about intra-organizational knowledge is among the success factors in NPD (Cooper & Kleinschmidt, 2007) but the present research also discusses that from the knowledge acquisition perspective.

Knowledge assimilation

Knowledge acquisition is followed by assimilation (Todorova & Durisin, 2007; Zahra & George, 2002). Assimilation is considered to be the aspect of potential absorptive capacity that connects understanding and interpretation into acquired knowledge (Lane & Lubatkin, 1998; Zahra & George, 2002). Before knowledge can be transferred (the third dimension of ACAP), it has to be comprehended. Creating formal programs that are dedicated to information sharing will help managers to find and assimilate new internal knowledge (Lenox & King, 2004). In addition, Lenox and King (2004) found evidence that prior relating experience will help the adoption of new knowledge, and they build their arguments strongly on managers' influence to distribute new knowledge between different functions. Organizational learning depends on absorptive capacity but also on an intensity of effort. If intensity of effort is high, the gradient of the absorptive capacity is positive and the knowledge base will increase (Tushman & Anderson, 2004). A slightly different perspective on assimilation is from Szulanski (1996), who addresses the idea of knowledge assimilation through categorizing. He argues that, once knowledge is interpreted, it has to be categorized and then it is possible to transform it further (Szulanski, 1996).

Knowledge transformation

Following Zahra and George (2002), the transformation of knowledge is the third dimension of ACAP and the first dimension of RECAP. In that dimension, the assimilated knowledge is converted and recodified for use by the rest of the organization (Fichman & Kemerer, 1999; Zahra & George, 2002). In addition, the role of individuals is crucial in knowledge transformation inside the organization (Hotho et al., 2012). Creating new knowledge configurations within the organization is pointed out as one of the crucial factors in the organization's success (Bojica & Fuentes, 2012; Bosch, Volberda, & Boer, 1999). The theme of knowledge transformation has also been discussed by Szulanski (1996), who suggests that knowledge has three dimensions: prior knowledge, knowledge sharing, and knowledge applying. In other words; combining Szulanski (1996) and Zahra and George (2002), there is a connection between knowledge sharing and knowledge transformation. It is suggested that social networks inside an organization have a role in organizational learning (Tsai, 2001), and that implies that linking organizational members to each other will also increase the learning capabilities of the organization. The organizational-level perspective of knowledge transfer is also supported by Alin (2010) in his studies of inter-organizational collaboration. He argues that knowledge transfer is one of the success factors in a networked environment and that it requires sub-processes on the cognitive level. Interestingly, Todorova and Durisin (2007) suggest similar findings. When new information is transferred from party to another, within the knowledge transfer, the cognitive/knowledge structure of the organizational member is changed (Todorova & Durisin, 2007).

Knowledge exploitation

The last dimension of absorptive capacity is describing the effective usage of the transformed knowledge. Along with knowledge transformation, the individual plays a role in the transformation of knowledge into use, but organizational processes also seem to have an influence on the exploitation of knowledge (Hotho et al., 2012; Jansen, Bosch, & Volberda, 2005; Lane & Lubatkin, 1998). Social interactions have been identified as antecedents for knowledge exploitation (Yli-Renko et al., 2001) and therefore it is straightforward to argue further that exploitation is tightly connected to resource harvesting inside the organization (Zahra & George, 2002). As knowledge is not evenly distributed in organization, knowledge sharing plays a role not only in intra-organizational knowledge acquisition but also in the effective exploitation of such knowledge. Knowledge exploitation is the dimension in ACAP where the organizational capability of acquired, assimilated, and transformed knowledge is commercially applied (Lane & Lubatkin, 1998). Without successful exploitation, the knowledge remains commercially useless, yet the achieved knowledge is used as the basis of a greater

capability for acquisition and assimilation and the accumulation of knowledge can therefore be used to enhance further acquisition and assimilation processes (Spender & Grant, 1996).

Absorptive capacity and organization

Absorptive capacity can be discussed by concentrating on different entities of an organization. It has been discussed at both the individual and unit (group of people) levels (Cohen & Levinthal, 1990; Hotho et al., 2012; Jansen et al., 2005; Zahra & George, 2002). Cohen and Levinthal (1989; 1990) in their seminal work discuss differences in individual and organizational absorptive capacity, and Hotho et al. (2012) build on that by suggesting that individual actors and their inter-unit activities are impacting on the organizational-level absorptive capacity. PACAP is referred as the potential amount of absorptive capacity that the individual or unit possesses, but the whole amount is not utilized by the organization (Zahra & George, 2002). Jansen et al. (2005) discuss absorptive capacity on the unit level and find correlation among cross-functional communication, participation, and PACAP. Following Zahra & George (2002) further, the amount of available and utilized potential absorptive capacity is referred as realized absorptive capacity (RECAP). According to the results from Jensen et al. (2005), RECAP is strengthened by connectedness and socialization. In addition, it is argued that complementary knowledge can be absorbed from consortiums if the company's absorptive capability is high (Murovec & Prodan, 2009; Sakakibara, 2003).

Having access to a network where new knowledge can be acquired requires more effort than traditional new product development management (Tsai, 2001). In addition, Tsai (2001) suggests that senior management should actively support organizational members in utilizing various networks. Furthermore and with dedicated effort, the capability to innovate can be increased due to intra-organizational collaboration (Bojica & Fuentes, 2012). According to Bojica & Fuentes (2012), the knowledge network inside the company and, in particular, across the functional units plays a major role. And, following Bojica & Fuentes (2012), one of the results is that a unit with high ACAP seems to be highly innovative. Similarly, Anderson and Tushman (1990) also argue that a company's capability to acquire and apply different ideas and knowledge plays an important role in development process. In addition, a company's high absorptive capability also reflects the speed of development (Lane et al., 2006; Moorman & Slotegraaf, 1999). Concluding the discussion of the literature, there seems to be convergence on the idea that absorptive capacity and NPD performance are correlating.

In addition, it is suggested that experience reflects on NPD performance, and the link between those is capabilities (Heimeriks & Duysters, 2007). Even though

Heimeriks and Duysters (2007) concentrate on alliances and experience, capabilities and performance in that context, they also mention that organizational learning (knowledge transfer) follows the same method. The prior knowledge of the organization is one of the key factors in identifying the business opportunity (Bojica & Fuentes, 2012; Shane & Venkataraman, 2000). Without identification of business opportunity, also identification of uncertainties are limited and the innovation decisions are done "blindly" (Ofek & Turut, 2008).The external knowledge required for the NPD process might be documented and codified in a way that is not useful for NPD personnel to acquire and assimilate it. Peers from different functions might be important middlemen to identify and recodify the available knowledge into the form that is useful for the rest of the organization (Marsh & Stock, 2006). The gap in person knowledge can bond or restrict finding the solution. In these cases, there is a clear need for information that can fill the knowledge gap (Byström & Järvelin, 1995; Shane, 2000). Individual capabilities vary among organizational members (Shane & Venkataraman, 2000). Information sharing will increase intra-organizational awareness and it makes it possible to learn from each other, increasing the realized absorptive capacity.

Scholars have been interested in managerial practices that relate to the amount of ACAP. Increasing absorptive capacity requires active guidance from management (Jansen et al., 2005; Lane & Lubatkin, 1998). Furthermore, there are suggestions that ACAP is a dynamic capability that can be managerially increased (Dushnitsky & Lenox, 2005; Mowery, Oxley, & Silverman, 1996). Similarities in managerial practices that relate to increasing both ACAP and NPD performance offer fruitful avenues for further studies. It has been found that the relation between absorptive capacity and NPD performance is neither positive nor negative but has more of an inverted-U shape tendency (Stock et al., 2001). The increase in absorptive capacity seems to increase NPD performance at the beginning but the relation then seems to be transformed to negative in at a high level of ACAP. However, the importance of cross-functional knowledge acquisition will be increased, particularly when the task at hand has a complex nature because, in that case, the requirement for additional information sources has increased (Bojica & Fuentes, 2012). In the organization, some groups and/or individuals are general sources of information and knowledge because they have high capabilities, as seen by others (Monteiro, Arvidsson, & Birkinshaw, 2008). And. on the other hand, those groups and/or individuals that have high capabilities can absorb information and knowledge from other groups and individuals (Zahra & George, 2002). Social cohesion will increase information transfer between individuals and, when organizational members share common ground, they are more motivated to share information and to learn from each other (Reagans & McEvily, 2003; Yli-Renko et al., 2001). This seems to have a positive link to the amount of ACAP between these individuals; they will easily absorb new knowledge from an acquaintance and, as a result their ability to absorb more (from the same party) is increased. Similar findings

are discussed by Gupta and Govindarajan (2000); the more knowledge overlaps between the receiver and the transmitter, the more new knowledge is acquired.

Critics of Zahra & George's model for ACAP theory

Zahra and George's (2002) interpretation of Cohen and Levinthal's (1989, 1990) seminal works about absorptive capacity has not been without critics. For example, Todorova and Durisin (2007) and Lane et al. (2006) argue that Zahra and George's interpretation and extensions do not entirely following the seminal work. Especially problematically Todorova & Durisin found sequential tendency of the four dimensions of ACAP and lacking the original value recognition step, but they also added a few extension to the model to have it to describe the seminal work better (Todorova & Durisin, 2007). They suggest that the social integration mechanism will influence not only the boundary of PACAP and RECAP but all aspects of absorptive capacity. They also suggest a couple of extensions to the impressiveness of power relations and regimes of appropriability. According to Todorova & Durisin (2007), power relations will also influence exploitation instead of only at the very beginning of the ACAP process as suggested by Zahra & George (2002), and according to Todorova & Durisin (2007) power relations will influence both the beginning of the process and after the exploitation. In addition, Todorova & Durisin interpret that Zahra and George's study is too closely tied to existing stakeholders and the organization's current standing and that any disruptive or radical innovation won't be acquired by the organization. The discussion from Lane et al. (2006) makes the same observation. According to Lane et al. (2006), Zahra & George's (2002) reconceptualization is missing the important link from the history to the future that is required of proactiveness in the organization. An organization should prepare itself for the future, and that can be done when lessons from the history are taken into account. Furthermore, Lane et al. (2006) argue that the seminal work by Cohen and Levinthal addresses the ACAP from two perspectives, as a funnel and a pipeline, not only a pipeline was proposed by Zahra & George (2002). According to Lane et al. (2006), forgetting the funnel metaphor compromises the explorative aspect of the ACAP theory developed by Cohen & Levinthal.

The criticism from Todorova & Durisin (2007) seems to be justified, at least from the social integration mechanism perspective, but also the criticism of the sequential nature of assimilation and transformation seems legitimate. As Todorova & Durisin (2007) pointed out, social integration mechanisms will influence all aspects of absorptive capacity. This social integration mechanism, as an extension to Zahra & George's model, is one part of the prior literature foundation on which the present study stands and to which it contributes. In addition, the interpretation by Todorova & Durisin that the type of acquired knowledge determines whether it is assimilable or transformable seems to fit better to the seminal work by Cohen and Levinthal.

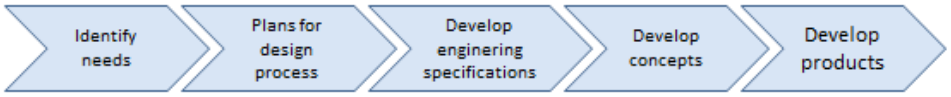
Furthermore, the criticism from Lane et al. (2006) is justified because there is the lack of explorative aspect in Zahra & George's (2002) reconceptualization. That missing aspect reflects on the absence of a funnel metaphor and the acknowledgement of lessons learnt. However, all the scholars seem to agree that absorptive capacity theory includes knowledge acquisition followed by assimilation (Lane et al., 2006). The present research elaborates on these perspectives and focuses on knowledge acquisition and assimilation. That aspect of ACAP is referred to (following Zahra & George reconceptualization) as potential absorptive capacity to clarify the focus and contribution of the research.

2.2. ACAP and NPD

There is strong agreement among scholars that success in new product development is an important factor for the success of the whole company (Barczak & Kahn, 2012; Cooper & Kleinschmidt, 2007). It is argued that high ACAP leads to innovativeness and performance in the organization (Tsai, 2001) and to collaboration in general (Tsai, 2009). In addition, according to the management literature, new product development can be further divided into different phases (Belliveau, Griffin, & Somermeyer, 2002). One of the widely known descriptions for these phases is the stage-gate process (Cooper, 1994) that has inspired scholars to offer various illustrations, depending on context. Three of those are presented in the Table 2.1 below. Further, these phases are traditionally depicted as partly overlapping arrows in the sequence. The definition of each phase is based on the typical but different characteristics in each of these phases (Belliveau et al., 2002; Kim & Wilemon, 2002). In addition, the first phases can be described as informal, fuzzy, and uncodified territory due to the lack of well-known specifications for the product to be developed. On the other hand, according to Kim & Wilemon (2002), the second phases make up a formal, clear, and codified machine that produces the product. Finally, the NPD process typically ends with commercialization phases. This rather ideal high-level depiction of NPD can be used to describe all kinds of NPD projects in some extent.

However, communication differs, depending on whether it takes place inside the main R&D center or in a satellite R&D site (Nobel & Birkinshaw, 1998). Even though the geographical distance between internal organizations to communication is argued to have an effect, the distance is not the only criteria for the quality and amount of the communication (Van Den Bulte & Moenart 1998). According to Nobel & Birkinshaw (1998), level of centralization also plays a role and has an impact on amount of communication between sites. In addition, the impact of distance between sites is argued to be smaller, particularly when IT technology is used to enhance the communication (Frößler, 2008; Song & Song, 2010).

Table 2.1. Variations of stage-gate process (adapted from Ericsson, 2013)

(Ullman, 1992)	
(Ulrich & Eppinger, 1995)	
(Cooper, 1998)	

Close cooperation between internal functions is extremely beneficial during the design phase of a new product (Gomes, de Weerd-Nederhof, Pearson, & Cunha, 2003; Hise, O'Neal, Parasuraman, & McNeal, 1990; Moenaert, De Meyer, Souder, & Deschoolmeester, 1995). In addition to the previously mentioned authors, Song et al. (1998) describe different stages of the development process and also discuss about the stage where internal functions will have the greatest impact to the development process of the new product. Furthermore, according to Utterback (1971), information that is available and easily accessible will support innovation, and a greater degree of communication between the firm and environment at each stage of the process seems to be important and therefore contributes to the project's success. Any external information should be recodified and shared internally to maximize its usability in each stage of the process.

It is argued that rivalry between internal functions seems to reduce the quality and amount of the shared information (Maltz, Souder, & Kumar, 2001). The importance of internal cooperation has been found by Souder & Moenaert (1992), who mention that cooperation between NPD and marketing will significantly decrease uncertainties between these internal functions (Souder & Moenaert, 1992). In addition to previously mentioned authors, cooperation between different organizations has been studied by Song et al. (1996) and Gupta et al. (1990).There is great importance in the teamwork and effects of cross-organizational friendships to be able to improve the efficiency of the communications (Song, Neeley, & Zhao, 1996) and it is argued that the successful innovation process requires a close and intact relationship between NPD and marketing organizations (Gupta & Wilemon, 1990).

It is also argued that roots for any new innovation are based on already existing innovations and it is expected that the most interesting ones yet to come are based on combinations of expertise from different fields (Shafique, 2012). This underlines the

importance of cross-functional communication in maximizing the knowledge base, as well as the value of the external parties that should be combined with NPD process. Therefore, knowledge is typically addressed as internal and external knowledge from the organization's perspective. External knowledge is something that the organization does not have but should be absorbing to increase its internal knowledge (Cohen & Levinthal, 1990). And the wider and deeper the internal knowledge is, the easier it is for the organization to absorb external knowledge and the more positive are the expectations for future success (Cohen & Levinthal, 1990). However, this idea argues that "internal knowledge" is something that is available and accessible so that all persons in the organization can utilize it. According to Cohen & Levinthal (1990) and Lane et al. (2006), all knowledge is based on individuals, not an organization. Therefore, the amount of intra-organizational knowledge is not the same as the sum of knowledge of organizational members, because no one else might be aware of a crucial piece of information held by an individual. In other words, the organization is made of individuals that have augmented knowledge to each other, but that cumulative knowledge base is not easily accessible or concrete. That implies that tacit knowledge cannot be easily codified (Gupta & Govindarajan, 2000). In many cases, isolated groups of organizational members between organizations restrict cross-functional knowledge sharing and absorption (Szulanski, 1996). Therefore, an organization's internal knowledge (as a cumulative sum of individuals' knowledge) might be significantly wider and deeper than is actually perceived. Internal knowledge is considered to have an aspect of information sharing (Griffin, 1997) and therefore cross-functional communication can be considered as the main component for lifting the organizational members' awareness of potential knowledge in organization closer to the sum of individual's knowledge.

As product lifecycles become shortened constantly, companies are challenged to speed up their development process (Murovec & Prodan, 2009). This inevitably requires the NPD process to be effective in the right time (Mikkola, 2001), but that characteristic of NPD is not trivially nor easily achieved. NPD projects are all surrounded by uncertainty. "Uncertainty is translated into the context of the decision about whom to place in charge of production." (Casson, 1982). Uncertainties can be addressed from the perspectives of the market or the technology (Gans & Stern, 2003). One can argue about whether technology or market uncertainty is more important to be decreased but both of these uncertainties should be screened and neither of them should be considered irrelevant.

If the beginning of the NPD process, the so-called fuzzy front end (FFE), fails to provide a clear solution for customers' needs, the rest of the NPD process cannot easily be successful anymore (Kim & Wilemon, 2002). Kim & Wilemon (2002) argue that, even though the solution is prepared with excellent process, there is a risk that it won't be relevant if it is based on poor decisions about the customer needs. It might even have insignificant market potential. Therefore, controlling and decreasing uncertainties at the

FFE (both technology and market uncertainties) are major aspects of managing the whole NPD process and reaching toward the successful outcome (Gans & Stern, 2003; Kim & Wilemon, 2002).The amount of acquired and assimilated knowledge plays a major role at the beginning of the development process and should be maximized as those dimensions of ACAP are used to decrease uncertainties (Cohen & Levinthal, 1990) and, due to the increased amount of acquired knowledge, the decision between solution ideas is based on greater mixture of knowledge varieties (Kim & Wilemon, 2002). The guidance of the management literature discussed previously that the beginning of the NPD process establishes a good incentive for the whole remaining NPD process; this supports the fact that the main interest in current research is to focus on the potential absorptive capacity (acquire and assimilation).

Success factors in NPD, project-process

An innovation can be considered as either a product innovation or a process innovation (Damanpour, 1991). Product innovations mainly aim at various markets but process innovations are typically elements that organizations are implementing. In the present research, the focus is not specifically to address only certain type of innovations, but to consider NPD in general.

Because NPD is widely agreed to contribute significantly to the success of the whole company, its success factors have been among the key bodies of interests in management literature. The studies by Booz, Allen and Hamilton (1968-1982) were among the drivers for Page to publish PDMA best practices (1993) and Griffin to update those practices (1995). The practices were further updated in 2004 (results published in 2009), and those 2004 results were even further updated in 2012 (Barczak et al., 2008; Barczak & Kahn, 2012; Griffin & Page, 1996; Griffin, 1997; Page, 1993). In addition, contributions to the best practices in management literature is also found in the works of Cooper, Kleinschmidt, Wilemon, and Gupta (Cooper, 2001; Cooper, Edgett, & Kleinschmidt, 2004a; Cooper & Kleinschmidt, 1995a; Cooper & Kleinschmidt, 1995b; Cooper & Kleinschmidt, 1996; Cooper & Kleinschmidt, 2007; Gupta & Wilemon, 1990). Success factors can be addressed on the project and/or the business level, and success on the project level might not contribute to business-level success. A summary of success factors is presented in Table 2.2.

Table 2.2. Collection of the synthesized success factors addresses in management literature

Success factor	Suggested in
High-quality new product process	(Barczak et al., 2008; Barczak & Kahn, 2012; Cooper, Edgett, & Kleinschmidt, 2004a; Cooper, Edgett, & Kleinschmidt, 2004b; Cooper, Edgett, & Kleinschmidt, 2004c; Cooper & Kleinschmidt, 1995a; Cooper & Kleinschmidt, 2007; Griffin, 1997)
A defined new product strategy for the business unit	(Barczak & Kahn, 2012; Cooper, Edgett, & Kleinschmidt, 2004b; Cooper & Kleinschmidt, 1995a; Cooper & Kleinschmidt, 2007)
Adequate resources of expertise and money	(Cooper & Kleinschmidt, 1995a; Cooper & Kleinschmidt, 2007; Page, 1993)
R&D spending	(Cooper & Kleinschmidt, 2007)
High-quality new product project teams	(Barczak et al., 2008; Cooper & Kleinschmidt, 1995a; Cooper & Kleinschmidt, 2007)
Senior management commitment and involvement	(Barczak et al., 2008; Barczak & Kahn, 2012; Cooper & Kleinschmidt, 1995a; Cooper & Kleinschmidt, 2007; Page, 1993)
An innovative climate and culture	(Cooper, Edgett, & Kleinschmidt, 2004a; Cooper & Kleinschmidt, 1995a; Cooper & Kleinschmidt, 2007)
The use of cross-functional project teams	(Barczak et al., 2008; Barczak & Kahn, 2012; Cooper & Kleinschmidt, 1995a; Cooper & Kleinschmidt, 2007; Griffin, 1997)
Senior management accountability for new product results	(Cooper & Kleinschmidt, 1995a; Cooper & Kleinschmidt, 2007)

Reward champions, project teams	(Barczak & Kahn, 2012; Cooper, Edgett, & Kleinschmidt, 2004a; Griffin, 1997)
Open communication	(Barczak & Kahn, 2012; Cooper, Edgett, & Kleinschmidt, 2004a)
Understanding of the business's NPD process	(Cooper, Edgett, & Kleinschmidt, 2004a)
Risk averseness	(Cooper, Edgett, & Kleinschmidt, 2004a; Page, 1993)
No punishment for failure	(Cooper, Edgett, & Kleinschmidt, 2004a)
Customer/user integration into NPD process	(Barczak & Kahn, 2012)
Long-term targets for NPD	(Barczak & Kahn, 2012)
Entrepreneurialism is encouraged	(Barczak & Kahn, 2012; Cooper, Edgett, & Kleinschmidt, 2004a; Cooper & Kleinschmidt, 1995a)
Intra-organizational relations	(Cooper & Kleinschmidt, 1995a)
Using IT tools	(Barczak et al., 2008)

The research question narrows the research focus and therefore the various influences of all these success factors (Table 2.2) on the implementation of social media tools are not equally interesting. Therefore, not all acknowledged success factors are to be measured but, using the research question and absorptive capacity theory as the theoretical lens (Flatten et al., 2011; Tsai, 2001), the most interesting ones are extracted and used in the framework metrics. The works of Muroved and Prodan (2009) and Ozer & Cebeci (2010) were also used to structure the metrics for the NPD environment. The present study proposes that the success factor themes that relate to communication, organization culture, process rigorousness, level of centralization, and senior management commitment are the most interesting factors to be identified before and after the implementation of social media tools, particularly from the PACAP perspective (Figure 2.1).

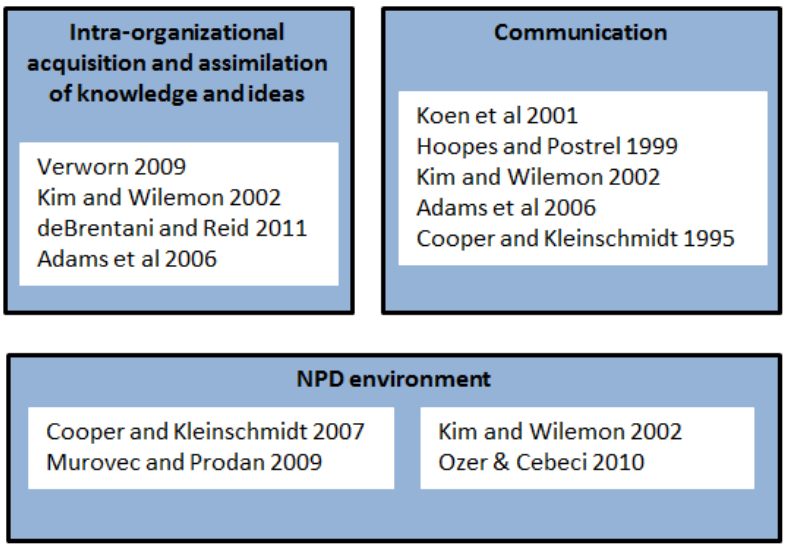


Figure 2.1. Selection of the key metrics

2.3. Collaboration and social media tools

It has been proposed that communication should be included in various organizational, managerial, and psychological theories, but the definition of communication is not universally clear (Fiske, 1990). From the perspective of the current research, communication is defined from the organization perspective; either it is between organizational members (internal) or with external stakeholders (external) and it contained aspects of interactions, written or spoken language, and perception of understanding. Internal communication has been divided into different domains in the literature. In cases when organizational members are also considered as stakeholders, internal communication has aspects of internal public relations (Seitel, 2006). In addition, domains of business communication, management communication, corporate communication, and organizational communication have been identified (Kalla, 2005) but, on the other hand, internal communication are addressed in terms of line management, team peer, project peer, and corporate communication (Welch & Jackson, 2007). In the present research, the main focus is on intra-organizational communication in the context of NPD process, and through the effective utilization of internal knowledge network external parties are contacted.

It has been suggested that the amount of uncertainty perceived is related to the required level of trust (Aldrich & Fiol, 1994). Aldrich & Fiol (1994) suggest that fruitful communication between different internal functions is built on trust and the need for trust is increased if uncertainties are big. In addition, they contend that uncertainties can be solved efficiently if the required knowledge is easily available and people are willing to participate to find the solution. The innovator is typically a person who is able to concretize the customers' (potential) need and provide a solution for it (Griffin, Price, Maloney, Vojak, & Sim, 2009). The ability to identify and spot the market potential is

not therefore always tightly connected to the individual's place in the organization. Griffin et al. (2009) point out that innovators can be across organization boundaries, and sometimes innovation requires fresh eyes to be visible but it definitely requires communication to share it internally with the right parties. Increasing trust between organizational members is therefore a key element in decreasing uncertainties. Establishing trust between different parties might be challenging but it is a mandatory element for communication (Xue, Liang, Hauser, & O'Hara, 2012).

Communication is also closely related to the concept of information transparency. Information transparency can be increased by increasing intra-organizational communication, as the level of awareness about pieces of information is raised. Information technology tools can be seen as enablers of internal transparency (Street & Meister, 2004). Street and Meister (2004) define internal transparency as an outcome of communication behaviors within an organization that reflects the degree to which employees have access to the information requisite for their responsibilities*'*. Therefore, internal transparency can be understood to be related to internal communication amount and quality. According to Street & Meister (2004), cross-functional communication between isolated groups is the key attribute that contributes to internal transparency. Information sharing inside a company contributes to the quality of decisions (Frishammar, Floren, & Wincent, 2011) and all should be active to share information (Moenaert, Caeldries, Lievens, & Wauters, 2000). In addition, discussions between various experts seem to have a positive influence on NPD (Aiken, Bacharach, & French, 1980) and a greater variety of knowledge at the NPD phase seems to reflect positively on a product's success to some extent (Henard & Szymanski, 2001).

Internal communication relies on overlapping knowledge to be efficient (Burgelman et al., 2008). In addition, Reagans and McEvily argued the knowledge sharing is more efficient if both parties have some common knowledge in that specific field (Reagans & McEvily, 2003). Similarities in background knowledge seem, however, to favor the development of small improvements (Zhou & Wu, 2010). Reagans and McEvily (2003) also pointed out that tacit knowledge is more efficiently delivered via strong social ties but codified knowledge can be delivered via weak connections (Granovetter, 1973).

However, the organization's capability to share this knowledge between individuals can be argued to be an important aspect for the organization learning perspective and utilizing the potential of internal expertise (Zahra & George, 2002). Utilizing the know-how that is already inside the organization is much less costly than trying to acquire external knowledge (Bojica & Fuentes, 2012).

As discussed previously, cross-functional communication plays a key role a) in sharing acquired knowledge throughout the organization to decrease the possible risk of lacking the key knowledge in future, and b) in discussing different ideas, as different

organizational members might have exclusive knowledge to support the screening of ideas. In addition, cross-functional groups have been shown to have three kinds of positive aspects: (a) It establishes a forum for iterative learning, including the overlapping of problem solving; (b) it creates a customer- and value-based delivery focus instead of an internally oriented, functional focus; (c) it provides greater flexibility for managing change than do more traditional structures (Kessler & Chakrabarti, 1996).

Social media tools in information sharing

It is argued that communication is argued to have changed from "information gathering" to "information participation" (Ruck & Welch, 2012). As a result, the amount of information sharing and collaboration will increase and the suggested instrument to be utilized in that task is social media (Kaplan & Haenlein, 2010). Searching competitive intelligence through social media is one interesting aspect for the use of social media by companies. Social media tools can help employees to collect and share competitive intelligence mutually and the company can implement the knowledge in its business (Vuori, 2011). Social media tools enable access to and utilization of social networks also inside organization, increasing awareness of potential knowledge that already is in the organization (Smedlund, 2011). Intra-organizationally used social media tools can be also addressed as online collaboration tools. As discussed in the precious chapter, information sharing between different parties has been argued to elevate the performance of NPD. Contrasting intra-organizational communication and communication with external parties, there are typically no issues with "leakiness" of knowledge between internal function, but more issues about "stickiness"; as knowledge is not floating effectively inside the organization (Brown & Duguid, 2001).

Reagans and McEvily (2003) pointed out that people are more receptive to ideas from their social network than to ideas that come from more distant acquaintances. Knowledge transfer seems to require trust to be efficient (Lohikoski & Haapasalo, 2013). This general understanding about collaboration and teamwork can be very fruitfully adapted to virtual teams and online collaboration. In the present research, the definition for virtual teams is adapted from Martins et al. (2004): *"teams whose members use technology to varying degrees in working across locational, temporal, and relational boundaries to accomplish an interdependent task"*. Even though the adoption rate of social media tools (from the perspective of internal communications in an enterprise) has not matured (Denyer et al., 2011), it has been seen that social media tools elevate cross-functional collaboration (Bertoni & Chirumalla, 2011). The existence of virtual teams and social media tools will not automatically solve the challenges of information sharing, but they should be considered resources that connect

expertise and knowledge (Von Krogh, 2002). Bertoni & Chirumalla (2011) studied social features of design applications and concluded that the positive impact, especially on knowledge sharing, is clear even though there might be some potential drawbacks based on confidentiality. In addition, utilization of virtual teams can be beneficial for the organization because it unites organizational members with different skill sets and abilities (Martins, Gilson, & Maynard, 2004). Even though the use of social media tools might result in huge amounts of shared information at the price of quality (Denyer et al., 2011), OCT can help organizational members to reach various acquired information that is scattered inside the organization (Leonardi, 2007).

There are some individual characteristics that relate to knowledge and information sharing (Cabrera et al., 2006). Congruently, there are similar individual characteristics that also have an impact on the adoption rate of the social media tools (Xue et al., 2012). One of those is perception of team cohesion. Virtual team cohesion is not as strongly studied as team cohesion but there are some similarities between virtual teams and traditional teams. For example, in a traditional team, it is argued that the background of the members in the team has a strong influence on the success of the team (Sastry, Tushman, & Anderson, 1999). It does not seem to be ideal if all members of the team are very homogeneous because the team members might not prefer to differentiate themselves (Shane & Venkataraman, 2000). They might be afraid of being removed from the team if they stand forward or they might share only common knowledge with the team but not any criticism. (Sastry et al., 1999). But without the ability to combine different ideas, the fruitful avenues and potential of combined ideas might not be studied (Tushman & Anderson, 2004). However, Tushman and Anderson (2004) have also found that employees might censor their ideas before sharing them in the group if they are aware of group members that are hierarchically over them. The challenge for knowledge and information sharing inside a team is evident and virtualness does not necessarily help to overcome it. Furthermore, it has been argued that collaboration (based on OCT) does not necessarily contribute positively to NPD performance, especially if the indicator of performance is financial success (Fichter & Beucker, 2012).

However, trust plays a big role in virtual communities and lack of trust may jeopardize many of the opportunities based on virtualness (Fichter & Beucker, 2012). As online knowledge sharing is not necessary between known parties but between parties that might not have been aware of each other, the issue of trust has to be considered. All the same issues (relating to inventions, for example) remain in a virtual team as in a traditional team. Organizational members might be reluctant to share their knowledge in online communities if these issues have not been addressed properly (Haefliger et al. 2011). In addition to trust, in virtual teams there is also a question of group identity (Fichter & Beucker, 2012) and therefore a virtual team might face challenges that are not straightforward issues to tackle. The compromised group identity might reflect the virtual team’s capability to resolve conflicts (Martins et al., 2004). In

addition, these virtual teams are assumed to have a more informal structure than traditional teams (Fichter & Beucker, 2012) and that informality might reflect positively on idea collection at the beginning of the NPD process (Kim & Wilemon, 2002). However, the benefits of online collaboration are not clear nor are they automatically received by the organization (Denyer et al., 2011), but active usage is required (Migdadi et al., 2012).

Haefliger et al. (2011) suggest that the amount and the moment of contribution on the individual level vary in terms of the architecture of the selected OCT. Some social media tools are designed mainly for collecting ideas and others can be, for example, wiki-based (Vuori, 2011). This reflects the fact that the comparison (in terms of good or not good) between tools cannot be made based only on the amount of user contribution. Organizational members might also use OCT in an unpredicted way that may have not been intended by managers and that might generate new kinds of unexpected situations in the organization (Haefliger et al., 2011). Those situations might not be negative and may even be used as part of the best practices in the organization.

Users of OCT are enabled to undercut hierarchies and to interact directly with anyone in the organization, and "social software" can also be used by organizational members to shape the organization's strategies by enabling them to participate in decision making (Haefliger et al., 2011). For knowledge sharing inside an organization, OCT can be used to filter out information and can also be a mediator between various perspectives and can introduce them to the management (Haefliger et al. 2011). On the other hand, online forums can also be used for political ends; for example, by senior managers to prepare the organization for the forthcoming change (Langman, 2005). Strategic management traditionally studies the survival of the organization, resource allocation, and business models (Haefliger et al., 2011). Unfortunately, according to Haefliger et al. (2011), it is not clear which strategic choices should be made and what are the best practices related to the efficient use of social media tools in an organization. Social media tools have an individual aspect and a social aspect, but they should also benefit the organization (Mumford, 2006). As discussed previously, the utilization of social media tools is connected to these aspects of strategic management.

2.4. Synthesizes and hypothesis development

The selection of main perspectives to research question is inspired from the literature, mainly from literature streams that have been discussed in previous sections. As discussed, communication is a vital and inevitable aspect that has to be measured along with the context, the NPD environment. As indicated previously in the chapter, one of the social media tools' strengths is ability to share, comment, and involve various discussion threads virtually. Those aspects increase intra-organizational transparency, and, furthermore, Cohen & Levinthal (1990) and Zahra & George (2002) connect those aspects to knowledge acquisition and assimilation. Therefore PACAP is addressed in terms of acquisition and assimilation. As mentioned, within the knowledge transfer relating knowledge transformation, the cognitive/knowledge structure of the organizational member is changed (Todorova & Durisin, 2007) and measures connecting that to the usage of OCT are not included in the present study. Congruently, referring to the discussion and gathered interpretation previously in this chapter, communication and the NPD environment together with knowledge acquisition and assimilation forms the four perspectives are the most interesting aspects when studying the impact of social media tools.

Conceptual model in the present research and hypotheses

In the present research, NPD performance is addressed through potential absorptive capacity and idea selection (Figure 2.2). However, there are several other antecedents of NPD performance than those that are addressed in Figure 2.2, so it should not be considered as an exhaustive illustration of NPD performance. The other dimensions of NPD performance are, for example, project management success, project success, stakeholder satisfaction, benefits to the organization, and preparing the organization for the future (Poskela, 2009). In addition, identified impacts based on high PACAP are not only filling internal knowledge gaps between internal functions and expertise but also enabling the possibility of combining different expertise in a unique way (Bojica & Fuentes, 2012). The illustration for the conceptual model that is based on the framework synthesized from literature is presented in Figure 2.2 and it is followed by detailed discussion.

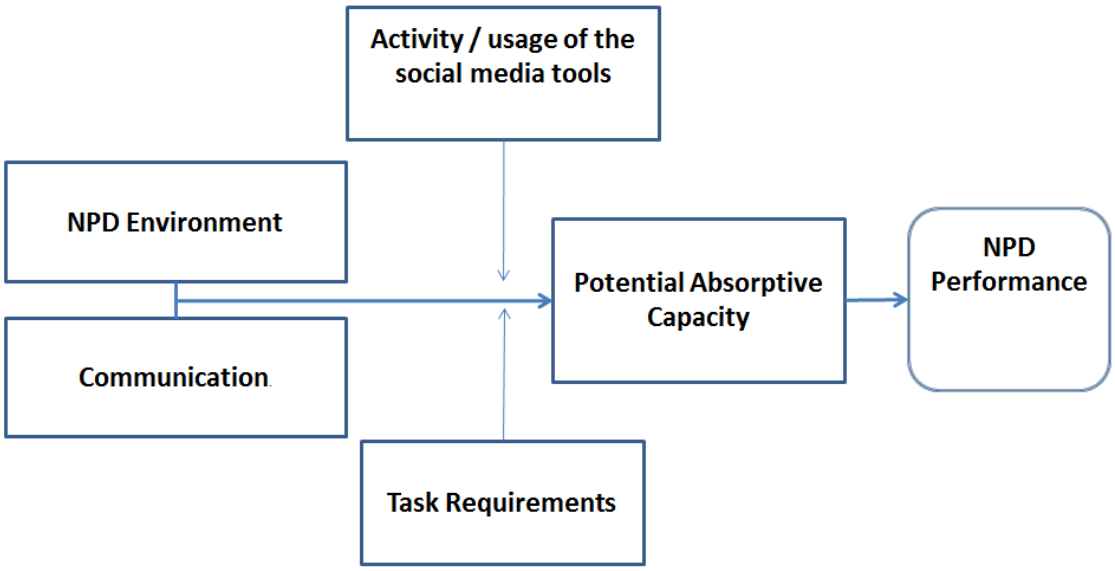


Figure 2.2. Conceptual model that address the principle of social media tools as it contributes to NPD performance through altered potential absorptive capacity.

The model includes two controlling variables, task requirements and OCT usage. These controlling variables will have a role in influencing communication and NPD environment to PACAP. The impact of social media tools is measured in terms of activity of usage as the mere existence of these kinds of collaboration tools might not have clear impact (Migdadi et al., 2012) and additionally it would also require new working practices on the organization level (Dahl et al., 2011). The metrics provide individual-level perception of the NPD performance and task requirements play a significant role on the individual level (Byström & Järvelin, 1995; Sims, Szilagyi, & Keller, 1976). Collecting and combining individual-level perceptions provides organization level insight for the NPD performance.

Potential absorptive capacity addressed in terms of Acquisition and Assimilation

Knowledge acquisition

Synthesizing from ACAP theory, as discussed previously, knowledge acquisition describes the ability to identify valuable information. In the present research, the definition of knowledge acquisition is adapted from Bojica and Fuentes, who define it as "processes through which organizational actors receive and are influenced by the knowledge of their peers" (Bojica & Fuentes, 2012). The success of new product development is strongly related to the amount of information acquired, especially at the beginning of the development (Birgit, 2009; Zahra & George, 2002). The amount of

uncertainties is the biggest at the beginning, and that can be decreased by having as much information and knowledge as possible to be identified (Kim & Wilemon, 2002), but also by internal collaboration (Bojica & Fuentes, 2012; Yli-Renko et al., 2001). In addition, the organizations should foster its capabilities for internal collaboration to maximize contacts and utilize the received knowledge from external stakeholders (Alexy, George, & Salter, 2013). Even though the amount of the acquired knowledge is important, it should not be the only criterion for the acquired knowledge. The usefulness of the acquired knowledge has to be analyzed and that is addressed through quality. Even though it is challenging to measure the quality of the acquired knowledge, it is a crucial aspect of knowledge acquisition (Adams et al., 2006). The quality of the acquired knowledge can be considered to be higher if the content of communication between parties is supporting current or possible business possibilities and the ideas acquired are considered to be valuable by the respondent. However, the connection between the quality of new ideas and the amount of network connections is not linear (Björk & Magnusson, 2009). According to Björk and Magnusson (2009) the connection can be depicted as a step function; after a certain level of connections, the quality of the ideas is stabilized on certain level. In the current research the focus is on the implementing phase of the OCT, and therefore there is expected a rapid increase in the amount of connections among organizational members. Due to these new intra-organizational connections, the utilization of social media tools is expected to impact on intra-organizational communication and collaboration. On the individual level (Haefliger et al., 2011), fostering the amount of the knowledge acquisition, but also the quality due to the wider scale utilization of OCT in the organization (suggested by Denyer et al. 2011). Therefore, the acquired knowledge is tested with the following hypotheses:

H1) The amount of acquired knowledge is increased by intra-organizational utilization of social media tools.

H2) The quality of acquired knowledge is increased by intra-organizational utilization of social media tools.

Knowledge assimilation

Knowledge assimilation is the ability to adopt the acquired knowledge that was discussed previously. Developing ideas with colleagues seems to increase assimilated knowledge (de Brentani & Reid, 2012). Information flowing between parties is related to the amount of the assimilated knowledge (Bojica & Fuentes, 2012). Bojica & Fuentes (2012) suggest that intense information sharing and discussions will increase organizational internal knowledge as the individual expertise of organization members becomes more widely recognized. The organization's internal knowledge, its

"knowledge repository" (Adams et al., 2006), is an accumulated database that can be used to evaluate ideas and knowledge. Existing assimilated knowledge can be further used to assimilate more, particularly when the existing knowledge repository can be addressed by various kinds of expertise (Todorova & Durisin, 2007). Active evaluation of ideas before elaborating them further will enable better quality of assimilated knowledge. However, not only the understanding about the existing knowledge but also the perception about the strategy and current business environment enable organizational members to concentrate on the relevant streams, and they don't need to spend their valuable time on items that will not be developed further in current time/business environment (Flatten et al., 2011).That implies that assimilation should be active, not passive (Bojica & Fuentes, 2012; Cohen & Levinthal, 1990). Communication and collaboration has an impact on assimilation (Flatten et al., 2011). The utilization of social media tools is expected to affect communication and collaboration and therefore there should also be an impact on assimilation. According to the Haefliger et al. (2011), the impact is expected to be on the individual level. In addition and analogically to knowledge acquisition, the research also evaluates also the organization-level effect (suggested by Denyer et al. 2011). Therefore, the acquired knowledge is tested with the following hypotheses:

H3) The amount of assimilated knowledge is increased by intra-organizational utilization of social media tools.

H4) The quality of assimilated knowledge is increased by intra-organizational utilization of social media tools.

PACAP addressed by Communication

The metrics for the present research from a communication perspective have been divided into two categories (cross-functional, and in-team). The influence that these two categories of communication have on the adoption of social media tools will be measured. The discussion about the metrics for cross-functional communication is followed by communication within a team. More specifically, both of these communication categories are described from two perspectives: amount and quality.

Cross-functional communication

The importance of cross-functional communication has been acknowledged widely and in many aspects among NPD scholars. Especially at the beginning of new product development, the organizational internal knowledge should be utilized to support the right selection from among the ideas (Koen et al., 2001). Both technological and market uncertainties should be decreased and when the amount of information is limited (as it

usually is among at the beginning of the new product development (Kim & Wilemon, 2002), all of its pieces should be harvested within the organization (Hoopes & Postrel, 1999). According to Hoopes and Postrel (1999), gaps in a team's knowledge base can be overcome with knowledge from the other team. In addition to the mentioned scholars, for example, Ozer and Cebeci (2010) have found empirical evidence that cross-functional communication correlates with NPD performance. Different internal functions can introduce various kinds of expertise and specialists into the project as, for example, Kim & Wilemon (2002) have concluded. More communication and collaboration between internal functions enable the utilization of these resources. In addition to the amount of cross-functional communication, it is important to measure the quality of the communication. Furthermore, according to the literature a link between internal communication and innovation is confirmed (Adams et al., 2006; Damanpour, 1991) and furthermore internal communication also has aspects of filling the knowledge gaps between organizational members (Bojica & Fuentes, 2012). Therefore, the other aspects of communication that are identified include the individual's awareness about co-workers' expertise and ideas that might relate to his/her expert area. However, communication and collaboration between organizational members in different functions is not always positive in all phases of development (Brettel, Heinemann, Engelen, & Neubauer, 2011). According to Brettel et al (2011) collaboration might reflect for example on the speed of the decision-process. In addition, cross-functional communication might be a waste of resources or it might even generate delays in the project (Song & Thieme, 2006). Interestingly, management literature includes also arguments the implementation of virtual communities might not generate more communication (Symon, 2000). Cross-functional communication is the key metric to address these relevant aspects and the impact of OCT utilization on cross-functional communication is suggested to be positive.

Therefore, the cross-functional communication is tested with the following hypotheses:

H5) The amount of cross-functional communication is increased by social media tools.

H6) The quality of cross-functional communication is increased by social media tools.

Communication within a team

Communication between team members is the second communication category to be discussed. The team is the base unit of organization in terms of communication and this communication is further identified as one critical success factor in NPD (Cooper & Kleinschmidt, 2007; Cooper & Kleinschmidt, 1995a). Therefore, it is very important to find out the impact for the amount of communication. In addition, communication within a team is also one indicator of the organization climate (Adams et al., 2006). The frequent interactions between team members strengthen ties between the members and

the team members become to know each other rather well (Bercovitz & Feldman, 2011). Close relationships also reflect on success in transferring tacit knowledge through collaboration between parties (Szulanski, 1996). That suggests (in line with Adams et al. 2006) that, in addition to the amount, also the quality of the communicated content has to be taken into account. The quality of communication is addressed through expertise sharing (Adams et al., 2006) and mutual awareness of ideas (Cooper & Kleinschmidt, 1995a). However, empirical results about communication in virtual teams are inconclusive (Martins et al., 2004). According to Martins et al. (2004), the amount of communication might decrease or increase, and the content of the interactions might be task-oriented or not. However, in the present research, the impact of OCT utilization on communication inside the project team is suggested to be positive.

Therefore, the in-team communication is tested with the following hypotheses:

H7) The amount of in-team communication is increased by the use of social media tools.

H8) The quality of in-team communication is increased by social media tools.

PACAP addressed by NPD Environment

For measuring the NPD environment, four perspectives have been identified from literature described previously that together contribute the most relevant indicator to the NPD environment that should be taken into account when measuring the impact of social media tool adoption and usage. Preliminary indications from literature discussed previously also indicate that these four aspects will impact absorptive capacity.

Decision-making authority

Decision-making authority is considered to be one of the success factors in NPD (Cooper & Kleinschmidt, 2007). One aspect of decision-making authority is time allocation. According to Cooper and Kleinschmidt (1995), allowing “skunk works” for the employers seems to improve NPD performance and these “skunk works” moments that are not marked for any existence projects can become springs of novelty and creative out-of-the-box ideas. Decision making should be less centered so that employees can themselves evaluate different ideas and explore some new topics (Damanpour, 1991; Olson et al., 1995), and these explorations should not be under the same formal procedure as the actual new product development process. However, studies related to the decision-making authority are not consistent and it is not evident

what level of centralizations is the most optimum for the NPD performance (Song & Thieme, 2006), or how the existence of the virtual communities effect on job autonomy (Symon, 2000). Defining the optimum level of centralization might not be straightforward because power relations in organizations are currently challenged by the new working practices (Bondar & Peltola, 2013). A change in power relations also reflects on the decision-making authority. In addition, there is a link between assimilation and power relations due to resource allocation (Todorova & Durisin, 2007), as those both impact equivocality in NPD and in decision-making. The decision-making process in NPD should have a clear target and the target should be well-known (Frishammar et al., 2011). Therefore, uncertainties are smaller if intra-organizational awareness of the target is increased.

Therefore, decision-making authority is tested with the following hypothesis:

H9) The level of centralization is decreased by intra-organizational utilization of social media tools.

Process rigorousness

The importance of process rigorousness has become more crucial for NPD success due to the change in business environments (Ortt & Smits, 2006). Furthermore, the rigorousness of the NPD process is one of the success factors that have been pointed out by various scholars (for example Barczak & Kahn, 2012; Cooper & Kleinschmidt, 2007). Barczak et al. (2012) and Cooper & Kleinschmidt (2007) address the importance of a clear and standardized process flow as one key aspect of a rigorous NPD process. In the literature, idea selection and screening at the beginning of the NPD are identified as elements for standardized process and they mark the rigorous starting point for the whole development (Reinertsen, 1999). In addition, uncertainties and equivocality can be controlled by familiar and rigorous NPD process (Frishammar et al., 2011). Process rigorousness can be addressed also from the absorptive capacity perspective (Murovec & Prodan, 2009). Murovec and Prodan (2009) suggested that there is a positive relation between process rigorousness and ACAP. As the present research suggests, social media tools have a positive influence on ACAP, therefore process rigorousness will also be altered.

Therefore, process rigorousness is tested with the following hypothesis:

H10) Process rigorousness is increased by intra-organizational utilization of social media tools.

Senior management commitment and involvement

Senior managers' roles in new product development are both indirect and direct (Dahl et al., 2011; Damanpour, 1991; Frößler, 2008; Szulanski, 1996). Directly, they can, for example, be actively involved in projects (Dahl et al., 2011; Frößler, 2008), or they can demonstrate their support directly by discussing and commenting on ideas (Kim & Wilemon, 2002). Indirectly, they can alter the organizational climate (Damanpour, 1991; Szulanski, 1996), but they can also make indirect (but concrete) contributions to the means of resource distribution (Dahl et al., 2011; Todorova & Durisin, 2007). Without sufficient resources, even the good ideas will not become success stories. The resource allocation is suggested to be more transparent due to social media tools because these tools undercut hierarchies by changing power relations and enabling new communal space for all organizational members (Bondar & Peltola, 2013). However, the utilization of social media tools among senior managers is not always straightforward (da Cunha & Orlikowski, 2008), and the impact of social media tools on senior management commitment and involvement is not clear.

Therefore, senior management commitment and involvement is tested with the following hypothesis:

H11) Senior manager commitment and involvement is increased by intra-organizational utilization of social media tools.

Innovative climate and culture

The climate and organizational culture are the foundation of co-operation and collaboration (Cooper & Kleinschmidt, 2007) and therefore they affect other metrics used in the present research. A direct measurement of organizational culture and climate might concern reliability and validity issues as climate and culture are abstract concepts and therefore the measuring have to be indirect, for example through perceptions and attitudes towards internal communication and collaboration (Kim & Wilemon, 2002; Ozer & Cebeci, 2010). The connection between absorptive capacity and innovative climate and culture is also indirect. Murovec and Prodan (2009) have confirmed the positive link between attitude and change and ACAP. The implementation of social media tools and new working practices is clearly a change. Even though, the success of the technology adoption will depend on the organization culture and climate (Denyer et al., 2011), the previous discussion also indicates an intertwined nature of ACAP and

organizational culture. Therefore the confirmation of the feedback loop of how OCT adoption enhances culture and climate is interesting.

Therefore, innovative climate and culture is tested with the following hypothesis:

H12) An organization's innovative climate and culture is perceived to be better due to the intra-organizational utilization of the social media tools.

Controlling variables to address PACAP

In addition to the OCT usage, another controlling variable is used in the present research: task requirements. The importance of task requirements as a controlling variable was derived from the work of Sims et al. (1976). Perceived task requirements will give signals of stress and hurry and one way to address task requirements is through task complexity (Sims et al., 1976). The impact of the communication and NPD environment on organizational members varies based on their individual perceptions and perceived task complexity (Campbell, 1988). Task complexity and its different aspects have been widely studied due to the possibility that it can be understood to be either primarily a psychological experience (Morgan, McDonagh, & Ryan-Morgan, 1995) or a combination of task and person characteristics (Tversky & Kahneman, 1981) or entirely the result of the task's objective characteristics (March & Simon, 1958). An indirect way to measure task complexity is to identify the number of sources that the person is using to perform the task (Tiamiyu, 1992). According to Tiamiyu (1992), finalizing a complex task seems to require more information sources than a simplified task and it might not be possible to determine those sources in advance. In general, according to Campbell (1988), a complex task is considered to be a difficult one, but in addition, it has been found that mutual trust in cross-functional organization seems to be one driver of a decrease in the amount of conflict in an organization (Lin, 2010). In addition, the complexity of the information seems to reflect the amount of uncertainty and that can be used as a one indication for task requirements (Byström & Järvelin, 1995). Therefore, if the social media tool use is considered as a "just another new task," it might reflect on perceptions and usage about the tool.

Therefore, the impact of the task requirements is tested with the following hypothesis:

H13) Task requirements reflect degradingly on organizational members' use of social media tools.

NPD Performance addressed by Idea selection

In addition to addressing NPD performance through PACAP, the research also addresses NPD performance directly in terms of idea selection (Barczak & Kahn, 2012; Cooper & Kleinschmidt, 2007; Koen et al., 2001). According to Koen at al. (2001), Cooper & Kleinschmidt (2007), and Barczak & Kahn (2012), high uncertainty decreases managerial visibility and the organizational ability to forecast clearly and to select the best possible idea to develop. The influence of OCT usage should impact uncertainties. In addition, a high absorptive capacity will increase an organization's ability to select the ideas with the most potential (Zahra & George, 2002) and, according to Zahra & George (2002), the efficiency and efficacy of NPD is better.

Therefore, NPD performance is tested with the following hypothesis:

H14) Idea selection is better with intra-organizational utilization of social media tools.

3. RESEARCH METHOD AND MATERIAL

The main driver for selection of the research method was to have empirical data that enable the evaluation of the impact of social media tools implementation on absorptive capacity. The data collected are used to address the research questions by the quantitative and qualitative data, based on three case organizations. As the research setting is to address hypotheses based on management literature, not generate hypotheses based on empirical data, the case study setting described by Eisenhardt (1989) is not followed entirely but used only as an overall insight to a case setting. Furthermore, the amount of unidentified but crucial latent variables favors a case setting over an experimental type of research setting (Yin, 1994). Therefore, as success in the adoption of social media tools depends on several variables, including organizational cultural and climate (Denyer et al., 2011; Murovec & Prodan, 2009), a case setting with qualitative and quantitative data is supported by the management literature. The research approach based on case organizations is a form of learning that it is not necessarily biased by researcher opinions (Flyvbjerg, 2006). According to Flyvbjerg (2006), the ability for falsification of results is, on the contrary, greater than verification.

3.1. Data collection

Some insights are adapted from Eisenhardt (1989) for data collection to support following three step analysis: a) analyzing within a case data, b) searching for cross-case patterns, and then c) composing all quantitative data into the combined dataset to bring forward patterns that can be traced back to the utilization of social media tools. The evidence is used to verify the conceptual model described in the chapter 2.

3.1.1. Data collection with interviews and online survey

Evidence synthesized from three cases is based on online surveys and interviews. All statement-styled questions on the online survey were Likert-scaled from 1 (totally disagree) to 7 (totally agree). That scale reflected also on quality-related questions as they were quantified by the respondent. The same structure of the online survey was used in each case. These quantitative responses are supported with qualitative data from interviews. Mixed-method methodology based on quantitative and qualitative data was conducted to create in-depth understanding about the operating and business

environment of each case organization. In addition, the data based on survey questionnaires and interviews can be triangulated to confirm reliability and validity of the findings. All three case companies operated in different business environments and therefore combining the data will decrease possible bias based on single case organization and, due to the nominator factor (social media tools implementation), reflections on to the research questions will be stronger.

Data collection process

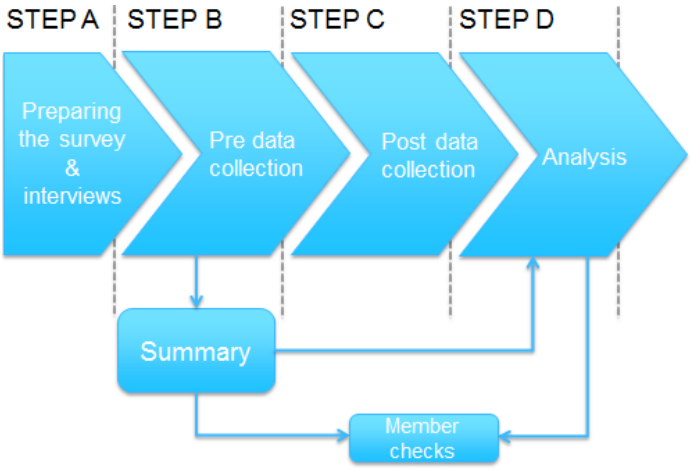


Figure 3.1: Procedure for the data collection

The data collection process began with preparing the survey and interviews. The initial step (Step A, Figure 3.1) included defining the widely-approved performance indicators in the literature and compiling them into questions. The preparing of the survey questionnaire included pretesting and a pilot survey. Pretesting was implemented inside the research group by the end of the 2011 and, based on received notes and comments, the questionnaire was refined. The pilot survey was conducted with a preselected group in case organizations. The results of the pilot survey revealed no major misunderstanding, but some case-specific terminology needed to be updated in each case. The survey questions based on the results of both testing phases were refined and finalized. The final questionnaire was used in pre data collection (Step B).

Pre-data collection (Step B) was conducted after the design and preparation of the data collection. On the practical level, the survey and interviews were launched in sequence in each case (Figure 3.2). Interviews were conducted at the same time that the online survey was active to relieve concerns that quantitative and qualitative data sets might have been exposed to different set of external and internal variables. Based on the pre-data collection, the reference point was determined, and that was shared within the cases as a member check. The member check included sharing transcribed versions of interviews with the each interviewee respectively.

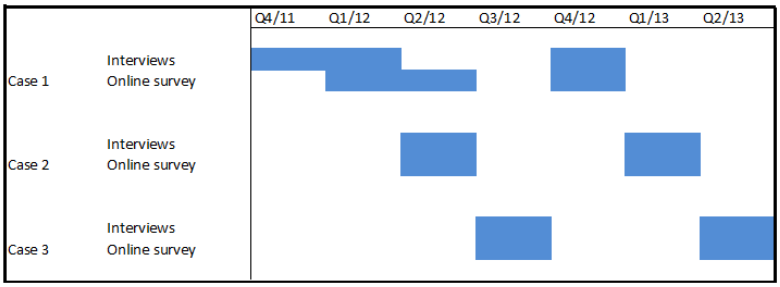


Figure 3.2: Data collection

Six to 12 months after the pre-data collection, the post-data collection was conducted (Step C). During the pre- and post-data collection, the social media tools were rolled out organization-wide. The post-data collection was crucial for the research, as the main findings will be based on impact of social media tools. The same sample population as in the pre-data collection phase was asked to participate the post-data survey. According to the mixed-method approach in the pre-data collection, the post-data collection also contained supporting qualitative data collection. Concentrating on the aspects that might have been changed was of great interest also in the interviews during the post-data collection. To maintain validity inside the qualitative data between pre-and post-data collection, no new persons were asked to invest their valuable time for the interview.

After the post-data collection analysis within a case organization was performed (Step D), summaries were sent for member checks in the corresponding case organization. Member checks after the post-data collection also included sharing transcribed versions of interviews with each interviewee. Based on the revised material, the analysis contained the previously mentioned three steps; a) analyzing data within each case, b) searching for cross-case patterns, and then c) composing all quantitative data into the combined dataset to bring forward patterns traced back to social media tools utilization (Eisenhardt, 1989). The questions are categorized according to the conceptual model, and are presented in Appendix 1. These categorized questions and the change in distribution are discussed in more detail in the following chapter 4. The main methodical tools for quantitative data analyses are the Mann-Whitney U test, principal component analyses (PCA), and linear regression analyses. The qualitative data was analyzed with ATLAS.ti software; the coding used in transcribed interviews is presented in Appendix 2. Coding follows themes in semi-structured interviews.

Detail structure of the surveys and interviews

There can be identified four primary sections in the final survey questionnaire (Appendix 3): (a) the survey attendant's background; (b) the current NPD process emphasizing idea acquisition, assimilation, communication habits and working practices; (c) general attitudes and familiarity towards for social media tools and technologies; and (d) a final feedback section. Through these subsequent stages, the survey questions were formed and their validity was confirmed with each case organization. The questions relating to the four main themes discussed in previous chapters (i.e., acquisition, assimilation, communication, and the NPD environment) were mixed inside the primary section (b) in the questionnaire (Appendix 3). Questions about these four themes enabled us to gather the understanding about the working practices. The primary section (b) contained the majority of the questions (67%). All the question in the primary sections (a), (b), and (d) remained the same in all cases in both the pre and post data collections. However, in the primary section (a), one question was added to the post survey to find out whether the respondent had participated in to the survey in the pre data collection. In addition, parts of the questions in the primary section (c) are different between questionnaires in pre and post data collection due to the research setup; pre data collection inquired expectations and post data collection actual usage of OCT. Each case company proposed the sample population to which the questionnaire was addressed. The sample population was the same in the pre- and post-data collection phases in all case organizations. The sample population that was selected included employees who related, or should have related, to the NPD process. The researcher provided the main criteria for the sample population for the case organizations, but each case organization nominated the sample population independently. Horizontally, the content of the sample population included research, development, product management, accounting, quality, and technical support.

The quantitative survey used in the post-data collection had the same three primary sections (primary sections a, b , and d) as the survey in the pre-data collection. The majority of the online survey questions were left intact but questions relating to usage of the social media tools (c) had no more forward-looking aspect but inquired about the change instead. Therefore, the structure of the survey questionnaire in the post-data phase was: (a) survey attendant's background, (b) the current innovation/NPD process emphasizing idea acquisition, assimilation and communication habits, (c) usage amount of social media tools as consumers and also as organizational members for work tasks, and (d) feedback. Accordingly, as in the pre-data collection phase, the questions relating to the working practices and four main research themes (acquisition, assimilation, communication, and the NPD environment) were mixed inside section (b) in the questionnaire.

The interview structure (presented in Appendix 4) and the method of approaching the innovation process through semi-structured interview was adopted

from Sim et al. (2007). Semi-structuring the interview required that the researcher had preselected the topics to be discussed with the interviewee, and the structure of the interview was the same to all interviewees (Denzin & Lincoln, 1994; Sim, Griffin, Price, & Vojak, 2007). The interview was divided into the following five primary sections: 1) the interviewee's background, 1) the current innovation/NPD process emphasizing the idea acquisition and selection methods, 3) challenges in the current process, 4) thoughts on how to improve the process, and 5) summary. The similar semi-structured approach was used for the post-data collection interviews than in the pre-data collection. The detailed structure of the post interviews contained the following primary sections: 1) summary of the research so far, 2) update the interviewee's position, 3) highlight any changes between interview rounds, 4) discussions about current way of working, 5) summary. The researcher aimed to have responses from different perspectives in different functions and various organizational levels that can be combined to represent a reflection of the whole organization. The main motivation for the interviews was to strengthen the knowledge about the case organization and that knowledge can be further used to support the quantitative analysis through methodological triangulation.

3.1.2. Supporting data

The present research is connected to the actual social media tools usage due to the statistics from social software. These statistics provides accurate information on how organization members used the social software during the research period. One of the insights that these statistics provide is the adoption rate, which will indicate the change that the organization faced during the research period in terms of social media tools (Denyer et al., 2011; Migdadi et al., 2012). A clear increase in the adoption rate is expected. That should reflect on the amount of virtual communities, which leads to another insight that statistics provide: the change in number of communities during the research period (Bercovitz & Feldman, 2011; Haefliger et al., 2011). In addition, the statistics reveal the number of user visits to these virtual communities and that third insight can be used to indicate perceived benefits on the individual level; the more frequently users are using OCT, the more they see benefits from it (Bercovitz & Feldman, 2011; Migdadi et al., 2012). This combined information based on the three insights increases the reliability and validity of the quantitative and qualitative data.

In addition, supporting data in the present research also includes a) notes during interviews, and b) informal discussions and meetings with representatives of the case organizations. This combination of supporting data was collected to enable the data triangulation for the qualitative results. Triangulation also elicits the credibility of the qualitative data as the data triangulation between supportive data and transcribed interviews is used to check the results in particular in terms of relieving concerns of

possible biases based on single method. In the present study the data triangulation is used at the coding phase of the transcribed interviews. In addition, the researcher was able to observe on-site for three months in case-organization 3 about the implementation of the OCT. That observation period strengthens the reliability and validity particularly in data relating to case-organization 3 (Lincoln, 1985). The observation period enabled access to various informal discussions where the impact of the OCT was addressed, challenges to reach forecasted benefits were described, and best practices to utilize OCT were shared.

3.2. Reliability and validity

The measurement quality can be addressed from reliability and validity perspectives (Alwin, 2005; Carmines & Woods, 2005). According to Duane (2005), reliability addresses the absence of measurement errors and validity. On the other hand, Carmines & Woods (2005) discuss whether the measurements are addressing the right concept. To overcome these concerns, the present research utilizes a) triangulation, b) member checks, and c) referential adequacy to confirm the data analysis.

Methodological triangulation between quantitative and qualitative data can be used to enhance reliability and validity (Lincoln, 1985). According to Lincoln & Guda (1985), the interpretation based on triangulation can be evaluated by contextual validation between data sources. Methodological triangulation is used in the present study to relief concerns towards negligible change between pre and post data collections and to discuss quantitative results. Minimizing any causality-related issues, quantitative and qualitative data collection is conducted simultaneously within each case. In addition to methodological triangulation between quantitative and qualitative data, triangulation within the qualitative data was performed with transcribed version of interviews, notes and observations from the interview, and additional formal and informal discussions with representatives of the case organizations. In addition to these triangulations, one of the crucial technologies for addressing reliability and validity is member checks (Lincoln, 1985). Member check is a technique in which raw data and analysis are exposed for comments (formal or informal) to those stakeholders from whom the data was originally collected. And, finally, the supporting qualitative data from members of three additional organizations that are not included among the three cases enable an approach of referential adequacy (Eisner, 1975; Lincoln, 1985). These referential tests can be used to establish a critique of the analysis and interpretations based on the actual research data. In addition, concerns about the confirmability of the research can be relieved by constructing a back-traceable path from the findings to the interview quotations and survey responses (Lincoln, 1985).

Furthermore, to relieve concerns about reliability in terms of the impact of the researcher, in the present research each case organization addresses the implementation of the social media tools through a sample population that was formed by the case organization; the researcher did not hand-pick any of the participants. The group included members from different functions and organization levels. Organizations in cases nominated the participants in a process that was beyond the researcher's sphere of influence. The researcher's ability to influence the research was through the research setting and approach and the findings should therefore hold also in any other context, such as a different additional case or with any of the current cases but in a different time (Lincoln, 1985).

In addition, concerns about validity were relieved by investing extra effort to decrease misunderstandings among respondents and interviewees about what should be included in NPD. People's perceptions about the reality around them is heavily related to their past (Hegel, 1812-1816; Hegel, Behler, Miller, Taubeneck, & Behler, 1990). This might reflect on the somewhat different descriptions given by organization members about what should be even included in the new product development. Also, the differences between software development and product development might reflect on perceptions about the content of the NPD. In the present study, new product development is understood to include all kinds of development activities from small improvements to major changes and radical innovations, and that definition was shared with the sample population.

3.3. Cases

There were several criteria for the case company selection. One of the main criteria was the research's intended time frame. As the time frame for the research was limited, the spectrum of possible organizations to be asked to participate in the research was narrowed. This time frame was reflected also on practical level as a driver and the limiting factor. The organization should at least have an office in Finland to enhance finding mutual trust rather quickly between the researcher and the case organization. The rest of the main criteria are collected in to the Table 3.1.

Table 3.1. Criteria for case organization

Criteria	**Reference**
Organization should have several internal functions	(Barczak & Kahn, 2012)
Organization should have active tendency to find new knowledge and ideas	(Hoopes & Postrel, 1999; Szulanski, 1996)
Organization should have interest to use social media tools company-wide	(Denyer et al., 2011; Haefliger et al., 2011)
Case organization should be from wide spectrum of different fields	(Damanpour & Evan, 1984)

3.3.1. Case organization 1

The case 1 is a large enterprise (eurostat, 2013) offering mobile solutions and networks. The company's NPD resources are located in various sites; as a result, the project's teams are scattered. The case 1 company was rolling out the social media application on a wider scale when the research started. The company's social media application is MS SharePoint tuned with Social Sites (the application from NewsGator Technologies) to make it fit the company's requirements better. The virtual environment includes several kinds of possible online collaboration methods, such as communities, wikis, and personal "Mysite" areas, and these have somewhat different content from each other. The implementation was closer to bottom-up than top-down: even though the implementation was decided by senior management they did not have a leading role in utilization.

3.3.2. Case organization 2

The case 2 company is a global and large enterprise sized (eurostat 2013) manufacturer and supplier of flexible manufacturing systems and robot cells. One of the differences between the companies in case 1 and case 2 is that the case 2 company doesn't have global NPD resources located in various sites but the members of NPD project's teams are typically sharing the same site, and the organization's members at that site are somewhat aware of ongoing NPD activities. The case 2 company is utilizing a social media tool called Confluence, which enables online collaboration based on discussion

forums and wikis. The implementation was not clearly bottom-up or top-down, in particular when compared to the other case companies, as organization members in various levels were utilizing the tool and the senior management did not have a leading role in utilization of the OCT.

3.3.3. Case organization 3

The third case organization contained a large enterprise (eurostat 2013) focusing on global IT solutions. The main research interest in the case was to focus on three pre-selected teams/communities. One of those was entirely located in two sites, both in Finland, and the others teams/communities were globally scattered on various sites. The case company implemented blueKiwi, a social media application that can be used for online collaboration in many ways such as activity streams, content sharing, and virtual places for teamwork. The case company performed social media tool implementation following the top-down method; senior managers pushed the implementation forward by actively using and marketing it, but also changing preferences for employees' working practices.

3.4. Use of methodical tools

In the present research, the methodical tools to address the hypothesis through quantitative data include principal component analysis (PCA), Mann-Whitney U test, and regression analysis. Detailed description about the methodical tools is presented in Appendix 5. The structure of the data analysis is presented in Figure 3.3. Confirmation of the change, i.e. has the implemented OCT generated any change in the organization, is addressed diligently. At first, the possible change is addressed by identifying statistical similarities in dataset based on pre data collection and compares those to the statistical similarities in the post data set. Furthermore the change is confirmed at first case by case and finally also for the combined data. Statistical similarities are addressed through principal components and variation between principal components in pre and post data sets indicates statistical difference. Analysis about the change is based on the difference between principal components and it is strengthened with methodological triangulation containing insights from qualitative results and administrative user statistics.

In addition to the confirmation of the change, pre and post datasets are also used to address similarities between case organizations. Contrasting variable distributions in datasets between pre and post datasets (Kruskal-Wallis -test), the relative change among case organizations can be revealed. Increased similarities in variable distributions indicate increased similarities in organizational members working habits in particular in terms of intra-organizational communication and collaboration.

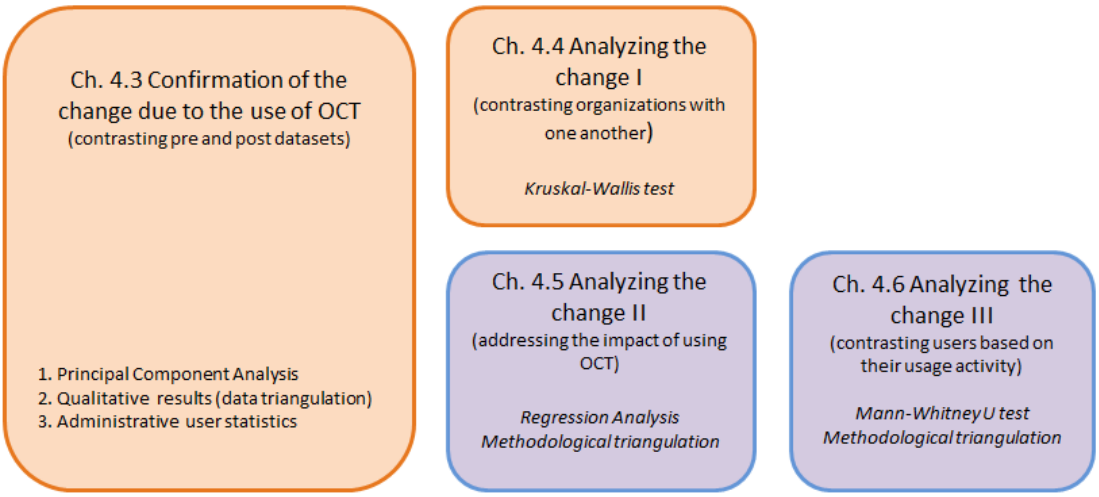


Figure 3.3. Quantitative data analysis in the present research

The further analysis is based on post datasets after concerns relating negligible change are relieved. Conceptual model is verified by linear regression analysis but before the analysis the amount of variables has to be decreased. The amount of original variables is 21 and including all variables into the regression model is not necessary as the statistically sufficient regression analysis can be performed with a few principal components. In addition, discussion about the impact of the OCT is supported by insights based on Mann-Whitney U –test. Contrasting users based on their activity of the usage indicates individual level differences about ways of working in particular in terms of intra-organizational communication and collaboration. The analysis of the quantitative results is strengthened with methodological triangulation.

The usage of the methodical tools is illustrated in the Figure 3.3. The color of the fittings in the Figure 3.3 indicates whether the dataset contains all of the data (orange) or only data based on post-data collection (blue) in that particular phase. In addition, phases that include methodological triangulation with qualitative results to confirm findings are ‘Analyzing the change II’ and ‘Analyzing the change III’.

4. RESULTS

In this chapter the results from the interviews, surveys, and observation about statistics from the social media tool are presented. In addition to these main data collection sources, supporting information was collected from formal and informal discussions with representatives in the case organizations, notes based on observations during interviews, and statistics from the social media tool usage. The quantitative results are discussed, based on the three different level of interest: starting with a general level that the survey data illustrate based on the pre-post setup through PCA, and then moving further on linear regression analysis, and a few interesting insights based on distributions on item level are shared and discussed at the end part of the chapter. For the qualitative data, there is not such a clear division for different levels of analysis and the main qualitative analysis is presented in the following section before the quantitative analysis.

4.1. Qualitative results

As mentioned previously, in addition to quantitative data the data collection included also qualitative data. Qualitative data is mainly based on semi-structured interviews. The interviews involved organization members with different backgrounds, and each interview took approximately 45 to 60min. The pre data collection in case 1 included 11 interviews and the post data collection included 7 interviews; 4 were not reached during the latter interview period. Survey responses in the second case were supported with 5 interviews in the both phases of data collection. The interviewed persons remained the same in both phases. Also in case 3, the same 5 interviewed person were interviewed twice, in both pre-and post-data collection phase. As a summary for the qualitative data, these three cases contained 21 interviews from pre-data collection and 17 interviews in the post-data collection phase.

The demographics of all 21 interviewed persons are presented in Appendix 6. Other streams of qualitative data are from notes from interviews, informal discussions, and meetings with representatives of organizations in case. These other streams of qualitative data are used to have the data triangulation with transcribed version of interviews. Transcribed versions of interviews are coded with ATLAS.ti software, and the main findings are summarized in the Table 4.1.

Table 4.1. Summary of the qualitative data.

Topic/theme	**N/pcs**	**Example quote from interviews***
Old way of working	214	" [Information sharing] …is based on old friendships"
New way of working	171	"[NWOW] …is not necessarily better, but I am used to it, and I think it is pretty good"
Positive towards OCT	134	"…with [OCT] it is easier to share information"
Negative towards OCT	5	"…I keep receiving updates that I consider as spam, about activity of one community. And I don't want to have that."
Communication (including within team, and cross-functional; 66 max)		"I do have feeling that [cross-functional] communication is better now"
Increase	34	
Decrease	2	"…it's [posting new ideas] more difficult than six months ago."
No clear effect	30	"…I think it's, really early to see [OCT] results."

*some quotes translated to English

The current way of working was discussed in both interview rounds and, in the current research, the initial way of working is addressed as "Old way of working" (Table 4.1) and the way of working during the latter interview round as "New way of working." The citations for either of the way of workings have no qualitative aspect and therefore the number of citations cannot be used to evaluate which one was better. "Old way of working" generated slightly more citations during the interviews, but the actual time used in discussing the "new way of working" was somewhat longer. At the initial data collection, one of the main research concerns was to achieve as good an understanding as possible about the case organization and how its members were working at that time. This generated several inquiries about the current way of working. In the latter data collection phase, the main research concern was to seek out the differences and discussions concentrated in the change. However, discussion about the change included also some references to "old way of working."

The general observation is that organizational members have positive expectations towards OCT and also towards new working practices. Organization members seemed to have found increased transparency to help them to reach their goals faster, and they are confident that they have had or will have benefits based on OCT and on new working practices at a higher level. The number of positive perceptions clearly

overwhelmed the negative ones, but those negative ones are interesting. The negative perceptions seemed to be rooted in certain functionalities and default configurations of the OCTs utilized in case organizations, but it was beyond of the current research to reach to the deep practical level in order to offer the right configurations for OCTs for different users. The current research, however, discusses possible fundamentals on a higher level to find out general implications why OCT, in some cases, might not be perceived as a part of the solution but as a part of the problem. In addition to the technological and user interface challenges, there is always reluctance in the organization towards change. From the perspective of new technology adoption, the reason might be, for example, individual characteristics, difficulties in seeing any individual benefits, or lack of trust (Denyer et al., 2011).

OCT was perceived to increase communication, yet the impact was not clear because almost as many did not perceive any positive effect. The amount of communication reported in the Table 4.1 was based on the slightly more structured part of the discussion and, from a maximum of 66 citation, communication (with-in a team and cross-functional communication) was cited 34 times to have been increased in terms of amount or quality. Only in two cases was communication perceived to be decreased due to the implementation of OCT. But for 30 citations, the communication was not (yet) perceived to have any impact due to OCT, so there remain some question marks about what is the impact in the long run. According to the results, the impact will anyhow be at least slightly positive. That finding is supported by data based on the referential adequate approach.

Looking closer to the material based on interviews during pre-data collection, there can be founded a few streams of interests; perceived challenges (PC), communication (C), and description of the way of working (WOW). Selection of quotes based on pre data collection is presented in Appendix 8. According to the perceived challenges, there is pointed out that characteristics of the organizational members will play a role in implementation and usage of any new technology (PC16). Examples of quotes about the communication are coded as C1…C7. In addition to the general comments about the communication (C1) there are pointed out some examples, such as tool used (C2), information sharing (C3…5) or cross-functional communication (C6 and C7). It seems that working life in case organizations is facing typical issues addressed widely by scholars (Cooper & Kleinschmidt, 1995a; Song et al., 1996; Utterback, 1971). The way of working from knowledge sharing perspective in case organizations is rooted to challenges and communication discussed. There is lack of transparency (WOW1…4), perception of the NPD isolation (WOW5), and vague understanding about new communication tools (WOW6).

4.2. Response rate and non-response bias

The response rate is discussed from the case organization perspective rather than the all combined perspective because the case organization level enables a more informative view of the research. Amount of responses and response rates are presented in the Table 4.2. As a summary of the quantitative data, the pre-data collection phase contained altogether 131 responses and the post-data collection phase ended up with 122 responses (121 valid responses).

Table 4.2. Response rates

	Pre data collection responses *Amount (response rate)*	Post data collection responses *Amount (response rate)*
Case 1	37 pcs (46.8%)	33 pcs (38.8%)
Case 2	47 pcs (51.6%)	32 pcs (36.4%)
Case 3	47 pcs (44.8%)	57 pcs* (38%)

* Some additional organization members were invited to take the online survey in the post-data collection phase

To open up the combined datasets, it can be noted that the post-data collection surveys harvested responses from slightly different sets of organizational members. New respondents made up 56.6% of all respondents in the post-data collection phase. Interestingly, though, there was no bias relating activity of usage among those respondents that answered both surveys. The "active users" dataset contains daily users in all three cases and the "conservative users" dataset contains all the rest users that use OCT more conservatively. The total share for conservative users was 36.9% in the post-data collection and the share of conservative users among the new responses was 36.2%. From the pre-data collection phase to the post-data collection phase the number of conservative users decreased by 54%, reaching a total and combined conservative user share of 53.2% (130/252), which indicates a slight conservative sound for statistical analysis. Interestingly, only in case organization 1 was the number of conservative users in the post-data collection greater than the number of active users.

The demographics of the survey respondents are presented in Appendix 7. Case organizations are technology organizations, and that is reflected on the required resources. As the majority of technology students (especially in ICT) in universities are male (Teknologiateollisuus, 2011), that trend also continues in organizations. According to the data, the dataset is biased towards male and high academic degrees. But those are typical properties for technology organizations. A somewhat clear bias towards NPD is a result for the selected context of the research, so the sample is representative.

The non-response bias in the survey is explored by verifying that the distribution of respondents' backgrounds is statistically similar to the distribution of the whole sample. The bias test is performed in each case organization separately. Assuming that distribution of background organizations among responses is different than in the whole sample, the Mann-Whitney U test is used to confirm the change in each case

organization separately. In all case organizations, the change is confirmed and responses can be statistically considered to be a subgroup of the whole sample population ($p<0,05$). In other words, there are no indications of bias from the background organization point of view.

4.3. Confirming the change in organizations

The change is in the organizations is confirmed by methodological triangulation based on qualitative results, administrative user statistics and quantitative data. Quantitatively part of the triangulation is performed by identifying statistical similarities among variables in pre and post datasets, respectively. The methodical tool is principal component analysis. The first round of data collection with the online survey consists of 57 total questions. Subtracting background and additional comments, 41 Likert-scaled questions, i.e., variables remained. The second data collection period contained 60 total questions and, after subtracting background questions and additional comments, the number of Likert-scaled questions was the same, 41. PCA is based on the same questions in both pre and post datasets.

The first case organization

During the research window, an organizational rightsizing was announced and conducted. This reflected slightly on some participants of the present research, but, according to the interviews the indirect impact was considered to be greater. The organizational change was mentioned in all interviews, but it was not considered to have any major role for the present research. According to the interviews, focusing on core businesses and projects has been one of the describing aspects during the research window. New working practices along with the new collaboration tools seemed to be one manifestation of this focus. According to the statistics, the organizational adoption rate of OCT (concurrent users) increased from ~5% to ~23%, the number of virtual communities more than doubled and landed on the level of 3500, and the users were scattered throughout different countries.

During the research window, an internal phonebook was integrated into the social software. That generated a huge leap in the adoption rate. As more organization members joined the OCT, the possibility for cross-functional communication increased and a higher level of acquired knowledge becomes utilized, which reflects on a higher probability of assimilating the crucial ideas. Tools to manage the new working practices in the NPD process are altered and the performance difference of the process can be

measured accordingly, therefore enabling the identification of any changes in forecasting capability.

In addition and as indicated previously, the change in the organization can be addressed also with quantitative data by grouping statistically similar variables and contrasting them between pre and post datasets. In the first case organization, 12 principal components were found based on pre-dataset. These 12 principal components result in 80.0% cumulative variance that contributes significant factor loadings of 0.6 or more into the variance's distribution (Hair, Black, Babin, Anderson, & Tatham, 2010). Based on the Varimax rotation, all principal components have at least one significant variable. These are presented in Appendix 9. The summary of the Appendix 9 containing the 4 most significant principal components is presented in Table 4.3. Component 1 indicates a statistical relationship between awareness of various ideas among team members and lack of acquisition from various other stakeholders. The reason might be that organizational members are considering that extant working practices are not sufficiently supporting collaboration beyond the team or they might not be aware of the right party to acquire ideas (Alexy et al., 2013; Flatten et al., 2011; Zahra & George, 2002). Component 1 can be therefore described as **Limited acquisition**. Component 2 is a construct of items addressing vertical and horizontal collaboration and it can be therefore described as **Assimilation**. Component 3 is the construct of items relating process rigorousness in terms of standardized process and clear connection to NPD strategy. Therefore component 3 is described as **Rigorousness**. Items in the next construct address intrinsic interaction and information acquisition activity with external parties and therefore it can be described as **Acquisition from external parties**.

Also in the dataset based on the post-data collection, 12 principle components can be found in the first case organization, resulting in 82.3% cumulative variance that contributes significant factor loadings of 0.6 or more into the variance's distribution (Hair et al., 2010). These are presented in Appendix 9. The insight of the Appendix 9 is presented in Table 4.3. Component 1 is a construct of 4 items addressing the easiness of finding required internal expertise, frequent of receiving input, sharing expertise, and awareness of ideas among team members. The combination of these items indicates **increased intra-organizational transparency**. Component 2 is a construct of items relating acquiring ideas from external organizations, various organizational levels, and other internal function. Therefore it is described as **Acquisition** in the Table 4.3. Furthermore, the component 3 addresses communication with external parties through three perspectives; as part of the task requirements, through frequent, and through the amount of valuable comments received. Combining all items, the construct indicates that organizational members whose task requirements includes interactions with external parties also communicates with them a lot and they also receive valuable comments from them. Therefore the construct is described as **Augmented communication with external parties** in the Table 4.3. Component 4 is a construct of

intra-organizational collaboration, Idea selection, and frequent of discussion with external parties. Interpretation of the construct is that idea selection is based on intra-organizational collaboration and that collaboration is also able to utilize comments of external parties. Elicit awareness about various ideas strengthens the assimilation (Flatten et al., 2011), and therefore the construct is described as **Augmented assimilation**.

Variables that had significant factor loadings in the principal components are mainly different between pre-and post-data collections. The statistical difference in components of pre-post PCAs represents the change in the organization during the research window and the change in the organization can be confirmed.

Table 4.3. The insight of the principal component analysis for the case organization 1, varimax rotation

Construct	**Description in pre data set**	**Description in post data set**
Component 1	Limited acquisition	Increased transparency
Component 2	Assimilation	Acquisition
Component 3	Rigorousness	Augmented communication with external parties
Component 4	Acquisition from external parties	Augmented assimilation

The second case organization

During the research window, the company went through organizational changes but those changes had more re-configurable perspective than for example downsizing. In addition, those changes were accepted rather positively by the organizational members. According to interviews, the changes were thought to enable the company to push new working methods forward and it was also mentioned that the positive attitude towards social media tools increased. OCT statistics reveal a huge leap in usage activity between the pre and post data collection phases. For example, views per day surged from the level of 250 to 2000 and similar upsurges in commenting activity was also witnessed. The users of OCT penetrated all organization levels.

At the beginning of the research, a discussion forum type of social tool was already used in some extent but, during the research period, the adoption rate significantly increased, based on intranet integration into the social tool. This integration enabled organization members to access the social tool more easily, as the requirement of dedicated access procedure was eliminated. It is expected that more convenient access to social software will increase even wider cross-functional contribution on different NPD themes, and the amount of knowledge acquisition based on dialogues between experts with different background will be elevated. Knowledge assimilation will be more exact and customer need will be more evident and strong in the NPD process.

Analogically to the first case organization, the change in the organization is also addressed with quantitative data by grouping statistically similar variables and contrasting them between pre and post datasets. According to PCA, 83.6% cumulative variance was able to be reached with 11 principal components. Within those 11 components, all components include at least two variables with factor loadings of 0.6 or more in the variance's distribution (Hair et al., 2010). These are presented in Appendix 10. The insight of the Appendix 10 containing the 4 most significant principal components is presented in Table 4.4. Component 1 is a construct of items relating acquiring ideas from external organizations, various organizational levels, and other internal function. Therefore it is described as **Acquisition** in the Table 4.4. Component 2 combines statistically items addressing intra-organizational collaboration, awareness of customer needs, skunk works, and senior manager's support for multifunctional teamwork. The construct indicates successful NPD process (Cooper & Kleinschmidt, 2007), and therefore it can be described as **Successful NPD**. The component 3 is a construct based on intra-organizational awareness and the lack of communication between projects, and it can be described therefore as **Intra-organizational communication.** Component 4 address communication with external parties. The construct combines perception of a fruitful source of new ideas and valuable comment, and therefore it can be described as **External parties as valuable source of ideas**.

The PCA for the post-data in the second case organization resulted in 12 principal components with 84.8% cumulative variance that contribute factor loadings of 0.6 or more into the variance's distribution (Hair et al., 2010). The first and second components have significant cumulative impact on the percentage of variances (24.8%), which indicates that the rest of the components will have considerable less impact in terms of variances. The summary of the post-data collection results is presented in Table 4.4. Component 1 is a construct of several items relating positive climate to skunk works, standardized process, Idea selection, and increased intra-organizational transparency that enables identification of required expertise from other functional areas. First construct addresses therefore the impact of OCT through **increased transparency** that has enables organizational members to utilize their intrinsic motivation to contribute in various projects, but also increased their awareness about

NPD process and idea selection. The second component addresses **communication within a team** through sharing ideas, perception of received input, and increased awareness of different ideas. Component 3 is a construct of intra-organizational collaboration, cross-functional communication, and communication with external parties, and therefore it can be described as **Augmented assimilation** to separate it from the **Assimilation** in pre data set (Flatten et al., 2011). Component 4 is a construct of items relating acquiring ideas from external organizations, various organizational levels, and other internal function. Therefore it is described as **Acquisition.**

The main observation for the PCA based on the post-data collection is the number of significant factors in **Increased transparency**. **Increased transparency** is the combination of a new set of variables that has no antecedent in the pre-dataset. Variances relating to communication and collaboration in many forms have significant factor loadings to **Increased transparency**, including idea selection. The statistical difference in components of pre-post PCAs represents the change in the organization during the research window and the change in the organization can be confirmed.

Table 4.4. The insight of the principal component analysis for the case organization 2, varimax rotation

Construct	**Description in pre data set**	**Description in post data set**
Component 1	Acquisition	Increased transparency
Component 2	Successful NPD.	Communication within a team
Component 3	Intra-organizational communication	Augmented assimilation
Component 4	External parties as valuable source of ideas	Acquisition

The third case organization

There was a strong commitment in case 3 towards enterprise-level social media tools already before the present research began, as there was an ongoing pilot project testing the possibilities and sketching the new way of working. The research was part of the bigger program and it had only aspects of measuring the influence of the social software once it had rolled out to wider audience. During the research period, possible benefits of the social media tool became more concrete because access to it became available for various organizations. According to the statistics, the adoption rate for the main OCT

surged up from practically nothing to 44% during the research period and including all organization levels, and the number of active communities increased dramatically from only a few to almost 1500 by time of the post-data collection.

Research concentrated only on activities of the preselected groups, but access to the social media tool was rolled out even more widely. As the social media tool connects more organization members to these virtual communities, the transparency of activities that colleagues are performing will be increased; it is assumable that those activities also include items that some colleagues other than those on the core team will have fresh ideas to share and help the current team. Cross-functional communication will open access to acquired intra-organizational knowledge that might otherwise be beyond easy accessibility. This pool of knowledge can be used to assimilate the needed knowledge to solve challenges.

The quantitative data based on the third case organization, can be addressed by 78.3% cumulative variance of 12 principal components. These 12 components include variable(s) with factor loadings of 0.6 or more in the variance's distribution (Hair et al., 2010). These are presented in Appendix 11. The insight of the Appendix 11 containing the 4 most significant principal components is presented in Table 4.5. Component 1 can be described as **Communication within a team** as it combines sharing ideas, perception of received input, and increased awareness of different ideas. Component 2 is a construct of **Cross-functional communication preferred** that has also aspect of commenting extant ideas and support from senior management. The next construct addresses **Communication with external parties**. The communication is based on task requirements, and it is perceived valuable. Component 4 is a construct of items relating acquiring ideas from external organizations, various organizational levels, and other internal function. Therefore it is described as **Acquisition**.

The PCA for the post-data in the third case organization resulted in 12 principal components with 77.6% cumulative variance that contribute factor loadings of 0.6 or more to the variance's distribution (Table 4.5). Component 1 can be described as **Augmented communication within a team** as it combines the perception that project requires intense multifunctional interactions and dialogue, sharing ideas among team members, perception of received input from a team member, and increased awareness of different ideas among team members. The component 2 addresses **Collaboration**. The collaboration enables sufficient resource allocation as it is part of the standardized process and it means that other functional areas, also vertically, provide their ideas to NPD. The next construct addresses **Frequent communication with external parties** as the communication is based on task requirements, it is perceived valuable and it is frequent. Component 4 is a construct of items relating acquiring ideas from external organizations, various organizational levels, and other internal function. Therefore it is described as **Acquisition**.

Communication within a team in the pre-data set together with requirement of intense multifunctional interactions and dialogue are forming the **Augmented communication within a team** in the post-dataset. That change includes more open and more dialogic climate in the organization. Components 3 in both data sets are discussing about external parties, but the difference between them is the increased perception of interactivity concerning idea discussions in post data set. The statistical difference in components of pre-post PCAs represents the change in the organization during the research window and the change in the organization can be confirmed.

Table 4.5. The insight of the principal component analysis for the case organization 3, varimax rotation

Construct	**Description in pre data set**	**Description in post data set**
Component 1	Communication within a team	Augmented communication within a team
Component 2	Cross-functional communication preferred	Collaboration
Component 3	Communication with external parties	Frequent communication with external parties
Component 4	Acquisition	Acquisition

Cross-case analysis

Cross-case analysis reveals common patterns but also some differences between case organizations. In case organization 1, a drastic change can be seen in principal components, compared to other cases. The PCA based on post-data combines and elevates variables that describe internal communication and collaboration. This is a significant change compared with the PCA based on the pre-data. Implementation of OCT seems to be one natural explanation for the change that is revealed by PCA. The argument that the amount of communication, collaboration, and information sharing has increased cross-functionally is supported by interviews. Similar findings can be made based on the second case organization. General awareness has been strengthened by more concrete concepts, such as communication and collaboration. Also notable is the dominant role of the first principal component (**Increased transparency**) in total

variances of the post-data set. The first component has as much as 6 significant factor loadings and it acts like an umbrella for the majority of communication-related variables. It can be argued that the change is one result of the implementation of the OCT for a wider audience, as it is very similar to the other case organizations and the implementation is the main known common factor between these. Interviews also support the umbrella analogy for OCT and communication. OCT has become an important communication tool for organizational members. From the cross-case perspective, in all post PCAs the communication-related variables have the main role, but the second case organization differs from the other cases by introducing the most significant impact of NPD environment into Component 1 (**Increased transparency**). There are some variations in principal components in the third case organization, but the main trend is the same as in the other case organizations; the variance distributions between variables concerning cross-functional communication and collaboration have become more alike. That trend reflects a more open and more dialogic climate in the organization. Interviews are confirming that the amount of communication, collaboration, and information sharing has increased cross-functionally between the pre- and post-data collections. Interestingly and on the contrary to the other case organizations, idea selection in the third case cannot be identified to have significant factor loading to any of the principal components. The number of variables with significant factor loadings has increased in the PCAs from pre-to post-datasets mainly due to the increase in significant communication-related variables in all case organizations and these can typically be statistically combined with another variable. However, there are these variables in all cases (mainly in the components of lower impact on cumulative variance distribution) that principal components have only one variable with significant factor loading, and therefore these variables cannot be statistically combined with the remaining ones.

Analysis of the combined datasets

In addition to the independent case-wide principal component analyses, the analysis of the combined dataset is to be discussed. The PCA for these combined (all cases) datasets is presented in Appendix 12. Both the pre-data and post-data PCAs indicated that all variables can be represented with 13 principal components. A handful of similar principal components can be identified that have similar factor loadings between pre- and post-data collection datasets. Those somewhat identical combinations of principal components are a strong indication of the robustness of variable themes; similar variables are addressing similar themes in both data collection phases. There can be identified 6 identical principal components. On the other hand, the change is concentrated on principal components that generate a somewhat lesser amount of variance distribution. As a general observation, mainly all principal components greater than 4 have changed. In addition, the importance of **Communication within a team** has

risen dramatically. Those variables can be used to explain 22,3 % of all variances compared to initial phase's 7,7,%. Secondly, the results indicate that the perception about the usage of OCT is not based on expectations in post-data about the reasons to use it (**Idea management tool as part of the process** vs. **Utilization of idea management tool**). According to the PCAs, there has been an understanding in all cases at the pre-data collection phase that the foundation for using OCT is through a rigorous process. Thirdly, the impact of **Go/no-go decisions** by senior management is almost doubled (predicted variance: 2,6 % → 4,9%). According to the interview, NPD process was not changed and therefore the increased impact can be explained by the increased transparency and therefore organizational members are more aware of decision making process. In addition, the amount of interactions with external parties is not necessary related to task requirements during the post-data collection as indicated in **Communication with external parties** (pre) but not in **Frequent intrinsic communication with external parties** (post). The statistical difference in components of pre-post PCAs represents the change in the organization during the research window, and the change in the organization can be confirmed.

The interviews during the post data collection phase confirm the change. The selection of quotes based on post data collection is presented in Appendix 13. Perceived change between the pre and post data collections (CGH) is discussed first. As a general comment, none of the interviewees pointed out a secondary, direct change that they perceived to have some reflection to the adoption of the OCT (CGH2) even though they specified some examples of minor changes (CGH1, CGH3…5). Any other communication tool was not replaced by OCT and therefore it was considered as a new tool (CGH7…8). However, the adoption was not finalized and the amount of active usage was not on the maximum level at the end of the research period (CGH6). However, there were perceived positive impacts on resource allocation, and finding required expertise (CPC1…4). One of the main impacts was increased awareness of organizational members about different functions (CPC2), their activities and possible task overlaps (CPC1). Comments concerning communication strengthen the positive tune about OCT implementation. Contrasting the cross-functional communication between the data collections it was noted to be increased (NC1, NC3, NC6). Additionally, also the general organization-wide awareness is perceived to be increased.

4.4. Analyzing the change by contrasting organizations with one another

Similarities across case organizations strengthen the reliability of the data. In addition, according to the Kruskal-Wallis test (sign < 0,05), only 28.6% of all variables among the cases have different distributions (at least one dataset is different compared to remaining ones), which indicates that the sample populations in each case organizations

are rather similar, yet there are some differences. The responses reflect organizational culture, industry, and business environment where the organizations are operating, and those aspects are independent for each organization; also small changes in distribution in certain variables were expected between the case organizations. Interestingly however, according to the Kruskal-Wallis test (sign < 0,05) in post-datasets, only 11.9% of the variables have a different distribution between case organizations, which indicates that responses are even more similar than in pre-datasets. Each organization faced different challenges and opportunities between the pre-and post-data collections. The one main change for all was the implementation of OCT on a wider scale. It seems that OCT implementation and utilization will drive organizations to be more similar. Increased similarities indicate that not only new working practices have various aspects, but also that those new working practices do not seem to depend on the organization or the business environment, but they can be extracted and generalized (Bondar & Peltola, 2013).

4.5. Analyzing the change by addressing the impact of using OCT

Methodological triangulation confirms the change during the research period and therefore the further analyses are conducted using only the post-data. The conceptual model illustrates relationships between dependent and independent variables based on research question. Those relationships are examined by a linear regression. Furthermore, there are two controlling variables; usage of OCT and task requirement. Task requirements are addressed in terms of perceived lack of time (TimePressure) and complexity of information (ComplexInfo). The regression models are based on NPD environment and communication-related items and these models are used to find the impact of task requirements and usage activity of social media tools on PACAP. The total number of independent variables involved is 27 totally; however, items related to interactions with external parties are excluded, as none of the case organizations used OCT for that and including those in to the regression model might result in difficulties of interpretation. After revising the set of items, the number of independent variables decreased to 21. These items are constructed to principal components to further decrease the number of independent variables in the model. The outcome of PCA is six principal components for NPD environment and communication (see Table 4.6) and these principal components are used as independent variables in regression model to address intra-organizational acquisition and assimilation. Regression analysis is sensitive for multicollinearity but using principal components these concerns are relieved. All VIF were under $\sqrt{10}$ (Hair et al., 2010).

Table 4.6. Summary of the principal components for communication and NPD environment related variables

Independent variable	**Description used in regression analyses**
Component 1	Communication within a team
Component 2	Cross-functional communication
Component 3	Rigorousness
Component 4	Communication sufficiency
Component 5	Resources
Component 6	Interactions

From the principal component perspective, constructs based on the post-dataset are according to the intentions as items loads their intended constructs (Appendix 14; Table 4.6 contains the summary). Component 1 addresses **Communication within a team**. According to the first component, team members who share ideas with each other also perceive positive input from their closest colleagues and their awareness about team member's ideas is better. The second construct addresses the **Cross-functional communication** in terms of awareness of knowledge, valuable information, ideas and the amount of intra-organizational interactions. Interestingly, organizational members' activity for intra-organizational interaction loads **Interactions**-construct but it is not among the communication items in the second construct. That suggests that the statistical difference between items is based on the difference perspective of the communication; there is a difference between intensity of intra-organizational interaction and mutual awareness of knowledge or accessibility to it. Component 3 is a construct that address the NPD process and its **Rigorousness** through decision making, transparency of NPD strategy, and standardized process. Principal component 4 implies an interesting connection between perception about the amount of communication and the need for communication. Those who perceive a lack of communication between projects have also the greatest need for intense cross-functional interactions and therefore it is described as **Communication sufficiency**. Component 5 "**Resources**" addresses the NPD Environment through items related to time and resources. Those both load positively on Component 5, implying that those who perceive that there are sufficient resources for the NPD projects also consider that they have the possibility of spending time on other projects.

PACAP addressed by the linear regression analysis

The intra-organizational aspect of the multifaceted impact of OCT utilization on PACAP is addressed through 4 regression models containing resolutions for the amount and quality of the both acquired and assimilated knowledge. The amount of acquired knowledge is addressed through the amount of received ideas from other functions (Appendix 15). Dependent variable in Model 1 is reverse coded and therefore the signs of independent variables are intended. Model 1c suggests that **communication within a team** and **cross-functional communication** have significant impacts on the amount of acquired knowledge. In addition, **Rigorousness** is also significant. That implies the importance of process rigorousness in terms of NPD strategy, standardized process with idea screening, and clear go/no go decisions. In addition, Model 1 suggests that task requirements don't have a significant impact on the amount of the acquired knowledge, at least in terms of the amount of received ideas from other internal functions. The significances of the controlling variables are confirmed by contrasting adjusted R^2 values between models. The usage of OCT has a great impact on the goodness of fit. However, according to models 1c and 1d, the significant impact of the controlling variable "usage of OCT" has the opposite sign contrasting towards the communication items addressed through **Communication within a team** and **Cross-functional communication**. Intuitively they should have the same sign. Therefore, the results imply somewhat mixed perceptions of OCT and the amount of received ideas from other internal functions. According to the interviews discussed previously, the amount of cross-functional communication via OCT is increased but, on the other hand, regression models 1c and 1d imply that increased communication has not been transformed into a sufficient amount of received ideas. One explanation is that expectations have been increased even more due to the utilization of OCT, and if those new expectations are not met then the perception might reflect negatively on the amount of received ideas. Therefore, the usage of OCT increases the amount of ideas but increased expectations pushes the limit of sufficiency even more. Therefore hypothesis H1 is supported. For model 1, the coefficient of determinant (R^2) is on the significant level of 0,27 (model 1c) and the F-values are on the acceptable level ($p<0,01$) (Hair et al., 2010).

The quality of acquired knowledge is addressed through the likelihood of communication across different functions and it suggests various implications (Appendix 16). Interestingly, only **Communication sufficiency** is insignificant in the regression model 2. The significance of other independent variables implies importance of the acquisition quality that is based on various aspects in the organization. However, task requirements are not among those as those has no significant impact on the quality of acquired knowledge. The Model 2 is the only model that has **Resources** as significant component. That connects the time and resource to the quality of the acquired knowledge and implies that if there is a lack of time and resources, then organizational members have to focus on the tasks at hand and the quality of the

communication is better, particularly from the organization perspective, as the communication is more task-oriented. Constructs for **Communication sufficiency** and **Interactions** address the intra-organizational interactions, but they are constructs of reverse-coded variables. Therefore, signs of all constructs in Model 2 are expected, even though the **Communication sufficiency** is an insignificant independent variable. According to Models 2c and 2d, the usage of OCT has no significant impact on quality of acquired knowledge and hypothesis H2 is therefore not supported. Based on the interviews, Model 2 can be described to represent an implication that the usage of OCT slightly strengthens the impact of the constructs relating on the quality of acquired knowledge in terms of an increased amount of intra-organizational communication (probably in online communities) and increased awareness, but it does not necessary reflect on the amount of face-to-face interactions. The coefficient of determinant (R^2) is on the significant level in all models, and F-values are acceptable ($p<0,01$) (Hair et al., 2010).

Regression Model 3 discusses knowledge assimilation (Appendix 17). The amount of assimilation is addressed in terms of the collaboration between internal functions. Constructs 1-3 are significant in the regression model 3. That implies importance of intra-organizational communication (**Communication within a team** and **Cross-functional communication**) to the amount of assimilation but also the significant of process rigorousness (**Rigorousness**). **Communication within a team** and **Cross-functional communication** are the strongest components in Model 3 and that indicates a connection between intra-organizational communication and the amount of assimilation. In particular Model 3c implies that **cross-functional communication** becomes stronger and more significant due to the usage of OCT. Interviews are supporting the finding. However, according to the regression, task requirements and the usage of OCT have no significant impact on the amount of assimilation. Furthermore, contrasting the adjusted R^2 between Models 7a and 7c, the regression has a stronger fit with usage of OCT. However based on Model 3, there cannot be found significant support for hypothesis H3. On the coefficient of determinant (R^2) perspective, the usage of OCT increases R^2 (from 0,23 to 0,28) and F-values are acceptable ($p<0,01$) (Hair et al., 2010).

Regression model 4 continues the assimilation discussion from quality perspective (Appendix 18). The quality of assimilated knowledge is addressed through item discussing whether the developed ideas are targeted to current customer needs. The insignificance of **Communication within a team** in Model 4b, 4c, and 4d follows the aspect of assimilation addressed by the dependent variable. The model 4 discusses current customers and therefore the **cross-functional communication** is more significant antecedent for the quality of the assimilated knowledge. The significance of **Communication sufficiency** is interesting because it implies the importance of multifunctional interactions but the construct also includes the item discussing the perceived lack of it. In a context of assimilation, that can be understood to represent the

recognition of various intra-organizational expertise due to the intra-organizational communication and observation that those have not been fully utilized. In addition, **Communication sufficiency** is significant only for the regression analysis addressing the quality of assimilated knowledge, implying that intra-organizational expertise has a significant role in evaluation of the amount of assimilated knowledge. That interpretation is supported with the significance of the **Interactions**. Due to the reverse coding, **Interactions** implies that organization should increase the amount of intra-organizational interactions to maximize the quality of the assimilated knowledge. As a whole, intra-organizational transparency seems to be more significant for assimilation quality than communication. According to the Model 4, task requirements and the usage of OCT have no significant role in the quality of assimilated knowledge. Between Models 4a,4b,4c,4d, there are no great differences in adjusted R^2 values, and that indicates insignificant control variables. The impact of the usage of OCT is slightly positive but not significant in Model 4. Hypothesis H4 is therefore not supported. Coefficient of determinant is on the significant level of ~0,15 and F-values are small but on the acceptable level (at least $p<0,05$) (Hair et al., 2010).

The finding for all regression models related to NPD environment and communication impact on PACAP is that task requirements won't have any statistical significance. Hypothesis H13 is not supported, as potential absorptive capacity does not seem to depend on how much rush there might be in the organization or how complex the information is that organizational members are receiving. That finding implies also that OCT is not considered to be "just another new tool" as the existence of OCT is not reflecting on the perception of task requirements. Another common characteristic is that due to the coefficient of determinant in regression Models 1-4, the data seems to fit in the conceptual model, indicating that the model can be used for addressing the impact of social media tools. Only for the quality of assimilated knowledge does the fitting of the model to be slightly worse, yet on the significant level. Despite the fact that regression analysis does not address communication in terms of amount and quality, the third observation is that communication has a strong impact on PACAP, according to regression models. Furthermore, the third observation connects the present research to the existing literature as communication as the major antecedent of ACAP has been recognized widely among scholars (for example Lane & Lubatkin, 1998; Szulanski, 1996; Tsai, 2001; Zahra & George, 2002). Therefore, the current research is also a strong support to existing literature.

NPD performance addressed by the linear regression analysis

NPD performance is addressed in terms of idea selection and therefore idea selection is used as the dependent variable in the regression analysis for NPD performance and items related to PACAP are used as independent variables (Table 4.7). Clarifying the

impact of OCT, NPD performance is addressed with pre and post dataset; Model 5 and Model 6, respectively. The regression Model 6 includes a significant independent variable. That addresses awareness for the needs of the current customers. They imply that OCT increases intra-organizational transparency and furthermore that the organization's members become more aware of various knowledge, projects, and ideas, which enables them to contribute to those—for example, by commenting via OCT. Therefore an organization can increase its idea selection capacity by implementing and utilizing OCT. The coefficient of determinant is low yet on the significant level (R^2=0,16) and the F-value is significant (p<0,01) (Hair et al., 2010), implying that PACAP is an indicator for idea selection, but as indicated on Chapter 2 PACAP is not a solely antecedent for NPD performance. As discussed in Chapter 2, NPD performance also depends on variables other than idea selection. Therefore, the link between social media tools and NPD performance cannot be overestimated, but high PACAP has been identified to be an antecedent of NPD performance.

Table 4.7. Regression analysis for NPD performance

Variable	Model 5 (pre)	Model 6 (post)
Constant	**5,146*** **	**3.04*** **
PACAP		
I receive too few ideas from other internal functions	-0,101	-0.114
I frequently discuss ideas internally between with different functions	-0,087	0.111
I frequently develop ideas with various internal functions	0,004	0.154
In my opinion, most developed ideas are targeted to current customer needs	0,019	**0.175***
R2	0,02	0.162
F	0,475	**4,07*** **

Significance: *) p < 0,1; ***)p<0,01.

Revised conceptual model based on regression analysis

According to the results, PACAP can be addressed with 6 principal components. **Cross-functional communication** seems to be the only antecedent of the PACAP that has a significant impact for the whole PACAP in terms of amount and quality. The second significant constructs are **Communication within a team** and **Rigorousness**. They both

are insignificant only in the model addressing assimilation quality. **Interactions**-construct is significant in the both acquisition and assimilation qualities, but **Resources** and **Communication sufficiency** are significant only in one aspect of PACAP; acquisition quality and assimilation quality, respectively. However, the impact of the OCT usage on PACAP is significant only through 3 of them; **Communication within a team**, **Cross-functional communication**, and **Rigorousness.** Furthermore, PACAP is significantly addressed only through acquisition amount. And finally, the impact of the OCT to the NPD performance through PACAP is significant through increased intra-organizational transparency that impacts on assimilation quality (Figure 4.1).

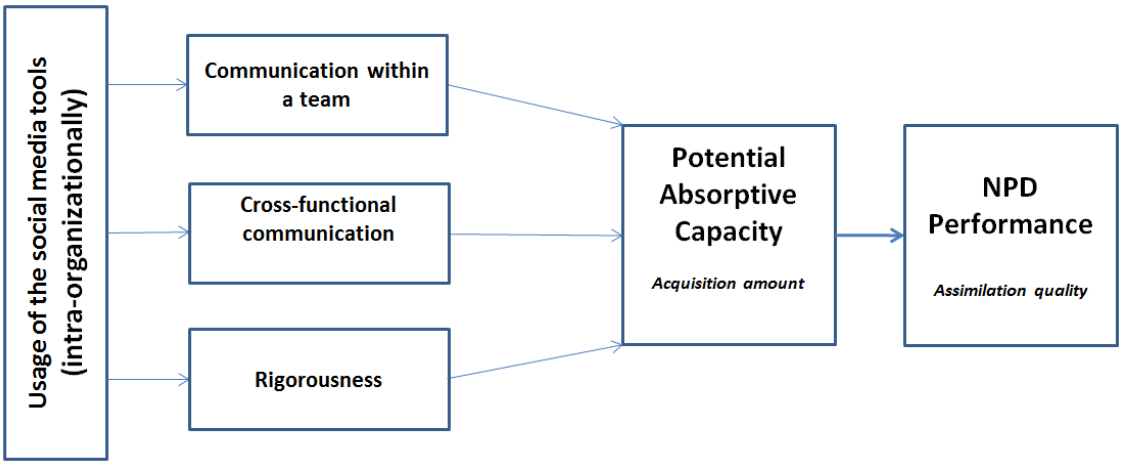


Figure 4.1. Revised conceptual model

The revised conceptual model suggests that intra-organizationally used social media tools will have significant connection to NPD performance through PACAP. The connection is significant through intra-organizational communication, but also through rigorousness. In particular acquisition amount seems to be effected by these antecedents based on the usage of OCT. Interestingly from NPD performance perspective, the impact on assimilation seems to be stronger than on acquisition. According to the results, the elicit awareness and utilization of the intra-organizational knowledge supports organizational assimilation as organization will have better capacity to assimilate existing but scattered acquired knowledge.

4.6. Analyzing the change by contrasting users based on their usage activity

To have a good understanding about the impact of the OCT, the impact of the social media tools on the item level is discussed next. Findings are based on contrasting distributions of responses between conservative and active users. The item level analysis is not taking account of relations between items in the same dataset, as it contrasts the differences between the same items in two datasets (having the difference in user activity). Therefore, it elevates the understanding about the impact of active usage of social media tools. Post-datasets are divided into active and conservative user groups, based on the background information. Active users are those who are using OCT at least daily. These groups (conservative and active users' datasets) cannot be differentiated by any other criteria (such as organization or organization level) but being active in the use of social media technology (Mann –Whitney U test $p<0,05$). Therefore, when contrasting these two datasets, it is more confident to assume that the latent variables are the same for both of the datasets. Based on the qualitative results and additional data (the referential adequate approach), organizational members did not have convergent motivations for joining in communities. Some of them were members of a community because they were told to be members, some because their task relates to the community's theme, and some others because they would like to know what is happening in that sector in the organization. These various motivations might reflect on members' activity and lack of discussions on the individual level. In addition, according to the Mann-Whitney U test these datasets are statistically different on item level, i.e., they are not subsets of each other or some third dataset.

From the PACAP perspective, many interesting changes can be noticed and discussed. First of all, the impact of the OCT on organizational members is that they are sharing their ideas and knowledge through the online collaboration tool, making it easier for them, but also for the rest of the organization, to spot out and acquire valuable topics and expertise. Easiness of sharing seems to reflect on perception of active users about the amount of ideas and they are somewhat frustrated due to the lack of the usage by the whole organization. They perceive that they are not receiving as much as ideas from their peers that they know might be possible. The ones who are sharing are typically also active users, and from this perspective the amount of knowledge acquisition is significantly greater among active users than conservative users and H1 is supported. Conservative users don't consider OCT being as appealing to use as active users do. The reason might be that they have not yet found the low-hanging fruits. A result of their absence is that they miss the possibility of commenting on ideas about OCT and the organization lacks their valuable input into these cases. OCT decreases organizational borders and isolation based on different organizational levels. There are no standard boundaries in the virtual world and organization members are on the same

virtual level. Only the activity of each organizational member will separate one from another. Active users can use this as a benefit. They have the tools, the possibility, and the access to discuss various topics with users at different organizational levels. Having more information available will enhance the quality of acquired knowledge as the understanding of what is important to the organization is increased. Therefore, H2 is supported. However, the data doesn't support arguments about a significant change in knowledge assimilation between active and conservative users and therefore both H3 and H4 are not supported. Together with regression analysis previously, that implies that organizational level measures are required for addressing assimilation. Even though none of the case organizations included scenarios in which online collaboration tools were used for direct communication with external parties at time of the data collection, those organizational members that are also active users consider that OCT will also reflect positively on communication with external parties. This understanding is mainly based on expectations, but it open interesting avenues for discussion. Active users have noticed the benefits of internal communication and collaboration, and they might be anxious to transfer the same tools to enhance communication and collaboration also with external parties. Naturally, there will be different challenges; for example, the amount of trust is totally different, and innovative and open communication and collaboration between organizational members and external parties might be extremely difficult to reach (Lohikoski & Haapasalo, 2013; Martins et al., 2004; Von Krogh, 2002). A summary of the statistically significant differences between conservative and active users is presented in Table 4.8.

Increased transparency has enabled organization members to be more aware of various types of expertise that exist in other departments, teams, and functions, which enables them to contact the right party more effectively. According to interviews, organizational members are communicating more with their peers in other functions due to the OCT (for example quote NWOW1 in Appendix 13). However, these arguments are not supported by quantitative data, if item distributions are contrasted based on activity of usage. Therefore, hypotheses H5 and H6 are not supported. Communication within the team can also be enhanced with social media tools. In-team communication is already at a high level to start with and the possible impact on that is not clear; however, active users perceive that the quality of communication is increased. Online communication tools help team members to share their expertise within the team and team members are more aware of ideas from other team members. According to the interviews, communication is very task-specific and majority of the communication is strongly related to the tasks at hand. Online collaboration tools enable easy and convenient team-wide ad-hoc types of access between team members, but also all material is in a virtual place that can be accessed with various devices, such as laptops or mobile devices. Therefore, hypothesis H7 is not supported but H8 is supported. Among NPD environment items, none can be identified as having a different distribution when contrasting active and conservative users. Therefore, hypotheses

relating to the NPD environment (H9, H10, H11, and H12) are not supported. In addition, when contrasting distributions at the item level, no difference can be found between active and conservative users based on their perceived task requirements. Therefore, also hypothesis H13 is not supported from the active-conservative perspective.

Table 4.8. Summary of statistically significant differences in terms of user activity (1-7 Likert scale)

Item	User group	Mean	Std dev	Result
I receive too little ideas from other internal functions	Conservative users	4.09	1.38	
	Active users	4.57	1.32	11,7% increase p<0,1
Submitting ideas into the idea management tool is appealing	Conservative users	4.22	1.54	
	Active users	4.74	1.55	12,3% increase p<0,1
I frequently comment on ideas in the idea management tool	Conservative users	2.51	1.25	
	Active users	4.04	1.74	61,0% increase p<0,05
My team members share frequently their expertise to me	Conservative users	5.31	1.36	
	Active users	5.92	0.93	11,5% increase p<0,05
I am aware of ideas from my team colleagues	Conservative users	4.98	1.45	
	Active users	5.61	1.10	12,7% increase p<0,05
Idea selection	Conservative users	4.38	1.13	
	Active users	4.70	1.05	7,3% increase p<0,1
OCT has changed my way of working	Conservative users	2.96	1.43	
	Active users	4.39	1.73	48,3% increase p<0,05
I have found OCT beneficially in my tasks	Conservative users	3.47	1.55	
	Active users	4.95	1.56	42,6% increase p<0,05

In addition, NPD performance was also addressed directly through the idea selection related variable in the present research. The results indicate a significant statistical difference between active and conservative users in idea selection (7.3% increase at significance level $p<0.1$). That strengthens the positive expectation about the benefits of active usage for the organizations. The research period was only 6-12months, including the roll-out of the OCT to a wider audience but, according to the first impressions and insights based on the usage of OCT, NPD performance can be addressed and improved with OCT and new working practices; therefore, H14 is supported.

According to the regression analysis (Appendix 19), those organizational members that have found OCT beneficial in their tasks have also changed their working practices ($R^2=0.511$; $F=126.4$; $p<0.001$). This suggests that users who have found benefits have also changed their working practices and became active users of OCT, and

they are more confident that usage of OCT will help them in their daily activities. Therefore the value of online collaboration tools and maximizing the number of active users in very early phases of the rollout should be recognized, when introducing new working practices to the organization.

4.7. Summary of results

Qualitative results provided insights into the case organizations, and contrasting quotes between pre and post data collections, they confirm that issues relating communication and collaboration have become better. OCT has increased intra-organizational awareness (for example quotes CPC1, CPC2, CPC4, CPC5, NC1, NC2, NC3 in Appendix 13). Interviews also provide discussion about perceived challenges. Implementation and utilizations of OCT is not easy task for the organization as indicated for example in quotes CPC3, NC4, and NC5.

The quantitative results are addressed from three levels of analysis: pre-post-datasets in each case and in cross-case analysis, combined pre-post-datasets, and item level. The confirmation of the change due to the use of OCT is addressed with pre-post analysis on the organizational level in each case. Principal component analysis is used as an instrument to decrease the number of variables and to group those into statistically similar groups. The PCA resulted in different components between pre-and post-datasets, and factors load their intended constructs that support the research question. OCT will increase collaboration and communication at the organizational level. Quantitative analysis also implies support for the conceptual model that is verified by regression analysis. The analysis was made by addressing different aspects of PACAP through post-dataset and with two controlling variables. Especially in the quality of acquisition, the coefficient of determination (R^2) is at a very good level (0.42). The differences in results between regression analysis and item level analysis addressing the quality of acquired knowledge is based on the slight conservative sound in quantitative data. The implementation phase of the OCT was ongoing and adoption rate in the organizations were not stabilized, and therefore the organizational impact was not reached its potential in terms of regression analysis. Furthermore, task requirements as controlling variable did not have a significant impact on PACAP. However, the usage of OCT seems to have significant and positive impact on knowledge acquisition. Analysis of item distributions is based on contrasting active-conservative users datasets. That detailed picture was used to elicit changes at the individual level. These three levels of quantitative analysis are partly overlapping but the convergence is the strength of the research and creates a good standpoint from which to address research questions. In addition, qualitative evidence is used to increase the researcher's knowledge about the working practices during both data collection phases. Interviews during the post-data collection phase also clarified the perceived changes during the research period.

Interviews confirm the change in working practices due to the OCT. In particular, there has been a change towards increased intra-organizational awareness and elicit intra-organizational communication, and therefore concerns described by Symon (2000) are not confirmed by the qualitative results. Additional qualitative data used as referential adequate approach is aligned with the key findings. In addition, administrative user statistics support the hypothesis of the change between data collection phases. The amount of usage has increased from many perspectives: number of users, virtual communities, and shared information. Table 4.9 presents a summary of the hypothesis that combines all quantitative data sources and results.

Table 4.9. Summary of hypothesis and quantitative results

Hypothesis		Result	Based on
H1	The amount of acquired knowledge is increased by intra-organizational utilization of social media tools.	Supported	Regression analysis, contrasting user activity
H2	The quality of acquired knowledge is increased by intra-organizational utilization of social media tools.	Supported	Contrasting user activity
H3	The amount of assimilated knowledge is increased by intra-organizational utilization of social media tools.	Not supported	Regression analysis, contrasting user activity
H4	The quality of assimilated knowledge is increased by intra-organizational utilization of social media tools.	Not supported	Regression analysis, contrasting user activity
H5	The amount of cross-functional communication is increased by social media tools	Not supported	Regression analysis, contrasting user activity
H6	The quality of cross-functional communication is increased by social media tools	Not supported	Contrasting user activity
H7	The amount of in-team communication is increased by the use of social media tools.	Not supported	Regression analysis, contrasting user activity
H8	The quality of in-team communication is increased by social media tools	Supported	Contrasting user activity
H9	The level of centralization is decreased by intra-organizational utilization of social media tools.	Not supported	Regression analysis, contrasting user activity
H10	Process rigorousness is increased by intra-	Not supported	Regression

	organizational utilization of social media tools		analysis, contrasting user activity
H11	Senior manager commitment and involvement is increased by intra-organizational utilization of social media tools.	Not supported	Regression analysis, contrasting user activity
H12	An organization's innovative climate and culture is perceived to be better due to the intra-organizational utilization of the social media tools	Not supported	Regression analysis, contrasting user activity
H13	Task requirements reflect degradingly on organizational members' use of social media tools	Not supported	Regression analysis, contrasting user activity
H14	Idea selection is better with intra-organizational utilization of social media tools	Supported	Regression analysis, contrasting user activity

5. DISCUSSION

Among empirical results the present study includes also theoretical results. The conceptual model was founded on the metrics synthesized from NPD success factors and ACAP in literature. PACAP was used as one antecedent for the NPD performance and the interest in the present research concentrated on maximizing PACAP. Measuring ACAP quantitative is scarce (Murovec & Prodan, 2009) but not unique (Flatten et al., 2011; Yli-Renko et al., 2001). The evidence from cases is based on various sources discussed in the early part of the thesis. The impact of active usage of OCT can be synthesized in two main findings: increased intra-organizational transparency and an increased amount of collaboration between internal functions. These findings both align with the success factors for an enterprise innovation community below (Dahl et al., 2011). In addition, utilization of communication technology innovation is also one antecedent of the firth-generation innovation process (Rothwell, 1994).

- Stakeholder involvement at all levels
- Pilot program before enterprise launch
- Value proposition for community members
- Network of support
- Transparency of results
- Foundation in current business objectives

Additionally, the results are align with works of Bercovitz & Feldman (2011) and Lazear (1999) about the capacity and composition of the team. According to the results, the usage of OCT increase intra-organizational awareness and transparency and therefore the core team has possible to utilize existing knowledge. Along with the increased communication, the increased awareness is considered as one indication for new working practices based on OCT (Appendix 13: NWOW1…2, NWOW5, NWOW10). Increased awareness among organizational members (about the activities of colleagues and about the strategy, targets, and processes) increase PACAP. Shared information will be an essential asset in an organization and that introduces the possibility of having the selection based on a wider and deeper knowledge base. Insights from referential adequate approach confirms that OCT should not be only an information channel to share information about new products/materials and forthcoming events, even though the possibility of accessing more information was considered an important motivation for organization members to join a community.

Interviews at the pre data collection phase revealed a fruitful foundation for the research. Even though the processes were excellent in many ways in all cases, there

were a few typical issues concerning communication and information sharing (Appendix 8). Quotes coded PC1…4 are examples for communication challenges perceived in case organizations. Also a challenge for finding the right person or piece of information is typical commonality in daily life in organizational members (quotes: PC5 and PC6), and together with scattered information (quotes: PC7 and PC8), the big picture can be veiled (quote: PC9). All those challenges might reflect that also knowledge sharing (quotes: PC10…12) and resource allocation (quotes: PC13…15) are compromised.

In addition to the positive aspects of new ways of working mentioned in the Appendix 13 there were also some conservative perceptions. There is a risk of being overfull of notifications generated by the OCT (quote: NWOW3), if one doesn't adjust the configurations properly. Also strongly relating to the specific tool and its configurations, it was pointed out that it is impossible to 'push' organizational members to accomplish a task by addressing the same 'push' note also to the boss as information (quote: NWOW9). And if there is not absolutely necessary to use such of tool, some organizational members might postpone the adoption (quote: NWOW4). It was also pointed out that just following the amount of comments generated by a post in OCT, was not very good criterion to be used in idea screening and evaluation (quote: NWOW7). Additionally, some remarks also have to be pointed out. As suggested by Migdadi et al. (2012) and Symon (2000), the existence of OCT not necessary increase communication among every organizational member as it requires contribution (i.e. activity) on the individual level. Organizational members should use these new collaborative working methods (quote: NC4) to reach the benefits. But on the other hand, the clear impact might require more time to be visible to all, as indicated in quote NC5. Perceptions vary also in terms of usefulness of OCT and new ways of working (quotes: NWOW6, NWOW8) but the bottom line seems to be positive, more or less.

On the whole, qualitative data supports findings from the quantitative data but also increases reliability and validity of the collected quantitative data. Based on the qualitative data there was no indication of crucial environmental variables that should have been taken into account in quantitative analysis. Results support the positive expectations towards social media tools and are congruent with existing literature. Positive expectations are supported with empirical data based on various sources. That should relieve concerns about OCT implementation in organizations. However, as indicated by Migdadi et al. (2012) and Meroño-Cerdán (2008), the results inevitable argue that the *usage* of OCT is the significant antecedent for organizational benefits based on OCT. OCT is not mere tool implementation but utilization requires upgrades also to working practices. That finding is supported by Bondar & Peltola (2013).

The connection between communication and ACAP has been discussed in literature (Flatten et al., 2011; Yli-Renko, 1999) and there is convergent understanding about a positive reflection from communication towards ACAP. However according to

the literature the impact of social media tools on organization is not clear (Bondar & Peltola, 2013; Denyer et al., 2011; Haefliger et al., 2011). On the other hand, there are indications that the active usage of OCT is required to have concrete benefits in organization (Meroño-Cerdán, 2008; Migdadi et al., 2012). The present study connects communication, PACAP, and social media tools in NPD context and provides metrics to identify the organization specific impact.

Answering the research questions

The research question was inspired by overwhelming positive rhetoric about social media tools and the scarceness of academic studies with empirical evidence about the benefits. The research focused on the research question to find out the impact of social software adoption in a tightly defined context. The critical phase of new product development is the beginning, including the selection of ideas to be developed further, but the ideas should be evaluated through the entire NPD process. That selection requires utilization of all relevant internal information to decrease uncertainties. Potential absorptive capacity is good indication for the organization's success in the selection of ideas in NPD. The research question RQ1 connects PACAP to NPD performance. The research question RQ2 connects social software adoption with potential absorptive capacity. In addition, PACAP is discussed from the individual and organizational perspectives.

The first sections of the result chapter discussed the change in the organization during the research period. The change between pre and post data collection was confirmed by methodological triangulation. Pre-post interviews and administrative user statistics indicated clear change, and that was supported by the quantitative data. The support by quantitative data was concluded by contrasting principal components between pre and post datasets.

The deepen patterns unveiled by PCA for case company 1 indicated that those who spent time on commenting ideas submitted in OCT cannot be identified with their habits to communicate with different stakeholders (Appendix 9: **Acquisition valuator**). In addition, idea selection was a somewhat unique variable at the pre-data set, but in the post-dataset it has statistical similarities with assimilation and acquisition (Appendix 9: **Augmented assimilation**). Furthermore, **Assimilation**, **Idea selection**, and half of the **Acquisition from external parties** –construct from the pre-data set are transformed into **Augmented assimilation** in the post-data set (Appendix 9). And **Communication with external parties** and the other half of the **Acquisition from external parties** are transformed into **Augmented communication with external parties** in the post-dataset. In addition, the awareness of colleagues' ideas is among the acquisition components in the pre-data collection (**Limited acquisition**) but not any more in the

post-data set (**Acquisition**). Interestingly, likelihood to submit ideas into the idea management tool and likelihood to comment ideas in the idea management tool are not factors in the same component in post-data set, as those are discussing acquisition in OCT perspective (Appendix 9). Additionally interesting is the perception that external parties are a fruitful source of new ideas -item is not significantly related to, for example, the amount of interaction between the organization's members and external parties. Intuitively, that kind of connection should have been existed. The motivation for interaction seems not to be collecting new ideas, and that piece of information suggests that the case organization 1 is following a technology push strategy rather than technology pull.

The point of interest in the Appendix 10 is **External parties as valuable source of ideas relating** to case company 2**.** That suggests that discussions with external parties take place during the development process, but these interactions are not based on organizational functions or positions, as there are no statistical similar variances among these variables. In addition, **Succesful NPD** indicates that assimilation is relating on climate in organization and senior management's efforts to multifunctional teamwork. Variances relating to communication and collaboration in many forms have significant factor loadings to **Increased transparency**, including idea selection. However, support from senior managers for multifunctional teamwork is not among these. The explanation may be that senior managers are not active members of OCT communities that are open to all organizational members, and therefore their perception towards OCT might be considered unclear by the rest of the organization. In addition, **Augmented assimilation** and **Proactiveness of organization** in the post-dataset enable interesting findings. Based on **Augmented assimilation**, assimilation is related to the activity to use OCT, and **Proactiveness of organization** indicates the proactiveness of the organization, as valuable ideas are considered to have been connected to the customer's potential needs.

Appendix 11 addresses the case company 3 and interestingly **Lack of communication between projects**–construct in the post-dataset implies that despite the more dialogic climate, organizational members are expecting even more communication between projects. Most likely the reason is OCT. Organizational members have noticed the possibilities and also they have realized that active usage is not adopted in all projects. Point of notice is also that unlike on the previous case organization, amount of interactions within the organization and the awareness of current customer needs are generating the main loadings to the same principal component (Appendix 11: **Increased awareness**). Interactions between internal functions seem to increase information transparency in an organization.

The conceptual model that was synthesized from literature in the end part of Chapter 2 was used to address the change through regression analysis. According to the conceptual model, the research studied the research question from four perspectives: a) communication about knowledge and ideas, b) the NPD environment, and how those reflect on c) the acquisition and d) assimilation of knowledge and ideas. The research questions were addressed through these perspectives using a linear regression analyses. The number of variables relating the NPD environment and communication was decreased by PCA and those principal components are used in regression analysis. Furthermore, the conceptual model was revised according to the regression analysis. At the end of the quantitative analysis, additional sparks of interests were also pointed out by contrasting the distribution of items between active and conservative users. The methodological triangulation did not reveal any major issues of discontinuity.

RQ1: How does an enterprise level social media tools usage influence the NPD performance through potential absorptive capacity?

Idea selection

The impact on idea selection has been addressed by contrasting users based on their usage activity and by regression analysis through PACAP. The NPD performance witnessed an increase in terms of the 7.3% better idea selection. The numerical value for the increase is based on contrasting distributions between active and conservative users on the item level. According to the results, the ability to screen and select the best ideas is positively related to increased collaboration in the organization. The increased intra-organizational transparency decrease uncertainties referred as the ‘white map’ by Sarasvathy (2001). Therefore, OCT implementation can be seen as one good method for increasing NPD performance. That finding is aligned with the regression analysis and revised conceptual model presented in Figure 4.1. OCT increases assimilation quality (in terms of intra-organizational transparency) and organizational members become more aware of various knowledge, projects, and ideas and the results also suggest that OCT enables an organization's members to contribute to those ideas by, for example, commenting via OCT. The motivation to enhance the NPD process can be linked to the literature, as success in NPD is crucial for the success of the whole organization (Cooper & Kleinschmidt, 2007).

RQ2: How does the usage of enterprise level social media tools influence the potential absorptive capacity through communication and NPD environment?

The both quantitative and qualitative data address communication and collaboration. However, qualitative data enables fruitful insights to working practices inside organizations, whereas correlations and predictabilities of items are reached with the quantitative data. Relying only on qualitative data the detailed impact of the OCT usage would have been challenging to be identified, but with quantitative data, in particular contrasting active and conservative users, identifying the impact on detail level is enabled.

Acquisition of knowledge and ideas

The evidence strongly supports that the usage of OCT will increase both the amount and the quality of knowledge acquisition. The related hypothesis H1 is supported by regression analysis and by contrasting the distribution of items between active and conservative users. Regression analysis suggests that there is a significant impact on the acquired amount of knowledge with active use of OCT. Based on contrasting distributions in terms of usage activity, the increase is ~12% ($p<0.1$).The regression analysis confirms the positive impact on the quality of acquired knowledge due to the use of OCT and that is also confirmed by the user activity perspective. The connection between increased transparency and knowledge acquisition has been suggested in the existing literature; for example through collaboration (Bojica & Fuentes, 2012; Yli-Renko et al., 2001) or as helping organizational member to utilize received knowledge from external parties (Alexy et al., 2013). The quality of acquired knowledge shows an outstanding 61% increase ($p<0,05$) when concentrating on cross-functional contribution based on differences between active and conservative users. Hypothesis H2 is therefore supported. The present study cannot be used to confirm the step-function relating the quality of acquired ideas suggested by Björk and Magnusson (2009). The shape of the performance curve remains unknown due to the limited data collection rounds. Additionally, task requirements have an insignificant impact on knowledge acquisition. That implies that OCT is not only considered to either increase requirements of tasks (Sims et al., 1976) or increase perception of task complexity (Tiamiyu, 1992) that might affect knowledge acquisition.

Assimilation of knowledge and ideas

The impact on assimilation is addressed also in terms of amount and quality but the collected quantitative data indicates insignificant impact on the both of those aspects. The related hypotheses, H3 and H4, are therefore not supported by regression analysis or contrasting distributions on the item level. However, according to the regression analysis, constructs related to intra-organizational communication become stronger due to the use of OCT and that can be argued to be the positive impact of OCT. Also the qualitative data suggest that knowledge assimilation is greater. Organizational members perceive that they can reach beyond the closest peers with OCT, and they can find and use the acquired knowledge that already is inside the organization. Interestingly, despite of indications by Todorova & Durisin (2007), increased transparency and awareness are not resulting in greater assimilation and the impact of OCT suggested by Denyer et al (2011) is not confirmed in terms of quantitative data. The explanation might be that the impact on assimilation requires more time to be clear. The present research measured the first reaction based on OCT, in terms of new tool and new working practices. Not all case organizations had existing guidelines for organizational members to utilize the tool or had generated new practices to be implemented at the time of OCT roll-out. New working practices require a 'management innovation' that is not as straightforward to implement as a technology innovation (Birkinshaw, Hamel, & Mol, 2008). Additionally, the role of task requirements is similar than knowledge acquisition, as it seems to be insignificant also on knowledge assimilation in the both amount and quality.

Communication about knowledge and ideas

Surveys and interviews established a solid foundation from which to discuss the working practices. Communication and collaboration are two crucial elements, so the metrics focused on those. Communication was discussed through three aspects: communication within a team, cross-functional communication, and communication with external parties. Communication with external parties was not included into the main analysis of the impact of the OCT as OCT was not used for that at the time of data collection. The metrics for each of these aspects was divided into amount and quality, and those were addressed by quantitative and qualitative data.

Regression analyses suggest that cross-functional communication is significant for the both acquisition and assimilation of knowledge. That supports existing discussion in the management literature (Flatten et al., 2011; Yli-Renko, 1999), but regression analyses in the present study addresses also the impact of OCT. According to the results, the usage of OCT seems to impact particularly on cross-functional communication related construct. Interestingly, that impact is not confirmed by

contrasting item level distributions even though connection between increased awareness and cross-functional communication was clearly suggested in the existing literature (Bojica & Fuentes, 2012). However, together with qualitative data, cross-functional communication will be increased in terms of amount and quality. Perceived changes between pre and post data collection phases (Appendix 10: CPC) along with the quotes relating communication (Appendix 10: NC) are supporting this. According to interviews, OCT has enabled more intra-organizational interactions that have also perceived valuable.

The increased amount of communication is missing the quantitative support, but on the other hand, as the usage of OCT has –nevertheless- increased, it can be argued that (even though the amount might not have been increased) the place of those discussions has been changed. Communications seem to take place in virtual communities. Together with increased transparency, the result is that the organization can utilize better the knowledge that is in those discussions.

Furthermore, communication within a team shows a significant change when distributions on the item level are compared for active and conservative users. Active users are 13% ($p<0,05$) more aware of various types of expertise on their team, but they also consider that they can utilize their peer's expertise 12 % better ($p<0,05$). Those findings based on quantitative data are convergent with existing literature about team communication (Bercovitz & Feldman, 2011). Interviews support these findings, as qualitative data suggest that awareness has been increased between team members due to the increased transparency. As a whole, the present study is not supporting findings of Martins et al (2004) about vague impact of virtual teams on communication inside a team. According to the results, the impact is positive.

NPD environment

The NPD environment was discussed through aspects of process rigorousness, senior manager commitment and involvement, innovative culture and climate, and decision-making authority. Regression analysis reveals that the NPD environment influences potential absorptive, but the impact of the four aspects of NPD environment is not equal. Process rigorousness seems to have significant impact on PACAP, especially through NPD strategy, standardized process, and go/no-go decisions. That finding is confirming the process rigorousness and ACAP relation discussed in the existing literature (Murovec & Prodan, 2009). The results relating other aspects of NPD environment provide partly augmented insights to the existing literature. Increased awareness is not resulting in decision making processes (Frishammar et al., 2011). It might be that OCT is understood as a tool, not as a part of new working practices. Additionally, as indicated by da Cunha & Orlikowski (2008) the adoption rate among

senior managers might not be on the high level, and therefore the decision making process and practices might not utilize the communality that OCT provides. In addition, even though the technology adoption depend on organization culture and climate, the suggested feedback loop based on the intertwined nature of ACAP and organizational culture, was not confirmed by the present study. Therefore, according to item's distributions contrast, quantitative data is not supporting changes in NPD environment that can be traced back to the usage of OCT.

6. CONCLUSIONS

The present research enters a very interesting discussion. The amount of research related to social media is huge nowadays. Rhetoric is highly positive and there are even some indications of management fashion described by Abrahamson (1996); all should use social media tools, because the usage will make life better and organizations more efficient. The present research joins in the discussion but focuses on measurable impacts and benefits. The foundation for reported benefits is built on quantitative and qualitative data that are collected from organization members in three cases. In addition, an interesting stream of supporting information is provided by the administrative user statistics about the actual usage of OCT in the case organizations. The combination of collected data is fruitful and looking it through the theoretical lens of absorptive capacity enables an excellent perspective and settles the metrics on a strong foundation. Absorptive capacity theory describes the importance of finding the right knowledge and using it in the most effective way. According to theory, knowledge goes through four phases; acquisition, assimilation, transformation, and exploitation, before it is fully useful for the organization. The present research focuses on knowledge acquisition and assimilation and on how the usage of social media tools will influence those dimensions of ACAP. Online collaboration tools (social media tools used in enterprises) can be used to decrease the time it takes for new resources to settle in. A new resource will get a good standing point with the projects/tasks and also an understanding of the social cohesion of the team by looking through the discussions and comments in the virtual community.

6.1. Contribution of the research

Theoretical contributions

The main academic interests in the present study relate to absorptive capacity, new product development, social media tools, and internal collaboration. The main contribution of the study's discussion is rooted in these streams of management literature. Furthermore, the present study has several contributions to make to the existing management literature, but the main contribution is linking absorptive capacity with social media tools and new working practices.

The research joins in the discussion about whether ACAP is a process or not by introducing quantitative metrics. Even though absorptive capacity has been vastly

studied by scholars since the seminal work by Cohen and Levinthal (1990), bodies of literature relating to quantitative and empirical findings are scarce (Murovec & Prodan, 2009). The present research supports the discussion that absorptive capacity can be measured directly and the findings can be statistically connected to the theory (Flatten et al., 2011; Yli-Renko et al., 2001).

The relation between high ACAP and the adoption of new technologies has been discussed in the literature (Denyer et al., 2011; Samoilenko & Nahar, 2013; Saraf, Liang, Xue, & Hu, 2013). The main argument is that high ACAP implies easier adoption of new technologies. In the current research, the interest was in finding out whether the connection works also the other way round or not. The present research contributes to ACAP literature in three ways: The research sparks discussion on that theme generally, as the result strongly supports the increase of PACAP due to the active use of OCT. Secondly, the understanding of the connection between communication and PACAP is strengthened, and thirdly, active usage of OCT is linked quantitatively to higher PACAP and better idea selection in the NPD process.

Active usage of OCT that is confirmed qualitatively by interviews and quantitatively by administrative user statistics about user activity will increase potential absorptive capacity from the individual perspective. In addition, the results show that increased transparency between internal functions will also help the organization to share information among organization members. Furthermore, increased awareness increases the PACAP at the organizational level. A PACAP increase is strongly rooted to individual benefits due to the OCT usage.

According to the regression analyses, increased impact of cross-functional communication on PACAP is one manifestation of OCT utilization. According to interviews, benefits are based on increased transparency that has generated increased awareness. Furthermore, as an easy-to-use communication platform, OCT lures an organization's members to contribute on various themes and share their own expertise to help others. Therefore, barriers for asking help are smaller because the right party can be spotted easily. The combined result shows increased knowledge acquisition in the organization.

The ability to select better in the beginning of NPD is crucial. One of the present research’s contributions is that it joins in the discussion with empirical evidence that connects active usage of OCT to better idea selection. Successful idea selection is among the critical success factors in literature and therefore that should be concentrated on by the organization (Barczak et al., 2008; Barczak & Kahn, 2012; Cooper, Edgett, & Kleinschmidt, 2004a; Cooper, Edgett, & Kleinschmidt, 2004b; Cooper, Edgett, & Kleinschmidt, 2004c; Cooper & Kleinschmidt, 1995a; Cooper & Kleinschmidt, 2007; Griffin, 1997). In addition to idea selection, these critical success factors acknowledge the importance of cross-functional communication as the antecedent of NPD

performance. Therefore, as cross-functional communication has been found to increase due to the OCT, the present research suggests as one of the key takeaways that OCT utilization should be included among the success factors. That key takeaway is supported by the existing knowledge that indicates utilization of communication technology innovations to enhance collaboration is crucial for organization survival in the long run (Rowlands, Morgan, & Hawksworth, 2006).

The present research contributes also to NPD performance discussions in the management literature. The beginning of the NPD process is the most important phase during the NPD (Kim & Wilemon, 2002). PACAP, cross-functional communication, and idea selection can all be increased with the active usage of OCT. Having realistic awareness about the expertise of colleagues in the organization will guide the selection but high PACAP also reflects on the amount of valuable acquired knowledge. Information value for the organization is best known by its organizational members and OCT will connect those members and enable them to build evaluating decisions on all relevant in-house knowledge.

Existing works suggest that the capacity of teams can be influenced by their composition (Bercovitz & Feldman, 2011; Lazear, 1999). The foundation for OCT is that the borders of project team are diminished. Ideally, all organization members can contribute on various issues and, according to Lazear (1999), the project group composition is then not missing any relevant party and the full potential for the organization can be reached. So far, the main interests in the literature have been B2C or B2B interactions (Jussila, Kärkkäinen, & Leino, 2011; Kärkkäinen, Jussila, & Janhonen, 2011; Vuori, 2011), but the empirical studies about the impact on internal collaboration have been scarce. The present research contributes to literature about social media technology by sparking a discussion from the perspective of internal collaboration and empirical evidence.

And last, the contribution is the revised conceptual model that can be used to measure the impact of OCT. The model has two sides: theoretical and practical. On the theoretical side, the conceptual model proposes a synthesis from NPD success factors and ACAP literature and connects those to the usage of social media tools. Various NPD success factors were collected and the most appropriate ones relating to social media implementation were selected to be used in the conceptual model. In addition to the theoretical side, the model also addresses the concrete impact of social media tools and that impact can be measured. The proposed revised conceptual model is validated with empirical data but it is also shared with the academic society for further discussion.

Managerial contributions

In addition to theoretical contribution, the present research offers interesting managerial contributions. Managerial contributions can be addressed through benefits on different levels. Strategy-level benefits for implementing new technologies are, for example, increased productivity (Trist & Bamforth, 1951), efficiency gain (Rockart & Morton, 1984), and delivery improvement (Tranfield & Smith, 1998). Rhetoric in executive reports indicates that any benefit from social media technology, virtual collaboration, and improved performance cannot be achieved if existing tools are not in use in the organization (Meroño-Cerdán, 2008; Migdadi et al., 2012). However, to win these benefits, companies should have a strategy of how cross-functional co-operation and processes can be utilized (McKinsey, 2012). The implementation of OCT can be argued to be a leveraging strategy because OCT can be used to assimilate the existing knowledge throughout the organization (Tushman & Anderson, 2004). Involvement of employees should be increased, and one method to reach that is to broaden the definition of innovation (Dahl et al., 2011). In addition, if new product development is understood also to contain radical or disruptive innovations, many organization members might not feel that they fit in. The mindset should be changed to acknowledge different roles in NPD. Contributing to the development process should also include roles of commenting and connecting, in addition to idea generation and actual developing tasks. And it should be possible to change these roles daily, if required, to be appealing to wide intra-organizational audience.

Organizations that have a proactive strategic orientation should notice crucial benefits based on increased PACAP (Liao, Welsch, & Stoica, 2003). Those organizations are relying on their innovativeness and they are proactively seeking solutions for market demands. According to the results, active usage of the social media tools increases intra-organizational awareness and transparency and therefore it can be used to enhance implementation of the organization's strategy. According to Denyer et al. (2011), the success in implementing a new technology can be addressed in terms of a) the organization members' perceptions and attitudes, b) how easy those members find the actual use, and c) managers' initial understanding of and commitment toward the change that the implementation requires. In other words, starting to use OCT will not be a straightforward "plug-and-play" type of implementation; rather it is similar to other new technology implementation and therefore it has a strategic impact.

According to the results, using the social technology tool should benefit or help the daily tasks of an organization's members to be actively utilized. This argument is supported by Dahl (2011). Without perceived individual benefits, the use of the tool most probably is buried under the daily task load and the usage of OCT won't be active. Perceived benefits depend on the type of the OCT. Different collaboration tools can be sorted out by the frequency they are used; discussion forums, repositories, shared databases, and workflows (Migdadi et al., 2012). On the other hand, OCTs can be a

facelift (such as collaboration add-ons) for an existing application or they can be stand-alone collaboration platforms. For example, intranets are diverse and they can be used as platforms where different OCTs are integrated (Meroño-Cerdán, 2008). According to results, the perception that it is just “one more task to do” should be smoothed away, and all kinds of OCTs should be easy to access without a separate log-in. In addition, practitioners should not concentrate on different categories but follow the strategy and the fundamental organizational target when implementing OCT.

The possibility of information filtering in OCT is perceived to be a benefit and identified as the main difference for example towards emails. Therefore, OCT should be used to filter out the noise from all communications. An online collaboration tool can be used to enable a user to access all communication that takes place in the organization. Inevitably there is shared a huge amount of information that is not relevant to all organizational members. One should filter out the noise to focus only on the valuable items. Filtering out irrelevant items enables the user to become the master of the time he/she uses and to spot relevance discussions/knowledge within the organization. As a result, filtering the available information also reflects positively on the quality (in terms of relevancy and perception of value) of perceived and shared information because the user can choose the peers, topics, themes, and keywords that he/she prefers to contribute to or to be aware of.

In addition to increasing the quality of communication, the usage of OCT will also have other positive dimensions. One of these is an increase in employee satisfaction that is based on improved communication and transparency. Increased satisfaction can also be reached through new working practices. Senior managers can introduce new working practices based on OCT at the organizational level but also allow the organization's members to find and utilize additional best practices. These unintended ways of using OCT might become an asset for organization. Most likely, there will be organization-specific ways to utilize OCTs that are not thought to be important in advance by senior management. One of those might be related to the workflow type of use; middle-level managers can assign and follow tasks according to their preferences.

Network transparency is one crucial antecedent for effective and efficient communication (Moenaert et al., 2000) and, from that perspective, the most important impact on the practical level is based on increased transparency. That finding challenges traditional top-down communication, enables intense cross-functional communication, and reflects positively on the well-being of the organization's members. In addition, the organization's size and number of employees reflect on these benefits. Typically large organizations have challenges with cross-functional communication and the transparency of projects, functions, and levels is limited (Szulanski, 1996). Information systems can significantly support internal transparency, especially in a small business environment (Street & Meister, 2004), and the present research suggests (align with Saldanha & Krishnan, 2012) that the impact is similar in large enterprises. Collaborative

processes and knowledge sharing enabled by OCT create links between past, present, and future, and connect the organization's members to the decision-making process (Migdadi et al., 2012; Szulanski, 1996). The existence of these links will help organization reach the better performance in NPD as utilization of potential capabilities of various organization members becomes as easy as Sunday morning.

6.2. Reliability and validity assessments

The collected data include different kinds of data (quantitative and qualitative), but also administrative user statistics about OCT usage and a lot of informal discussions with representatives of the case organizations. The number of different data sources and the convergent findings among these data sources in each case organization relieves concerns about reliability and validity. The present research aims to generalize findings based on case organizations. That introduces certain validity and reliability concerns about the generalization of cases that should be discussed.

Reliability in research can be discussed in terms of whether a different researcher would have reached the same conclusions or not. Validity, on the other hand, can be confirmed by verifying that the researcher has had the access to the right information and that it has been understood correctly. Data collection with an online survey is independent of the researcher, but the semi-structured interviews always have an aspect of dialogue that might result in various discussion paths. But, due to the pre-defined structure, the dialogue had fixed themes and topics and therefore the influence of the researcher was narrowed. Reliability and validity concerns about the results are relieved by triangulation, which is based on contextual validation between quantitative and qualitative data, member checks, and referential adequacy.

Metrics to measure PACAP are not directly adapted from existing studies but are synthesized from management literature. Therefore, the validity of the specific questionnaire items cannot be directly verified by existing studies. However, concerns about reliability and validity are relieved by methodological triangulation between quantitative and qualitative data and contextual validation. The combination of online surveys, semi-structured interviews, administrative user statistics about the actual usage of OCT, and other informal communication in case organizations placed the main findings and conclusions on a solid foundation. In addition, the validity of the metrics was confirmed with PCA to elicit common patterns that implicated changes between pre- and post-data collection, but also items loaded their intended constructs. Member checks are used to verify the measured data and results based on all findings based on each case organization. Additional qualitative data about the utilization of social media tools was used to follow the referential adequacy approach. That approach strengthens the reliability and validity of the measurements because the measurements used in the

research are validated with other data that were not included in the research's datasets. Confirmability of the findings is addressed through transparency in the results chapter that relieves concerns about the interpretation of raw data about the usage of the statistical tools, and finally to hypothesis testing. The straightforward path is reproducible for scholars.

6.3. Limitations

The data collection based on case organizations introduces limitations in terms of the number of cases and the selection of cases. The number of cases can be identified as a limitation. Even though respondents were rather heterogeneous, based on background information, the number of cases might not have been enough to reach saturation about the phenomenon in general. However, it is not trivial to define the required number of cases as there is no "right" number of cases. For example even only one case might be enough (Siggelkow, 2007; Yin, 1994). The number of case organizations is a limitation mainly for the generalizability of the conceptual model used in the present research. Therefore the conceptual model should be further tested with data based on additional cases. In addition, case organizations in the present research were biased toward large enterprises and the generalizability of the findings into any other context might be limited and the validity of the results might be compromised in other research settings.

Another limitation concerns data collection. The adoption rate of the OCT and user activity during the post-data collection had not reached the final level and therefore the impact of OCT might not have been fully stabilized. Differences between active and conservative users are considerable at the implementation phase, and organizational level impact depends on adoption rate. That limitation reflects on the results and findings and might hide some of the long-run benefits. Also, not all findings based on short-term results are the same from the perspective of longevity. The high expectations in the early part of OCT utilization might decrease as time goes by (O'Leary, 2008).

The conceptual model is tested with principal components as it was statistically unnecessary to use the whole set of independent variables. Principal components that had eigenvalue greater than 1 were selected and those explained ~62% of the cumulative variance of the whole dataset. Even though the explained cumulative variance is at the acceptance level (Hair et al., 2010), it might have left something not fully explained and congruently, limiting the validation of the conceptual model.

The discussion about the impact of the OCT relies on the both quantitative and qualitative data. Findings that were based mainly on the insights of qualitative results are not as strong as they are lacking the full quantitative support. For example findings that indicated increased amount of cross-functional communication are mainly based

only on qualitative results. Therefore there are some limitations concerning findings and observations without methodological triangulation.

The focus in data analysis was strictly on intra-organizational communication and collaboration. Therefore acquisition and assimilation were both addressed based on depending variables relating amount of received ideas from other internal functions, likelihood of discussion between internal functions, collaboration between internal functions and awareness whether the customer need is used to drive the development process. Whereas the strict focus limits discussion, it also clarifies the contribution. The impact of the OCT usage to any other aspect is beyond the findings presented in the present study.

6.4. Further studies

The present study focused on PACAP and discussed it through focused research questions. The tight focus was reflected in the data analysis and, even though the huge amount of data collected might enable many other insights and perspectives about social media tools, they are not included into the dissertation. For example, the impact of the NPD environment on communication and how it is changed when social media tools and new working practices are implemented might be a fruitful starting point for further research. Another possible insight could be addressing the multifaceted impact of OCT utilization with more detailed resolution through several dependent variables.

In addition, the positive expectations about social media tools are overwhelming, yet the best practices and concepts are under discussion, especially in the context of small and medium-sized enterprises (SME). The present research addressed the theme from the large enterprise perspective and the validity of those findings should be tested in smaller organizations and institutions. Findings synthesized from current datasets might not be optimal for smaller organizations as the whole aspect of implementing and utilizing OCT might be different. It is presumable that, for example, perceived benefits might be somewhat different in the SME context. Therefore, further studies are needed to compose valid arguments in those contexts. If transparency is not among the main concerns, the benefits might be connected to the virtual cloud aspect of the OCT, where material and discussions are stored to be easily accessible everywhere by organizational members.

The methods and practices used to increase the motivation of organizational members to collaborate more with other organizational members is a challenging and interesting theme to point out one clear solution (Hertel, Niedner, & Herrmann, 2003; Sauermann & Cohen, 2010), but that discussion was not in the focus of the present research. The theme is definitely not saturated with academic research and more

research should be invested to identify different aspects of the social media tool usage and new working practices in various contexts.

One of those contexts might be identifying differences among business models as the performance increase based on the OCT might be depending on the business model but also on industry. For example engineering workshops, consulting organizations, and design manufactures might all face different performance increase, yet the increase might be similar among reference organizations with similar business models. The contribution on that discussion is beyond the focus of the present study, and the findings in the present study cannot therefore be used to describe these possible differences among various business models. However, utilization of social media tools in various enterprises is inevitable and therefore supporting research should be invested to clarifying the impact.

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APPENDICES (19 pieces)

Appendix 1. Categorized online survey questions, syntax is adapted from literature (for example Flatten et al., 2011; Sparrowe, Liden, Wayne, & Kraimer, 2001; Talukder & Quazi, 2011)

Item	Description	Reference
ExtIdeas (Acquisition 1)	I receive too few ideas from various external organizations	(Birgit, 2009; Flatten et al., 2011; Kim & Wilemon, 2002; Murovec & Prodan, 2009)
OrgLvsIdeas (Acquisition 2)	I receive too few ideas from various organization levels	(Birgit, 2009; Flatten et al., 2011; Kim & Wilemon, 2002; Murovec & Prodan, 2009; Tsai, 2001)
IntFuncIdeas (Acquisition 3)	I receive too few ideas from other internal functions	(Birgit, 2009; Flatten et al., 2011; Kim & Wilemon, 2002; Murovec & Prodan, 2009; Tsai, 2001)
SharingIdeas (Acquisition 4)	Submitting ideas into the idea management tool is appealing	(Birgit, 2009; Kim & Wilemon, 2002; Tsai, 2001)
DiscussExt (Acquisition 5)	I frequently discuss ideas with external parties	(Adams et al., 2006; Flatten et al., 2011; Murovec & Prodan, 2009)
CommentIdeas (Acquisition 6)	I frequently comment on ideas in the idea management tool	(Hoopes & Postrel, 1999; Kim & Wilemon, 2002; Murovec & Prodan, 2009; Tsai, 2001)
DiscussOrgLvs (Acquisition 7)	I frequently discuss ideas internally with various organization levels	(Adams et al., 2006; Flatten et al., 2011; Murovec & Prodan, 2009; Tsai, 2001)
DiscussIntFunc (Acquisition 8)	I frequently discuss ideas internally between with different functions	(Adams et al., 2006; Flatten et al., 2011; Murovec & Prodan, 2009; Tsai, 2001)
ValueableProductIdeas (Acquisition 9)	Most of the product ideas I receive are valuable to me	(Adams et al., 2006; Tsai, 2001)
IntFuncCollaboration (Assimilation 1)	I frequently develop ideas with various internal functions	(de Brentani & Reid, 2012; Flatten et al., 2011; Murovec & Prodan, 2009; Tsai, 2001; Van & Moenart, 1998)
OrgLvsCollaboration (Assimilation 2)	I frequently develop ideas with various organization levels	(de Brentani & Reid, 2012; Flatten et al., 2011; Murovec & Prodan, 2009; Tsai, 2001)
CurrentCustomer (Assimilation 3)	In my opinion, most developed ideas are targeted to current customer needs	(Adams et al., 2006; Flatten et al., 2011)
PotentialCustomer (Assimilation 4)	In my opinion, most developed ideas are targeted to needs of potential customer	(Adams et al., 2006; Cooper, Edgett, & Kleinschmidt, 2004a; Flatten et al., 2011)
IdeaSelection (Idea selection)	Ideas are screened against each other before ideas are selected	(Cooper & Kleinschmidt, 2007; Murovec & Prodan, 2009)
NoInteractions (Communication 1)	I do not interact with anyone outside of the project team	(Ozer & Cebeci, 2010; Tsai, 2001)
IntraIdeas (Communication 2)	In my opinion, other functional areas frequently provide their ideas for NPD in our company	(Hoopes & Postrel, 1999; Koen et al., 2001; Tsai, 2001)
Multifunctionality (Communication 3)	In my opinion, NPD process requires intense multifunctional interaction	(Flatten et al., 2011; Rosenau, Griffin, Castellion, & Anschuetz, 1996; Tsai, 2001)
IntFuncAwareness (Communication 4)	I am aware of ideas and/or comments from other internal functions that relate to my expertise	(Adams et al., 2006; Flatten et al., 2011; Kim & Wilemon, 2002; Rosenau et al., 1996; Tsai, 2001)
EasyFindExpertise (Communication 5)	It is easy for me to find needed expertise from other functional areas	(Adams et al., 2006; Kim & Wilemon, 2002; Rosenau et al., 1996; Tsai, 2001)

ValuableIdeas (Communication 6)	Most information I receive from other internal functions is valuable to me	(Adams et al., 2006; Kim & Wilemon, 2002; Tsai, 2001)
ShareTeam (Communication 7)	I share my ideas frequently with my team colleagues	(Adams et al., 2006; Flatten et al., 2011)
TeamInput (Communication 8)	I frequently get input from team colleagues	(Adams et al., 2006)
TeamShare (Communication 9)	My team members frequently share their expertise with me	(Adams et al., 2006; Belliveau et al., 2002; Flatten et al., 2011; Tsai, 2001)
AwareTeam (Communication 10)	I am aware of ideas from my team colleagues	(Adams et al., 2006; Rosenau et al., 1996; Tsai, 2001)
TaskReqComm (Communication 11)	My tasks require me to communicate with external parties	(Kim & Wilemon, 2002)
SeldomComExt (Communication 12)	I communicate seldom with external parties	(Kim & Wilemon, 2002)
ExtShare (Communication 13)	External parties frequently share valuable comments with me during the development process	(Kim & Wilemon, 2002; Tsai, 2001)
AwareExternal (Communication 14)	I am aware of ideas from external parties that relate to my expertise	(Kim & Wilemon, 2002)
SkunkWorks (NPD Environment 1)	I am allowed to spend time in activities that are not directly connected with my daily tasks	(Cooper & Kleinschmidt, 2007; Frishammar et al., 2011)
GoNoGo (NPD Environment 2)	Go/no-go decisions are made by senior management	(Cooper & Kleinschmidt, 2007; Frishammar et al., 2011)
NPDStrategy (NPD Environment 3)	Selection for NPD projects is supported by NPD strategy	(Kahn, Barczak, & Moss, 2006)
StandardProcess (NPD Environment 4)	Screening filters in the beginning of NPD process follow a standardized process	(Reinertsen, 1999)
Pre-specifiedProcess (NPD Environment 5)	The NPD project will always follow a pre-specified process	(Cooper & Kleinschmidt, 2007; Frishammar et al., 2011)
SamePM (NPD Environment 6)	The same project manager is responsible for the project from the beginning to its end	(Cooper & Kleinschmidt, 2007; Frishammar et al., 2011)
RareComm (NPD Environment 7)	In my opinion, communication between projects is rare	(Kim & Wilemon, 2002; Ozer & Cebeci, 2010)
ExtIdeas (NPD Environment 8)	External parties are a fruitful source of new ideas	(Kim & Wilemon, 2002)
Feedback (NPD Environment 9)	I consider feedback about my ideas as an important part of internal communication	(Kim & Wilemon, 2002)
SMsupport (NPD Environment 10)	Senior managers visibly demonstrate support for multifunctional teamwork	(Flatten et al., 2011; Murovec & Prodan, 2009; Rosenau et al., 1996)
SMcomment (NPD Environment 11)	Senior managers spend time on commenting ideas	(Kim & Wilemon, 2002)
Resources (NPD Environment 12)	In my opinion, resources are adequate for NPD projects	(Kim & Wilemon, 2002)
TimePressure (Task Requirements 1)	I perceive myself as being under a lot of time pressure in my job	(Sims et al., 1976)
ComplexInfo (Task Requirements 2)	In my opinion, the information I usually receive has a complex nature	(Byström & Järvelin, 1995)
HowOften (OCT Usage 1)	How often do you use OCT in your work	(Denyer et al., 2011; Migdadi et al., 2012)
ImportantAspect (OCT Usage 2)	The most important aspect for the enterprise level social software	(Denyer et al., 2011; Vuori, 2011)

Appendix 2.

Topic/theme	**Codes**	**Reference to quantitative data**
Working practices	Idea generation, NPD process, challenges change	Acquisition, assimilation, communication, NPD environment
Communication	Increase, decrease, no effect.	Communication
OCT	Expectations, best practices, training, most important aspect	Controlling variables, NPD environment, communication

Appendix 3.

Structure of the online survey

Pre-data collection	Post-data collection
Survey attendant's background 9 questions	(a) Survey attendant's background 10 questions
(b) The current NPD process emphasizing idea acquisition, assimilation, communication habits, and working practices 40 questions	(b) The current innovation/NPD process emphasizing idea acquisition, assimilation, and communication habits 40 questions
(c) General attitudes toward and familiarity with social media tools and technologies 6 questions (4 controlling variables)	(c) Usage amount of social media tools as consumers but also as organizational members for work tasks 8 questions (6 controlling variables)
(d) Feedback 2 questions	(d) Feedback 2 questions

Appendix 4.

Structure of the interview

Pre-data collection	Post-data collection
1.) Introduction. Description of the research in general Description of the structure of the interview in detail	1.) Summary of the research so far
2.) Discussions about interviewee's background Position /organization Education Work history	2.) Update interviewee's position
3) Discussions about current way of working Challenges? Thoughts about how the process might be better	3.) Highlight any changes between interview rounds Organizational changes Any changes in number of applications (replacements/new ones/obsoleted)
4) Discussions about optimal way of working (if not covered during other topics)	4.) Discussions about current working practices
5) Summary and wrap-up	5) Summary and wrap-up

Appendix 5

Principal component analysis

Principal component analysis (PCA) is a statistical tool that is used to reduce the number of correlating variables by introducing artificial but linear components (principal components) that maintain all statistically relevant information in the dataset. PCA is used for quantitative data to decrease the number of variables by grouping them into statistically similar groups (Jolliffe, 2005). These principal components can be used in regression analyses without any risk of multicollinearity (Jolliffe, 2005). Visually, PCA aims to find those surfaces where the projected data will generate the greatest variance without losing any significant information. The number of components is therefore smaller than the number of original variables. As a result, the first main component will explain most of the variance and, as the correlation between the component number and the amount of variance will explain, the explainability of the last principal component will be the lowest. Typically, further analysis (such as regression analysis) will proceed with those components that will have more than one eigenvalue; i.e., they will explain more than one variable (Hair et al., 2010). Factor-loading distribution among principal components can, in some cases, be impacted by allowing the rotated axis of coordinates. The rotated axis of coordinates can be orthogonal or non-orthogonal. In the present research, orthogonal Varimax rotation is used. Varimax rotation aims to find a load matrix (set of principal components) where each component includes high loads for some variables and low loads for some other variables. In the present research, PCA is used in different datasets to find out changes in each case organization and for combined datasets. Changes in principal components can be used to describe variations at deeper level inside organizations (Jolliffe, 2005).

Mann-Whitney U test

The Mann-Whitney U test is a statistical non-parametrical test for testing the null hypotheses that two sample sets are statistically the same. In other words, the Mann-Whitney U test is a tool to analyze the specific sample sets for significant differences between them. Because it is non-parametrical, it does not require a normal distribution assumption in the sample set. If two datasets are statistically similar, it can be argued that they represent subgroups of the bigger group or that either one of them is a subgroup of another. In that case, any conclusion, for example, based on their different means cannot be made. The Mann-Whitney U test is used in the present research to test statistically significant differences between different datasets and therefore the main objective for the Mann-Whitney U test is to verify that datasets are not statistically similar and the findings based on the differences are statistically significant. In the present study, the 0,05 significant level is used. The test requires that the scale for

responses be ordinal, so that variable values can be compared (it is meaningful to compare responses "7" and "2" in terms of bigger or smaller). Ordinal scale, as pre-requisition, is satisfied with the used samples in tested datasets. The Kruskal-Wallis test is an extension to Mann-Whitney U-test that is used for three or more groups.

Linear regression analysis

Regression analysis is used to forecast the prediction ability of variable(s) for some other variable(s) (Hair et al., 2010). Multiregression analysis is used to test the predictability of several independent variables for the dependent variable. Regression analysis includes terms of coefficient of determination (R^2), Adjusted R^2, and F.

The coefficient of determination (R^2) is used to indicate how well the data fits into the model. R^2 can have values between 0 and 1, where values close to 0 indicate poor fitting, and values close to 1 indicate a very good fit to the model. The coefficient of determination can be criticized because it will be increased if irrelevant factors are added into the test even though those should be irrelevant for the goodness of fit and not increasing it (Hair et al., 2010). To avoid that risk, an adjusted R^2 can be used because it will not take account of these irrelevant values, but takes account only of values that increase the predictability of the model. Therefore, adjusted R^2 might be a more usable coefficient to use for testing the model goodness, especially if there are contrasting models with different amount of variables. The adjusted R^2 cannot be bigger than R^2.

Another statistical tool used in the present research is the F-test described in equation 3.4 below. It gives a number that represent independency between test variables. Larger F gives stronger evidence against the null hypothesis, H_0. However, high F only gives the indication that one test variable (in multiregression) has significant impact on prediction, and any arguments for all of them cannot be made (Hair et al., 2010).

Appendix 6.Demographics of the interviewed persons

	N/pcs	%-share
Gender		
Male	14	67%
Female	7	33%
Highest degree		
University	17	81%
Organization level		
Senior manager	4	19%
Employee	17	81%
Organization		
NPD	9	43%
Marketing & Sales	3	14%
Consulting	4	19%
Other	5	24%

Appendix 7. Demographics in quantitative data

	Pre	Post	Cumulative	%-share
Gender				
Male	119	104	223	88.5%
Female	12	17	29	11.5%
Highest degree				
University	109	86	195	77.4%
Organization level				
Senior manager	33	42	75	29.8%
Employee	98	69	177	60,3%
Organization				
NPD	54	48	102	40.5%
Consulting	15	20	35	13.9%
Assembly	15	2	17	6.7%
Tech support	17	5	22	8.7%
other	30	46	76	30.2%

Appendix 8.

Pre data collection phase	
Quote from interviews	code
Perceived challenges	
"Communication is one that pops in my mind and personal abilities to find and share information with the right people in a right way…"	PC1
"Communication, sharing information, finding the right people"	PC2
"Communication is always a challenge"	PC3
"…Communication between R&D and those who discuss with customers, between those there is not really happen communication…"	PC4
"…finding the right person and expertise is clearly a challenge"	PC5
"…Finding the relevant information [is a challenge]…"	PC6
"…to have more contribution from different stakeholders, and to share more information with them"	PC7
"I do not think that the system or process is broken, the information is there, but it is scattered into various places"	PC8
"Scattered understanding of the big picture"	PC9
"…it is easier to sell something concrete [hardware] than solution"	PC10
"Majority of the time is spent for hand over. Teaching, knowledge sharing, and communication…"	PC11
"…How to do it, what to be moved forward and what [projects] to be killed "	PC12
"…Delivering information has always been a challenge, and it always will be a challenge…"	PC13
"…forecasting the actual schedule, the delivery time"	PC14
"On practical level, one of the main challenges is resource allocation. We have always a huge amount of interesting ideas that should be studied further, but how to find the needed resources. And especially resources that have sufficient competence. "	PC15
"…Well, I think also people's behavior, as I said, we have already SharePoint which is a good tool and which should be used. But it's sometimes, I don't know	PC16

why, people don't want to bother or, I don't know, they don't upload documents there although they should."	
Communication	
"…I think that communication is not efficient [at the moment] "	C1
"[in addition to communication within a team] for cross-functional communication we are using WebEx.."	C2
"I am aware of [product] features because I am part in these discussions"	C3
"Awareness [of projects] is strongly based on personal characteristics"	C4
"I personally don't always know what people are doing [in other site]".	C5
"…some customer related idea might come through sales person, but other sales persons might not be at all aware of that idea"	C6
"…I'm pretty sure that there's no database [for knowledge sharing] for those projects"	C7
Way of working	
"There is no transparency across organization"	WOW1
"Designer probably doesn't even know, as the question [about resource] is pointed directly to his superior"	WOW2
"[Information sharing] …is based on old friendships"	WOW3
"I have heard that people might consider [site] as 'secret society' as not so much information is shared"	WOW4
"…[the process] has not changed a bit, sales persons will sell and the then it comes to us"	WOW5
"… I think those that work from home are more active users of instant communicators"	WOW6

Appendix 9: Principal component analysis for case organization 1, varimax rotation

pre-data collection			**post-data collection**		
Constructs	% of variances	Items in construct	Constructs	% of variances	Items in construct
Limited acquisition	10.2	ExtIdeas, OrgLvsIdeas, IntFuncIdeas AwareTeam	Increased transparency	10.7	EasyFindExpertise, TeamInput, TeamShare, AwareTeam
Assimilation	10.1	IntFuncCollaboration OrgLvsCollaboration	Acquisition	10.3	ExtIdeas, OrgLvsIdeas, IntFuncIdeas
Rigorousness	8.1	NPDStrategy StandardProcess	Augmented communication with external parties	8.7	TaskReqComm, SeldomComExt, ExtShare,
Acquisition from external parties	8.0	DiscussExt, SeldomCommExt	Augmented assimilation	8.5	IntFuncCollaboration OrgLvsCollaboration IdeaSelection DiscussExt
Project orientation	6.9	Resources, SamePM	Rigorousness	7.3	GoNoGo, NPDStrategy
Communication with external parties	6.3	TaskReqComm, ExtShare	Acquisition enabler	6.2	SharingIdeas
Idea selection	5.8	IdeaSelection	Acquisition valuator	5.9	CommentIdeas
Perceived lack of interactions	5.5	NoInteractions	Requirement of multifunctional interaction	5.5	Multifunctionality
Lack of communication between projects	5.3	RareComm	perception of customer need	5.0	CurrentCustomer
pre-specified process	5.0	Pre-specifiedProcess	Valuable ideas	5.0	ValuableProductIdeas
go/no-go decisions	4.6	GoNoGo	Resource allocation	4.7	Resources
Skunk works	4.3	SkunkWorks	Needs of potential customer	4.3	PotentialCustomer

Appendix 10: Principal component analysis for case organization 2, varimax rotation

pre-data collection			post-data collection		
Constructs	% of variances	Items in construct	Constructs	% of variances	Items in construct
Acquisition	11.1	ExtIdeas, OrgLvsIdeas, IntFuncIdeas	increased transparency	13.2	SkunkWorks, StandardProcess, IdeaSelection, IntFuncAwareness, EasyFindExpertise, AwareExternal
Succesful NPD.	10.8	IntFuncCollaboration OrgLvsCollaboration, PotentialCustomer,SkunkWorks, SMsupport	communication within a team	11.6	ShareTeam, TeamInput, TeamShare, AwareTeam
Intra-organizational communication	10.2	RareComm, IntFuncAwareness	Augmented assimilation	8.6	CommentIdeas, DiscussIntFunc, IntFuncCollaboration OrgLvsCollaboration
External parties as valuable source of ideas	7.7	ExtShare ExtIdeas	Acquisition	8.4	ExtIdeas, OrgLvsIdeas, IntFuncIdeas
Multifunctional projects	7. 1	GoNoGo, Multifunctionality	Communication with external parties	6.7	TaskReqComm ExtShare
Communication within a team	7.0	ShareTeam TeamShare	multifunctional teamwork	6.6	SMsupport NPDStrategy
Rigorousness	6.7	NPDStrategy, StandardProcess	proactiveness of organization	6.0	ValuableProductIdeas PotentialCustomer
Cross-functional communication	6.6	EasyFindExpertise ValuableIdeas	Frequent of intra-organizational communication	5.8	IntraIdeas SMcomment
pet projects	5.9	SamePM IdeaSelection	Rigorousness	5.5	Pre-specifiendProcess GoNoGo
ideas received from external parties are shared to NPD	5.8	SharingIdeas DiscussExt	Requirement of multifunctional interaction	4.5	Multifunctionality
Cross-functional contribution	4.8	CommentIdeas DiscussOrgLvs	perception of customer need	4.0	CurrentCustomer
N/A	N/A	N/A	Importance of dialogue in internal communication	3.8	Feedback

Appendix 11: Principal component analysis for case organization 3, varimax rotation

pre-data collection			**post-data collection**		
Construct	% of variances	Items in construct	Construct	% of variances	Items in construct
Communication within a team	10.2%	ShareTeam, TeamInput, TeamShare, AwareTeam	Augmented communication within a team	11.4	Multifunctionality, ShareTeam, TeamInput, TeamShare, AwareTeam, Feedback
Cross-functional communication preferred	9.8%	CommentIdeas, IntraIdeas IntFuncAwareness	Collaboration	8.8	IntraIdeas, StandardProcess SMcomment, Resources
Communication with external parties	9.2%	TaskReqComm ExtShare ExtIdeas	Frequent communication with external parties	7.5	TaskReqComm ExtShare, ExtIdeas DiscussExt
Acquisition	8.0%	ExtIdeas, OrgLvsIdeas, IntFuncIdeas	Acquisition	7.3	ExtIdeas, OrgLvsIdeas, IntFuncIdeas
Standardized project	6.8%	SharingIdeas Pre-specifiedProcess	Rigorousness	6.5	GoNoGo, NPDStrategy
Skunk works	5.6%	SkunkWorks	Horizontal collaboration & Communication	5.7	IntFuncCollaboration ValuableIdeas
Valuable ideas	5.3%	ValuableProductIdeas	Valuable ideas	5.5	ValuableProductIdeas
Project manager stability	5.1%	SamePM	Acquisition valuator	5.5	CommentIdeas
The lack of communication with external parties	5.0%	SeldomComExt	Increased awareness	5.4	CurrentCustomer NoInteractions
Customer needs	4.5%	CurrentCustomer, PotentialCustomer	Intra-organizational transparency	5.0	EasyFindExpertise
Intra-organizational transparency	4.5%	EasyFindExpertise	Project manager stability	4.5	SamePM
Vertical collaboration	4.5%	OrgLvsCollaboration	Lack of communication between projects	4.5	RareComm

Appendix 12. Principal component analysis from pre-post perspectives, varimax rotation

pre-data collection			**post-data collection**		
Construct	% of variances	Items in construct	Construct	% of variances	Items in construct
Acquisition	17.9	ExtIdeas, OrgLvsIdeas, IntFuncIdeas	Communication within a team	22.3	ShareTeam, TeamInput, TeamShare, AwareTeam
Communication within a team	7.7	ShareTeam, TeamInput, TeamShare, AwareTeam	Assimilation	8.0	IntFuncCollaboration OrgLvsCollaboration
Assimilation	7.4	IntFuncCollaboration OrgLvsCollaboration	Frequent intrinsic communication with external parties	6.4	ExtShare, DiscussExt, ExtIdeas
Communication with external parties	6.0	TaskReqComm ExtShare, ExtIdeas	Acquisition	5.4	ExtIdeas, OrgLvsIdeas, IntFuncIdeas
Intra-organizational communication	4.7	IntFuncAwareness RareComm	Go/no-go decisions	4.9	GoNoGo
OCT Usage	4.3	HowOften	OCT usage	4.7	HowOften
Idea management tool as part of the process	3.9	SharingIdeas CommentIdeas ValuableProductIdeas StandardProcess	Resource allocation	4.1	Resources
Intra-organizational transparency	3.6	EasyFindExpertise ValuableIdeas	Mindset of proactivity	3.7	PotentialCustomer ValuableIdeas
Frequent discussions with external parties	3.5	DiscussExt	Utilization of idea management tool	3.4	SharingIdeas CommentIdeas
Idea selection	3.4	IdeaSelection	The frequent of communication with external parties	3.2	SeldomCommExt
The perception of customer need	3.1	CurrentCustomer	Lack of communication between projects	2.9	RareComm
Project manager stability	2.8	SamePM	Bridge between external parties and organization	2.7	SkunkWorks Feedback TaskReqComm
Go/no-go decisions	2.6	GoNoGo	Project manager stability	2.6	SamePM

Appendix 13

Post data collection phase	
Quote from interviews	Code
Changes in organization, communication tools, personal level	
"…the impact of intranet is smaller"	CGH1
"…if we think [about the whole organization], we have not faced any big changes"	CGH2
"…with [OCT] it is easier to share information"	CGH3
"…integration of intranet into [OCT] platform…"	CGH4
"[organizational change] was token very positively by the people "	CGH5
"…Target is that it [OCT] will replace emails but it has not yet happened"	CGH6
"We didn't have any tool [such a collaboration tool], so it's rather new for us. It's not replacing anything that was in place."	CGH7
"…we did not have any correspondence tool before, [OCT] …came as a new tool"	CGH8
Change in challenges perceived at the initial stage	
"…[the use of OCT] of course it will helps, as it helps to identify overlaps…"	CPC1
"…for resource allocation probably not, but for identifying competences it is a great help"	CPC2
"… the 'secret society' is still there….This [OCT] helps, I think so… at least it is a step to right direction…	CPC3
"… There is clearly a significant improvement [in finding a relevant expertise]"	CPC4
"…[OCT] is a good step to increase transparency "	CPC5
Communication	
"I do have feeling that [cross-functional] communication is better now"	NC1
"I would say that general awareness has been increased"	NC2
"I can speak only for my unit, but it [communication] is increased"	NC3
"…even though you are provided access to all information but you are not interested or active about it, you will remain in the dark"	NC4
"…I think, there, then the effect is limited. That's partly because we are in, still in the middle of implementing all this so, the real benefits still have to come."	NC5

"… Yes I see that now the situation is better because, we create a community for new, innovative, initiatives."	NC6
Way of working	
"…I am aware of the people's activity that I have not been heard before…And it is easy to ask questions and give comments for them"	NWOW1
"…we put documents there and we are aware now about who has made updates into them and it is easy to continue from that [to contribute yourself]"	NWOW2
"…I keep receiving updates that I consider as spam, about activity of one community. And I don't want to have that. "	NWOW3
"…if people had not to have to use [OCT], the adoption won't be fast"	NWOW4
"[before] you was not easily able to notice all ideas, … but now those are popping up on your first page, and then people are keen to read and comment those"	NWOW5
"[NWOW] …is not necessary better, but I am used to it, and I think it is pretty good"	NWOW6
"…one have to remember that amount of comments is not necessary a sign of the good idea…"	NWOW7
"…well, I personally think that it [OCT] is one of the most important tools that I use in my tasks"	NWOW8
"…When I used to push people to e-mail, copying your boss or something like that, it's not possible to [OCT]. It's possible but it's not, [OCT] is not intended for that. So, I think that it's something that could have to change."	NWOW9
"…with [OCT], what happened is that now is mainly deployed, because last year it was only a pilot, and now it's fully deployed."	NWOW10

Appendix 14. Principal components for communication and NPD environment related variables, varimax rotation

Construct (Independent variables in regression analysis)	% of variances	Items in construct
Communication within a team	27.08	ShareTeam (Communication 7) InputTeam (Communication 8) TeamShare (Communication 9) AwareTeam (Communication 10)
Cross-functional communication	9.64	IntraIdeas (Communication 2) IntFuncAwareness (Communication 4) EasyFindExpertise (Communication 5) ValuableIdeas (Communication 6)
Rigorousness	8.83	GoNoGo (NPD Environment 2) NPDStrategy (NPD Environment 3) StandardProcess (NPD Environment 4) Pre-specifiedProcess (NPD Environment 5)
Communication sufficiency	5.97	RareComm (NPD Environment 7) Multifunctionality (Communication 3)
Resources	5.69	SkunkWorks (NPD Environment 1) Resources (NPD Environment 12)
Interactions	5.10	NoInteractions (Communication 1)

Appendix 15. Regression analysis for knowledge acquisition (amount)

Construct	Model 1a	Model 1b	Model 1c	Model 1d
Constant	**4,393*** **	**4,927*** **	**3,286*** **	**3,883*** **
Within a team	-,159	-,137	**-,243** **	**-,216** *
Cross-functional	**-,431*** **	**-,432*** **	**-,489*** **	**-,491*** **
Rigorousness	**-,418*** **	**-,420*** **	**-,392*** **	**-,392*** **
Comm. sufficiency	,097	,115	,078	,094
Resources	-,041	-,054	-,020	-,029
Interactions	-,142	-,154	-,125	-,135
TimePressure		-,080		-,069
ComplexInfo		-,018		-,043
Usage of OCT			**,242** **	**,243** **
R^2	,226	0,231	,270	,274
Adj R^2	,186	,176	,225	,216
F	5,60***	4,24***	6,01***	4,71***

Significance: *) p < 0,1; **) p<0,05; ***)p<0,01.

Appendix 16. Regression analysis for knowledge acquisition (quality)

Construct	Model 2a	Model 2b	Model 2c	Model 2d
Constant	**4,627*** **	**3,411*** **	**4,845*** **	**3,667*** **
Within a team	**,345*** **	**,287** **	**,367*** **	**,315** **
Cross-functional	**,636*** **	**,635*** **	**,648*** **	**,651*** **
Rigorousness	**,237** **	**,244** **	**,236** **	**,243** **
Comm. sufficiency	-,017	-,041	-,010	-,032
Resources	**,278***	**,282** **	**,279** **	**,284** **
Interactions	**-,219***	**-,209***	**-,225** **	**-,217***
TimePressure		,102		,105
ComplexInfo		,127		,130
Usage of OCT			-,045	-,060
R^2	,395	,415	,397	,417
Adj R^2	,351	,356	,344	,350
F	8,93***	7,09***	7,60***	6,28***

Significance: *) p < 0,1; **) p<0,05; ***)p<0,01.

Appendix 17. Regression analysis for knowledge assimilation (amount)

Construct	Model 3a	Model 3b	Model 3c	Model 3d
Constant	**5,179*** **	**4,634*** **	**4,848*** **	**5,065*** **
Within a team	**,483** **	**,443*** **	**,373*** **	**,489*** **
Cross-functional	**,308** **	**,304** **	**,524*** **	**,331** **
Rigorousness	**,266***	**,251***	**,213** **	**,249***
Comm. sufficiency	-,031	-,024	,141	-,008
Resources	,028	,004	-,028	,008
Interactions	-,098	-,111	,034	-,124
TimePressure		-,037		-,031
ComplexInfo		,140		,145
Usage of OCT			-,042	-,102
R^2	,234	,247	,276	,254
Adj R^2	,178	,172	,231	,169
F	4,18***	3,29***	6,20***	2,98***

Significance: *) p < 0,1; **) p<0,05; ***)p<0,01.

Appendix 18. Regression analysis for knowledge assimilation (quality)

Construct	Model 4a	Model 4b	Model 4c	Model 4d
Constant	**5,090*****	**4,705*****	**4,814*****	**4,508*****
Within a team	**,189***	,158	,168	,143
Cross-functional	**,225****	**,228****	**,211***	**,217****
Rigorousness	,073	,064	,079	,069
Comm. sufficiency	**,232****	**,244****	**,227****	**,240****
Resources	,085	,059	,091	,064
Interactions	**-,208****	**-,220****	**-,204****	**-,216****
TimePressure		-,067		-,065
ComplexInfo		,143		,138
Usage of OCT			,060	,046
R^2	,135	,155	,138	,157
Adj R^2	,09	,095	,085	,089
F	3,99**	2,59**	2,61**	2,32**

Significance: *) p < 0,1; **) p<0,05; ***)p<0,01.

Appendix 19. Regression analysis for the predictability of the perceived OCT benefits

Construct	OCT has changed my way of working
Constant	**0,61***
I have found OCT beneficially in my tasks	**0,74****
R^2	,511
F	**126,4****

Significance: *) p < 0,1; ***)p<0,01; ****) p<0,001

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