UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

Master Degree Project in Innovation and Industrial Management

Creating New Customer Value Using a Co-innovation Perspective

A case study of ABB

Adam Vesterberg

Supervisor: Daniel Ljungberg
Master Degree Project No. 2014: 43
Graduate School

CREATING NEW CUSTOMER VALUE USING A CO-INNOVATION PERSPECTIVE
- A case study at ABB

By Adam Vesterberg

School of Business, Economics and Law, University of Gothenburg, Vasagatan 1
P.0. Box 600, SE 40530 Gothenburg, Sweden

And

ABB AB, Corporate Research Center RDAT
Forskargränd 7, SE 72181 Västerås

Contacts: vesterbergadam@gmail.com; jan.nyqvist@se.abb.com

ABSTRACT

Studies has shown that organizations that are networked and interdependent are able to collaborate and co-create value. The main purpose of this case study of ABB is to examine the innovation process and how to involve customers. Theoretical results show that the development of innovation models has resulted in a complex value chain. Therefore, new tools and processes are necessary to take advantage of potential new values and experience for the stakeholders in the innovation value chain. The co-innovation platform is a process to create more value for these stakeholders where new ideas can come from various internal and external sources. It is built on three major pillars i.e. convergence, collaboration and co-creation. The empirical findings show that ABB have some tools and processes to enhance idea generation but missing guidance to collaborate with these stakeholders. The improvements appear to be about optimizing the innovation model, alignment problems and how to collaborate internally and externally. The final recommendation to ABB is to ensure horizontal alignment and how to co-create value with stakeholders.

Keywords: *innovation process, co-innovation, co-creation, customer involvement*

ACKLOWLEDGEMENTS

I am grateful for the support and supervision given by Daniel Ljungberg at the institute for Innovation and Entrepreneurship, Department of Economy and Society, School of Business, Economics and Law. He was helpful throughout the process of giving feedback and suggestions to improve the thesis.

I would also like to thank Corporate Research Center and my supervisor Jan Nyqvist for giving me the opportunity to write my master thesis about co-innovation at ABB. Moreover, he assisted me to gain valuable internal information and also helped me reaching out to actors involved in the innovation process. I would also like to thank all the employees at ABB who allocated valuable time for me during the empirical data collection.

Finally, I am grateful for the participants externally from CRC i.e. business unit managers and end-customer managers.

Adam Vesterberg

May 2014, Västerås

TABLE OF CONTENTS

ABBREVATIONS

BU – Business unit

CA – Competitive advantage

CRC – Corporate research center

CF – Corporate fund

FTE – Full time equivalents

R&D – Research and Development

SCA – Sustained competitive advantage

STP – Strategic Technology Plan

1. INTRODUCTION

This chapter aims to provide the background for writing the thesis and to introduce the company of interest, ABB, and the thesis aim, scope and delimitations.

1.1 Background

The dynamic changes in the global economy changes the business environment dramatically, forcing firms to change their competitive strategies. Many new innovations have been acknowledged as engines for sustainable competitive advantage (SCA). Innovations such as Just-in-Time systems, Six Sigma and Total Quality Management have become commodities and since they easily can be implemented, the life span of competitive advantage (CA) has resulted in shortening product life cycles. That is especially due to technological developments in ICT. In the past, CA was achieved by offering product-focused innovations but due to the shortening product life cycles and management innovations being commodities, product-focused innovations are no longer SCA (Lee, Olson, & Trimi, 2012).

Innovation matters, today smart firms know that if they fail to innovate both in terms of processes or product and services they will lose CA. Invest time into create new systems, structures and processes is to ensure a sustained flow of innovation. (Bessant & von Stamm, 2007) New criteria are emerging to successfully face competitors and the ability of companies to meet consumer demands depends greatly on their ability to innovate. Innovation is a key driver to achieve SCA and value creation through innovation is dependent on the restructuring of cognitive dimensions of involved actors in the innovation process (Rejeb, Guimaraes, Boly, & Assielou, 2008)

Companies have come to realize that predicting future is not enough. They must also build links with different sets of stakeholders to enhance shape and influence emergent alternatives and be a part of a future, which co-evolves out of those interactions (Bessant & von Stamm, 2007). Customers usually searched for values such as speed, quality, price and customization from products and services. Now customer searches for values beyond these, which introduces a complex environment for organizations to develop and achieve SCA through innovation (Lee, Olson, &

Trimi, 2012). Organizations are starting to look outside their normal knowledge zones and follow open innovation strategies. Networking, whether it is internally or externally across different knowledge groups is one of the biggest management challenges of the 21st Century (Bessant & von Stamm, 2007).

1.2 Introduction of chosen company

The problem ABB is facing in their innovation process is that they do not possess a methodology for customer involvement. They want to make it easier to reach out to the customers and sell their products for the price ABB think it is worth. Corporate Research Center (CRC), an ABB R&D center in Västerås operates with little customer interaction and therefore having problems in the sale process of their offerings. ABB is looking for a new way in which customers could be involved in their innovation process in order to create greater customer value for their products and services. When, where and how in the process should customers be involved and what is necessary to do so.

1.3 Thesis aim and scope

The aim of this thesis is to analyze how ABB can create customer value from the innovation process in their product and services and to propose a framework for customer involvement. Therefore, research on the latest innovation process evolution 'co-innovation' has been conducted in order to understand benefits and drawbacks on integrating customers to create value. In order to develop a framework for value creation, studies has been carried out in close collaboration with ABB on their current innovation process, customers and business units (BU) in the Process Automation division.

1.4 Research questions

In order to develop a framework of value creation for ABB, understanding about their current situation is necessary to identify possible improvements or transformations, the research questions are:

Question 1: How is ABB's current innovation process designed in the Process Automation division?

Question 2: How can ABB increase customer value from the innovation process from the perspective of a co-innovation process?

1.5 Delimitations

Since the aim of this thesis is to investigate how to create more customer value in the innovation process, this will only be the area from the co-innovation platform focused on. The co-innovation platforms suggest five different areas in which firms can create value from. However, the author of this thesis will focus on how to create new customer value at ABB. The figure below shows the five areas where value can be created by using the co-innovation platform.

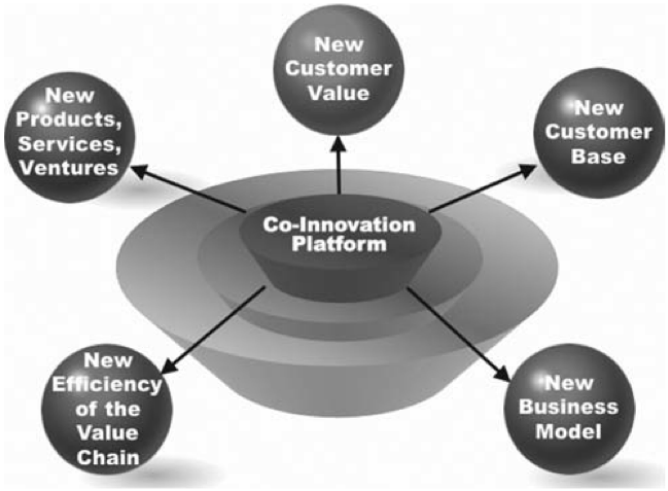


Figure 1 The co-innovation platform (Lee, Olson, & Trimi, 2012)

Furthermore, the research addresses ABB's innovation process but the research will for practical reasons be limited to ABB's Process Automation division and involved actors within that division i.e. corporate research in Västerås, business units and the customer Boliden.

1.6 Thesis disposition

Chapter 2 presents theory about co-innovation, which will provide input to the empirical data collection and be used as a framework for the analysis.

Chapter 3, the method used to provide understanding on how the research has been carried out.

Chapter 4 aims to present the empirical data generated from the case study at ABB and feedback from involved actors in the innovation process. This chapter answers the first research question.

Chapter 5 analyses the theoretical framework to the empirical findings. It answers the second research question.

Finally, the conclusion will summarize and discuss the conclusions from the research. The conclusion will give a recommendation for ABB with a framework for customer involvement. Furthermore, the author recommends further research necessary in order to succeed with a co-innovation perspective.

2. THEORETICAL FRAMEWORK

This chapter presents existing theory of co-innovation, which will provide input to the empirical data collection and be used as a framework for the analysis. The chapter presents both the development of innovation processes in the modern society and theory with models and research on co-innovation.

2.1 Innovation process evolution

Tidd (2006) outlines that innovation process evolution has gone from a linear structure of activities as a waterfall model, to a more complex and interactive activity (Domingeuz-Péry, Ageron, & Neubert, 2011). The importance is to understand innovation as a process that is shaped in which we try and manage it. Confirmed as well by Roy Rothwell suggesting that the nature of innovation processes has evolved from simple linear models to increasingly complex interactive models. Furthermore, technological leadership does not necessarily result in economic benefit. Achieve benefits from technology depends on two factors i.e. First, the firm's capacity to translate technology to commercially products or processes, and secondly the firm's capacity to defend its advantage (Tidd, 2006). No organization is local anymore and individuals, organizations, governments and economies are all networked and interdependent. Changes in the global economy have become very dynamic and unpredictable. A major trend has been the technological advances and how things are converged to create new technologies. New business models has been developed because of the advances in ICT, making organizations able to collaborate and co-create value. Hence, a new innovation model is required and has resulted in an innovation revolution (Lee, Olson, & Trimi, 2012). The author of this thesis claims that innovation models have been developed because of new problems that have arisen or new opportunities due to developments in society in general. Until today, innovation models has been categorized in four different models i.e. closed innovation, collaborative innovation, open innovation and the latest; co-innovation.

2.1.1 Innovation model 1.0: closed innovation

CA is achieved by attaining unique core competence internally and often by complete secret to the outside world. The R&D department is a major source of innovation to the value chain of the organization (Lee, Olson, & Trimi, 2012). A closed innovation model forces the firm to do everything itself from idea generation, development and

production to marketing, distribution, service and financing (Figure 2). Innovation projects only enter the innovation process at the beginning, developed using only internal resources and capabilities. Finally it can be commercialized through the firm's own distribution channels. If an idea, technology or project is rejected, it will be stored in internal databases and possibly never be used. As a result of this, using this innovation model, many promising business ideas and technologies will never be used (Herzog, 2008).

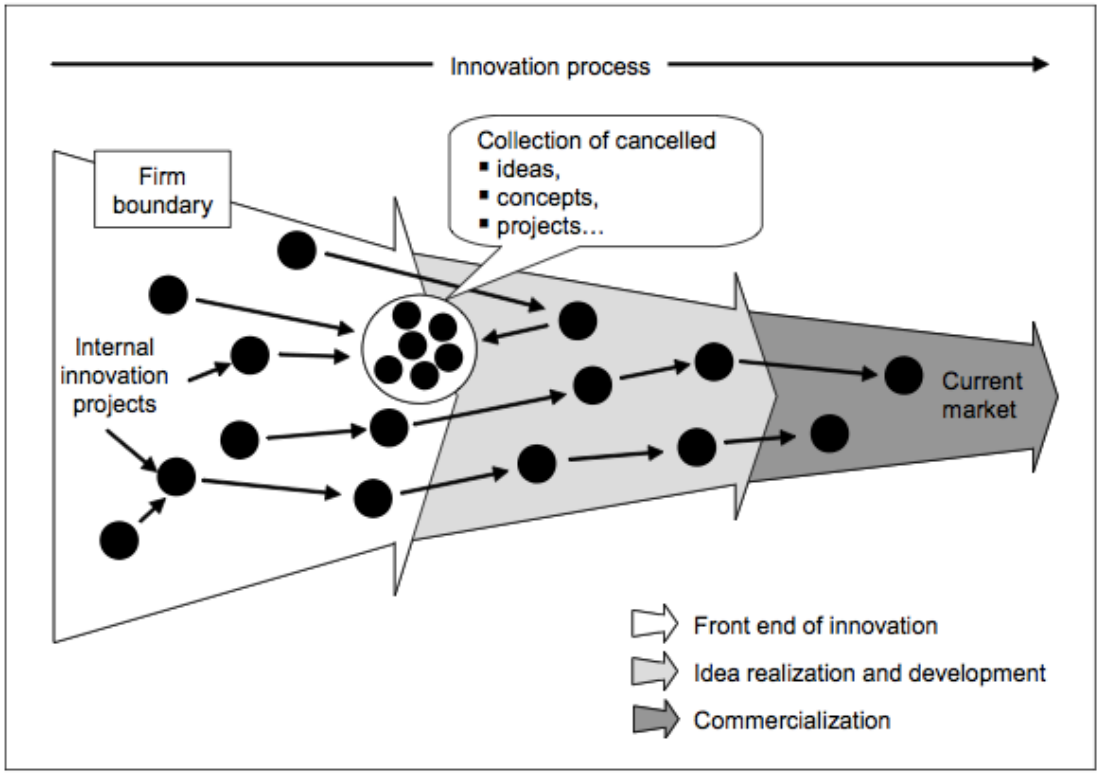


Figure 2 The closed innovation model (Herzog, 2008)

2.1.2 Innovation model 2.0: collaborative innovation

Self-reliance or self-sufficiency became an impossible goal relying only on organization's own unique competence. It was necessary to find collaborative partners to design an innovative value chain, combining different competencies. The advances in ICT were one reason that made it easier to search for collaborating firms anywhere in the world. New forms of strategic alliances, joint ventures, partnerships and patent sharing agreements were constructed to create SCA (Lee, Olson, & Trimi, 2012). The goal is to stimulate creativity and to address inter-dependencies among market choices, product design and process design decisions. Collaboration increases the number of sources for new innovative ideas through shared knowledge and experience. R&D personnel are given greater access to these sources, which creates

potential recognition of possible technology applications. Collaboration also reduces development and product-delivered costs since dependencies are dealt with early in the development process. Collaborative innovation can be seen as a revenue-enhancing, as well as cost-reducing initiative. However, to achieve successful collaboration, then physical barriers, knowledge barriers and organizational barriers must be dealt with (Swink, 2006).

2.1.3 Innovation model 3.0: open-innovation

Collaborations are not only restricted between firms but also with external partners such as universities, research institutes, communities and individuals. The basic idea is to integrate ecosystem of innovations in the value chain and combine complements to value creating solutions with collaborative arrangements. External competence is the core of open-innovation (Lee, Olson, & Trimi, 2012). I.e. firms should use external ideas and technologies as well as external paths to market and enhance the innovation process. In contrast to closed innovation, ideas and technologies can enter the innovation process at any time by various means through in licensing or venture investments (Figure 3), Furthermore, innovation projects can be commercialized using external distribution channels, such as spin offs or out licensing (Herzog, 2008). Unfortunately, scholars provide several and broad definitions of open innovation, which make it unclear what open innovation is (Pisano & Verganti, 2008) (Bellantuono, Pontrandolfo, & Scozzo, 2013) (Dahlander & Gann, 2010)

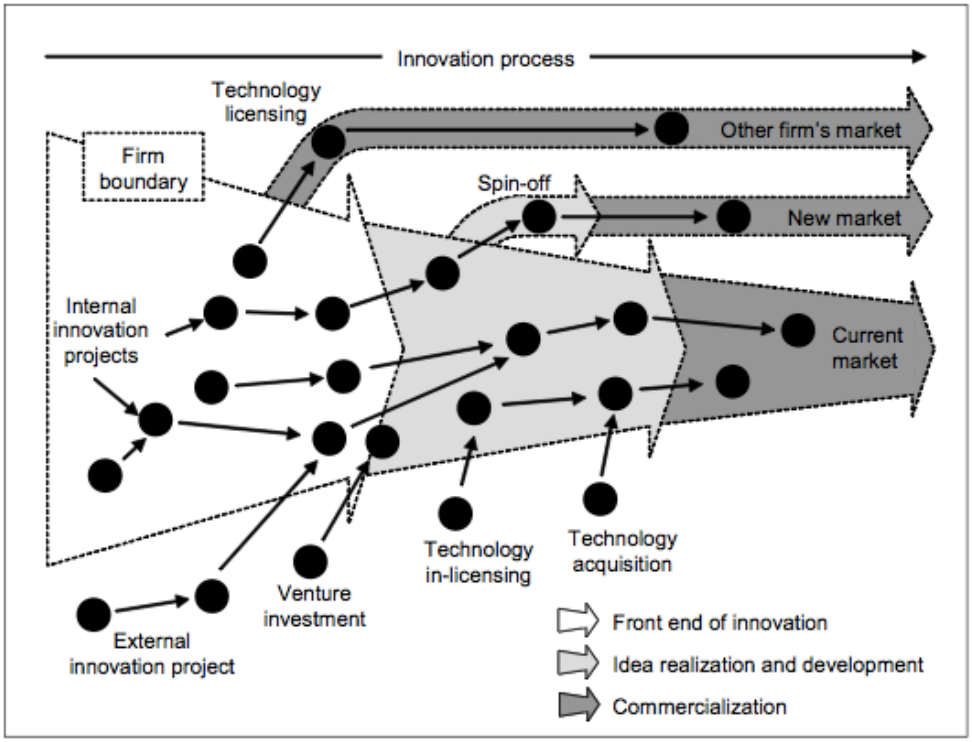


Figure 3 The open innovation model (Herzog, 2008)

According do Chesbrough (2006), he referred innovation as either ‘open’ or ‘closed’. However, recent studies have pointed out that innovation is not simply closed or open, instead argues that it varies in a continuum between the different modes (Bellantuono, Pontrandolfo, & Scozzo, 2013) (Chesbrough, 2006). According to Herzog (2008), open innovation is processed within all three phases of the innovation process i.e. front end, idea realization and development, and commercialization. In the front end of innovation, firms searches for problem solutions externally. In the second phase, realization and development may be licensed by external IP or acquired through external innovations to offer opportunities. Technology can also generate additional sales by licensing it to others. Hence, Open innovation is about the way firms manage, use, employ and generate intellectual property (Herzog, 2008).

Another factor that increases pressure on firms to seek external support is the industry convergence. Convergence is defined as the blurring of boundaries between industries due to converging value proposition, technologies and markets. This could be about filling knowledge gaps missing from other industries and new business models with complementary partnerships can play an important role. Chesbrough states that today many options and opportunities for the commercialization lies outside the firm’s boundaries (Herzog, 2008). Lichtenthaler (2011) found that adapting to open

innovation pays of in terms of return of investments. However, it exists barriers to open innovation such as knowledge gaps, security and copyright issues and competitive threats (Bellantuono, Pontrandolfo, & Scozzo, 2013) (Lichtenthaler, Hoegl, & Muethel, 2011). The development of innovation models has resulted in a complex innovation value chain but also created opportunities for creating new value or experience for all stakeholders in the chain. Hence, a new innovation model is required to take advantage of potential new values and experiences to create strong CA for firms. The Co-innovation model is a platform where new ideas come from various internal and external sources to create new value or experience for all stakeholders, including costumers (e-customers, end users, global customers, non-customers and customer communities). The core of co-innovation is experience, engagement and co-creation of value that is difficult to imitate by competition (Lee, Olson, & Trimi, 2012).

2.2 Innovation model 4.0: Co-innovation

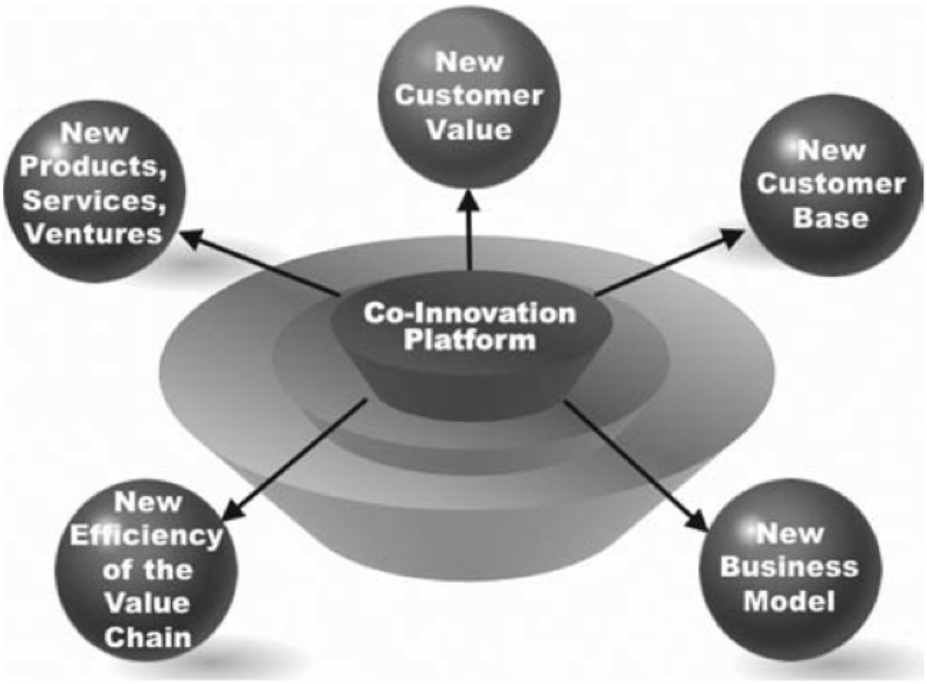


Figure 4 The co-innovation platform (Lee, Olson, & Trimi, 2012)

The main purpose of co-innovation is to create value for the organization and its (Gupta & Govindarajan, 2004). Organizations have five areas where it can create value in the chain from the co-innovation platform i.e. new products, services and ventures, new efficiency of the value chain, new customer value, new customer base and finally new business models (Figure 4) (Lee, Olson, & Trimi, 2012).

The first area is to leverage innovative ideas to introduce new *products, services or new ventures* (Lee, Olson, & Trimi, 2012). This would require collaboration with both internal and external partners to make the innovation resistible against imitation (Chan & Mauborgne, 2005). This could be a result of convergence and new ventures can be created due to intrapreneurship or interorganizational collaboration. The second is to *optimize the value chain with innovations* that would cut costs, improve quality and increase the speed of the process e.g. lean manufacturing or outsourcing. The third of value creation is to evaluate the *concept of customer value* of the organization. Traditional values for the customer would be price, speed, customization and quality of product and services. Today customer demand is more complex; they might require experience of the innovations and looking for opportunities to learn. Here value co creation plays an essential role together with customers through shared values. The fourth area also involves the customers and it is about *expanding the customer base*. This is about looking at the whole customer value chain and its participants; the end users are also important factors for business success. Creating customer value for all customers differentiate value if innovations are delivered to all of them, even non-customers who could be potential future buyers. The final area where innovation can create value is *a new business model*, how products and services are delivered to the customers. New ways to improve customer security and privacy, speed of transaction, service quality and information exchange, provide new solutions etc. would create new value to all stakeholders (Lee, Olson, & Trimi, 2012).

The co-innovation model enables firms to attain value from the five value creating areas discussed above. These are all based on three major pillars that are important for success and to control the innovation value chain (Figure 5). The platform is built upon convergence, collaborative arrangements and co-creation of experience with different partners in the value chain (Lee, Olson, & Trimi, 2012).

Figure 5 Innovation model 4.0 – co-innovation (Lee, Olson, & Trimi, 2012)

2.2.1 Convergence

Convergence of different industries represents opportunities to capabilities, competences and knowledge, initiating new ways of co-creating value (Payne, Storbacka, & Frow, 2008). *Convergence* creates a network of ideas and advances in technologies often by at first unrelated things to meet an existing demand. Synergy effects are very applicable on co-innovation to create new product/services and ventures, new business models and value chain processes (Lee, Olson, & Trimi, 2012). The source of CA has gone from economies of scale, to scale and scope, to scale and scope-expertise, and to new economies of scale-scope-expertise-convergence. The primary innovative strategy has gradually decreased from exploitation to exploration of new competencies. The success is based on the ability to predict the future and usage of convergence to offer new operational innovations, new customer values, new products/services and new customer bases (Lee, Olson, & Trimi, 2010). Convergence makes imitation difficult, and is therefore crucial for a SCA. For example the internet-based business model is possible due to expertise of a number of firms and therefore proves that convergence plays a key role in co-innovation (Lee, Olson, & Trimi, 2012).

The evolution of convergence is categorized in six different levels i.e. Component/product/service convergence, Functional convergence, Organizational convergence, Technology convergence, Industry convergence and Bio-artificial systems (Lee, Olson, & Trimi, 2010). Level 3, *Organizational convergence* has evolved due to the new technological developments changing the organizational

structures. Communication is possible all over the world to combine skilled people in different locations. The possibilities to collaborate at distance enhance the value chain activities where joint ventures between suppliers, distributors and even competitors are good examples of organizational convergence. Inter-organizational relationships or business-webs are new business models that agile organizations are using to remain competitive (Lee, Olson, & Trimi, 2010). Organizational convergence can also be a form of cultural integration where cultural differences are reduced. Furthermore, knowledge transfer will increase through cultural convergence since it enhances the communication between organizational members (Sarala & Vaara, 2010). Level 4, *Technology convergence* is a result of information, communication and digital technology. The most prevalent are the information and communication technology (ICT), biotechnology, engineering, nanotechnology, and artificial intelligence (Lee, Olson, & Trimi, 2010). In nanotechnology evident to create technological value to find solutions for health, environmental and energy challenges (Allarakhia, 2011). Level 5, *the industry convergence* can create new industries and customer value innovations e.g. the convergence of computational technology using communication and the music industry has led to the iPod. Industry convergence occurs when two or more previously distinct industries become direct competitors or cooperators or create a new one. There are three types of industry convergence i.e. Functional-, Complementary-, and Institutional convergence. *Functional convergence* occurs when products from different industries perform the same function such as the personal computers and the television industries are becoming substitutes for each other. *Complementary convergence* occurs when multiple objects of value from different industries are linked into one location such as when travel agents sell both airline tickets and hotel rooms. *Institutional convergence* occurs when firms act as one and two industries are linked. This convergence is focusing on the organizational structure, e.g. some oil industry firm's claims that they are in the energy business since they are developing both petroleum products and hybrid fuels and other energy forms (Lee, Olson, & Trimi, 2010).

2.2.2 Collaboration

The importance of collaborations is to achieve a value chain with world-class competencies and the characteristic of collaboration in co-innovation is a shared purpose (Lee, Olson, & Trimi, 2012). Collaborations to support innovation could be with suppliers, customers, business partners etc. However, about 50 percent of the strategic alliances fail due to collaborative barriers (Lawrence, Goldwasser, Choate, & Blitz, 2008). Effective shared purpose is about how a firm positions itself in relation to its competitors and partners. Furthermore, what contributions the firm has to customers and society. Collaborative communities share a set of values called ethic of contribution i.e. going beyond one's formal responsibilities to solve broader problems and not just applying greater effort. The key mechanism of collaborative community is the process of shared purpose across different projects i.e. interdependent process management. Collaborative process management requires people to continually adapt to others needs because it mobilize everyone's knowledge and must be centralized since knowledge must be coordinated. Therefore, collaborative organizations rely heavily on 360-degree feedback (Adler, Hecksher, & Prusak, 2011). Collaboration is especially effective for value creation of new products/services/ventures, new business models and process innovation. Collaborative organizations are focusing on knowledge production through internal and external collaboration. An internal collaboration culture is essential for simplify external collaborations e.g. a new business model as e-business, would require ICT expertise of external collaborations as well as changed internal business structure to benefit all stakeholders (Lee, Olson, & Trimi, 2012).

To manage co-innovation, three building blocks are recommended: alignment, boundaries and commitment. The first, alignment is about ensuring that the business strategy is communicated throughout the organization both horizontally and vertically (Figure 6). Horizontal alignment often requires a new unit or adjustments of existing ones to eliminate structures and processes that are barriers for collaborations. There should be no barriers across functional groups, geographies, and divisions. To prevent this, often job functions, performance measurements and responsibilities will be needed for co-innovation (Lawrence, Goldwasser, Choate, & Blitz, 2008).

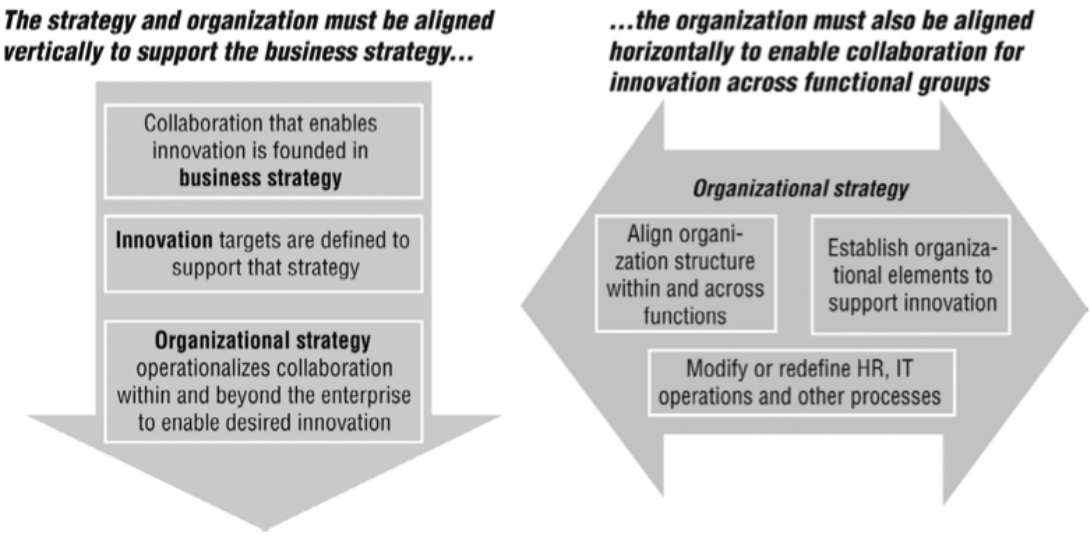
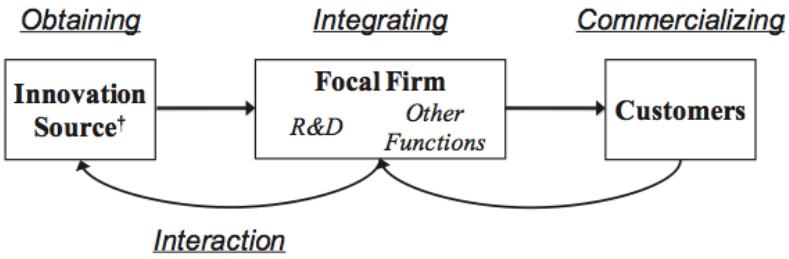


Figure 6 Horizontal and vertical alignment (Lawrence, Goldwasser, Choate, & Blitz, 2008)

The second, boundaries are the reasons for most strategic partnerships to fail. Hence, they require building trust, decision-makings, and legal terms of ownership, solve issues of collaborating across cultures, communication and so on (Lawrence, Goldwasser, Choate, & Blitz, 2008). The researchers West and Bogers created a model of how firms profit from external innovations based on traditional models of integrated innovation. They suggested tree major steps in the process of involving external innovation to its delivery to the customer (Figure 7) (West & Bogers, 2013).

It is important to understand the history and culture of each participants as well as sharing goals and terms together. For example legal terms of ownership would require governance for covering areas such as intellectual property rights and decision-making processes. Technology integration and visibility across all organizations are critical to enable communication and sharing of information between different partners. Interactions may require both physical and virtual presence, and therefore, strong collaborative tools are required (Lawrence, Goldwasser, Choate, & Blitz, 2008). It is important to obtain innovations from external sources, enable integration and eliminate barriers for that. Integration across all phases is necessary for commercialization and therefore interaction mechanisms across functional groups are necessary (West & Bogers, 2013).



†Sources may include suppliers, rivals, complementors, and customers.

Figure 7 A Four-phase Process Model for leveraging external sources of innovation (West & Bogers, 2013)

The third, commitment to transformation and change are crucial for succeeding with co-innovation. Creating a collaborative culture takes time and will require leadership communication and reinforcement for the development as well as establishing key measures of the collaborations (Figure 8). Leadership is needed to enhance internal and external collaborations, and eliminate all barriers for collaborations. Performance management is needed in order to motivate, reward, evaluate and select collaborations (Lawrence, Goldwasser, Choate, & Blitz, 2008).

Figure 8 Commitment (Lawrence, Goldwasser, Choate, & Blitz, 2008)

Often firms develop innovation relationships without considering their organizations structure and principles. Important to observe is that different modes of collaborations involve different strategic trade-offs, firms should choose the modes best for their capabilities. Pisano and Verganti recommend four basic collaboration categories i.e. closed or open and the collaboration is either flat or hierarchical (Figure 9). The decision of either using a flat or hierarchical collaboration depends on how the governance structure needs to be. In an open-hierarchical collaboration (*innovation mall*), anyone can offer ideas but the firm chooses which the problem as well as the solution. In the open-flat collaboration (*innovation community)*, anyone can offer ideas but no participant has the authority to decide whether the innovation is valid or

not. In the close-hierarchical collaboration (*elite circle*), the firm chooses which participants to include in the idea generation and which ideas are developed. In the closed-flat collaboration (*consortium)*, a selected group is invited to offer ideas; sharing information and intellectual property rights and makes decisions together (Pisano & Verganti, 2008) (Bellantuono, Pontrandolfo, & Scozzo, 2013).

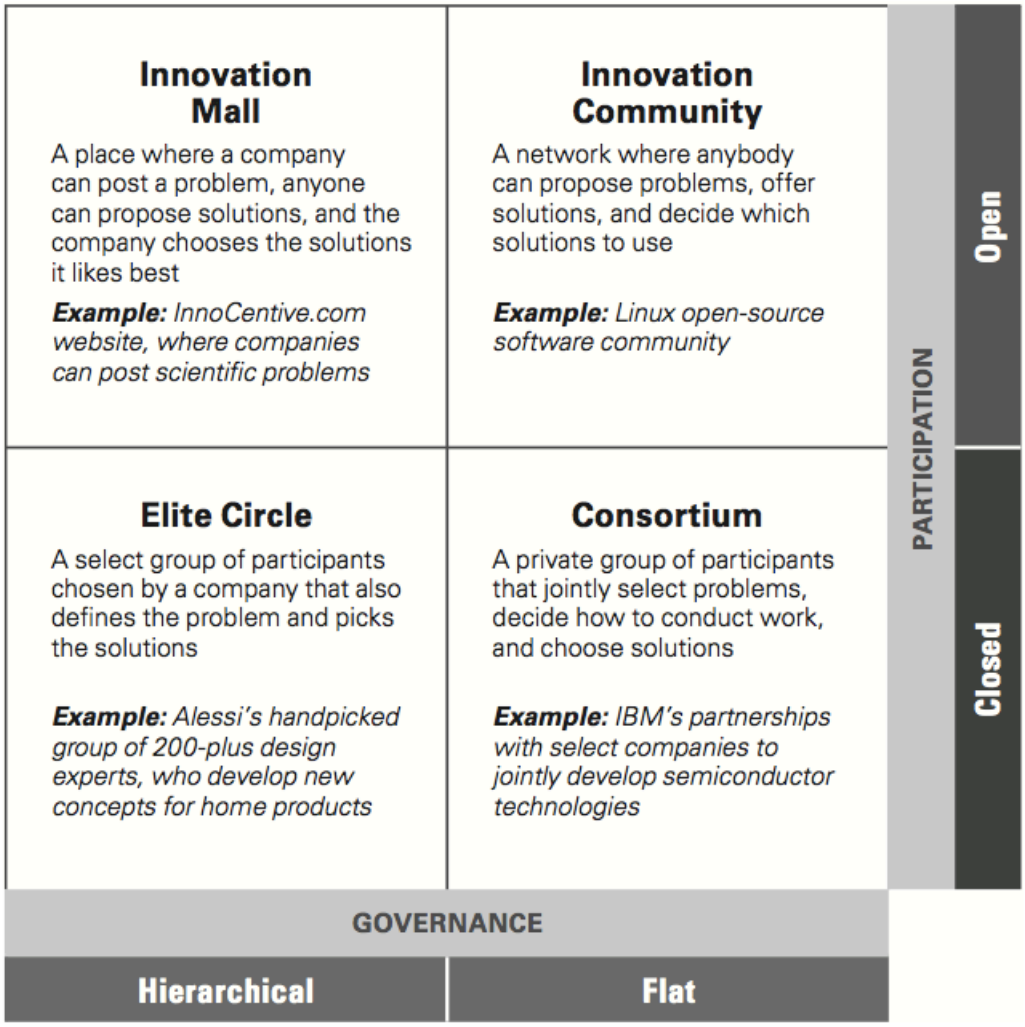


Figure 9 The four ways to collaborate (Pisano & Verganti, 2008)

Closed collaborations tend to be much smaller than open collaborations. One reason could be that the cost of searching for and selecting participants grow as the network becomes larger and larger. However, the big advantage of an open network is the potential to attract large number of problem solvers and ideas. Interesting innovative solutions can come from any organization or people (Pisano & Verganti, 2008). The web can be used as a marketplace. There are now many websites creating a global market place for ideas (Bessant & von Stamm, 2007). Open modes however are not as effective as closed collaborations in identifying and collect the best participants. For

example, the development of radically concepts needs an environment where collaborators can closely interact. Therefore, closed collaboration is preferred (Pisano & Verganti, 2008).

Pisano and Verganti (2008) propose collaboration based on two dimensions (Bellantuono, Pontrandolfo, & Scozzo, 2013). The hierarchical and flat form of governance decides who is choosing the solution and defines the problem. The hierarchical governance is when a specific organization has this authority and who are controlling the innovation process and capture its value. This governance is desired when your organization has the capabilities and knowledge needed to define the problem and evaluate solutions. In a flat governance form, the decisions are decentralized or jointly with the collaborators. The advantage here is the ability to share cost, risk and technical challenges of innovating. Furthermore, when collaborators all have an interest in how a problem is solved and only will participate when they get something to say (Pisano & Verganti, 2008). According to van de Vrande et al. (2009), open innovation modes can be classified as technology exploitation (e.g. IP licensing, employee involvement and venturing) and technology exploration (e.g. customer involvement, external networking, outsourcing R&D and external participation) (Bellantuono, Pontrandolfo, & Scozzo, 2013) (Vrande, de Jong, Vanhaverbeke, & Rochemont, 2008). In addition, Bellantuono et al (2011) claims that in a certain innovation process, an organization may adopt a different innovation model (either open or closed) for any several knowledge suppliers. Knowledge suppliers are any collaboration/interaction with external sources, such as other organizations or individuals that provide knowledge to the collaboration (Bellantuono, Pontrandolfo, & Scozzo, 2013).

Choosing the right collaboration mode must take into account the firms strategy on building and capturing value and firms can use combination of collaboration modes to support these strategies (Bellantuono, Pontrandolfo, & Scozzo, 2013) (Pisano & Verganti, 2008). IBM is a successful example of usage of both an innovation community and consortia to support the strategy of its server and computer businesses (Pisano & Verganti, 2008).

2.2.3 Co-creation

Traditionally, firms have been offering plans to produce product and services with a push system to employees, partners, suppliers and customers. In a co-creation process, the firm works together with all stakeholders, especially customers. The core principle is about engaging people to create experiences together and four elements are suggested for co-creation: interactions for collective intelligence, engagement, experience mindset and network relationships (Lee, Olson, & Trimi, 2012). The experiences define what is valuable to the customer (Payne, Storbacka, & Frow, 2008). The customers should be involved working with firms to create value, not only for themselves but the general public as well e.g. including the social issues and the environment (Lee, Olson, & Trimi, 2012).

The market is both the collection of consumers and the exchanges a firm trade product and services with the consumers. In the traditionally approach, firm acts autonomously in the innovation process with little or no interference or involvement with customers (Figure 10). Customers only get involved at the point of exchange. The traditional concept of a market and the value creation is company-centric i.e. when companies are focusing on the customer experience and connecting the customer to the company's offerings. They are product-, and service-centric, therefore company-centric (Prahalad & Ramaswamy, 2004). The difficulty is to understand customers' needs and can sometimes be a costly process. Even when customers know what they want, they often face problems of transferring that information to manufacturers completely. One can see trends of industries moving towards 'market as one' and costs of understanding and responding to customers can easily go out of control. Customers do not fully understand their needs until they try out prototypes to explore what would work and what does not (von Hippel & Thomke, 2002).

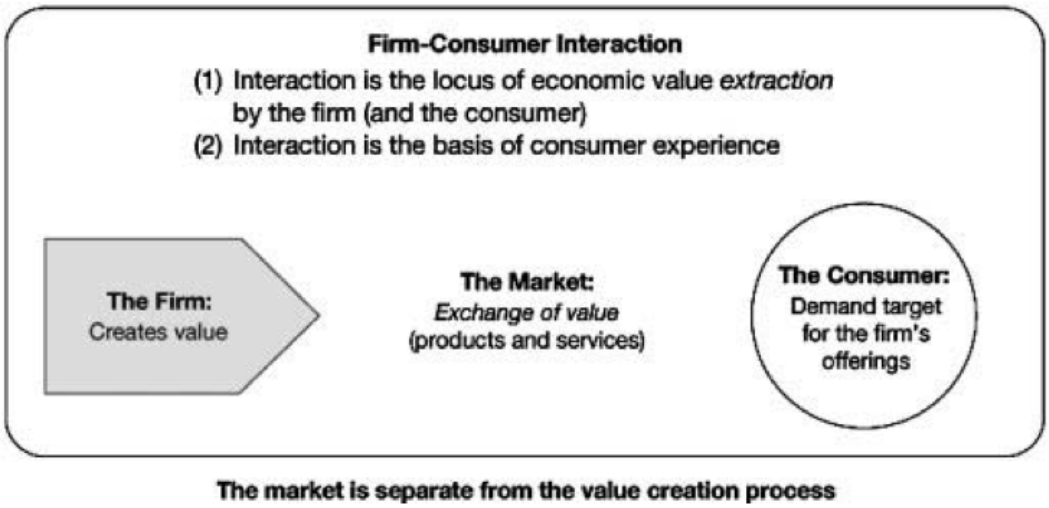


Figure 10 The traditional concept of a market (Prahalad & Ramaswamy, 2004)

Today, with new emergent technologies consumers seek to exercise their power in every part of the business system and interact with firms, thereby co-create value. Furthermore, they are not totally dependent anymore on communication from the firm since they now have alternative sources for information. They can choose the firms they want based on their own views of how value should be created for them. With new knowledge influence in today's increasingly transparent business environment, customers are more willing to negotiate prices and transactions with companies (Prahalad & Ramaswamy, 2004). However, organizations are starting to collaborate more and more, and together with the new trend of customer communities, collaborative networks could represent a positive paradigm on personalization and innovation. Therefore, co-create (Romero & Molina, 2011).

The consequences of the globalization, outsourcing activities, deregulation, convergence of industries and new technologies are making it harder for managers to differentiate their offerings. If consumers do not see any differentiation, they will probably choose the cheapest choice for them. To prevent this, firms as well as customers may have to work against the firm-centric view and instead seek to co-create value with personalized interactions between the customer and the company. Firms need to create an experience environment within each customer that can create their own unique experience (Figure 11). Thus, products and services can be commoditized, but co-creation experiences cannot (Prahalad & Ramaswamy, 2004).

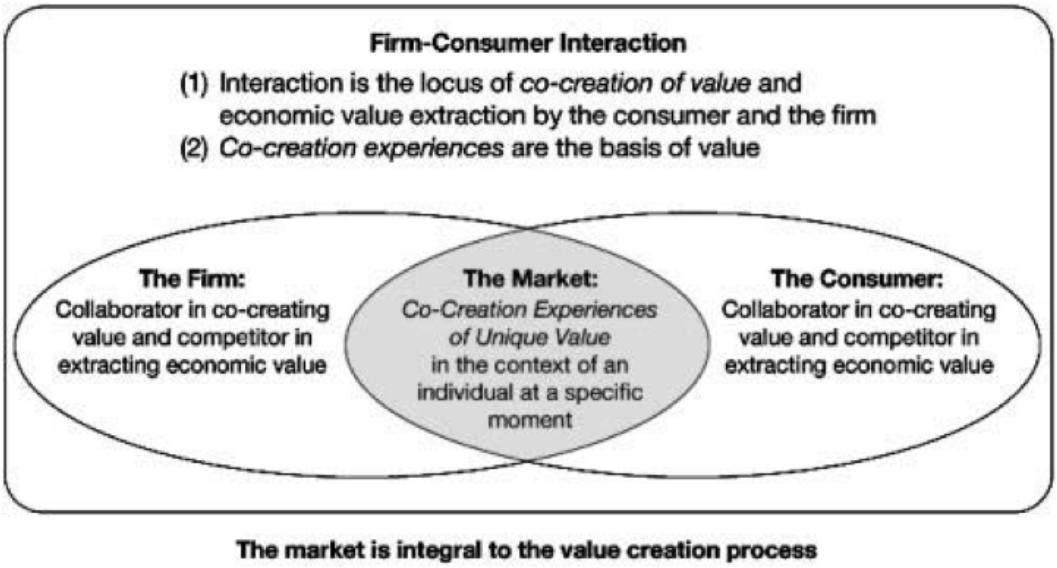


Figure 11 The emergent concept of a market (Prahalad & Ramaswamy, 2004)

The personalized experience of a value creation process is about high-quality interactions with specific customers aiming for engaging customers and firms with an on-going dialog about pros and cons when tailoring a specific product or service. It makes customers able to engage in joint decisions about information, recognition of costs and risk implications. The value co-creation process gives the customer an experience with greater knowledge and expertise about the product or service that could be translated into customer satisfaction (Romero & Molina, 2011). Rather than asking customers what they might like, researchers that observe the everyday life of people and capturing experiences leads to the creation of new insights and understanding of actual products and services used, and also new needs or wants that a company might be able to address (Bessant & von Stamm, 2007).

Building a co-creation system requires some important factors internal as well as external i.e. with dialog, access, risk-benefits, and transparency. Dialog is an important factor in terms of communication between the customer and the firm. The firm and the customer must become equal and work jointly with problems in order to have a dialog with engagement and interactivity. To make this dialog work properly, then the customers must have the same access and transparency to information as the firm (Prahalad & Ramaswamy, 2004). ICT infrastructure plays a key factor for the customer interaction platform needed between service provider and customer (Romero & Molina, 2011). Collaborative-networked organizations (CNO) are one possible driver for value co-creation because it allows firms to access skill,

knowledge and sharing risk and resources. Together with virtual customer communities (VCC), an online customer community where they are publishing and sharing their experiences from products and services, the whole experience can be co-created with interactive channels and establish experience-centric networks (Romero & Molina, 2011).

Traditionally, firms have taken most of the responsibility and work to develop products and services for customers. This has been a costly process and with time consuming interactions between them. One solution has been the 'customer as innovators' approach where a firm provides customers with user-friendly tool kits so that they can design and develop parts of a product for their own. This has greatly increased speed and effectiveness. However, tool-kits will not satisfy every type of customer since they are creating products that are not to the same extent technically sophisticated as the once developed by engineers. Furthermore, a firm that turns its customers into innovators means that they are outsourcing a valuable service once being a major source of SCA (von Hippel & Thomke, 2002).

Prahalad and Ramaswamy (2004) argue that personalized co-creation differs from the concept of customers as innovators that still can be applied to a company-centric approach. The same applies to the approach of product and service customization (Prahalad & Ramaswamy, 2004). Another is Frank Piller who writes about co-creation between companies and customers, who has analyzed hundreds of companies with this approach (Sanders & Stappers, 2008). Personalizing the co-creating experience means developing individualized interactions and experience outcomes with customers and how they interact with the experience environment. An example is the firm John Deere that has established networks for farmers to share their experiences and dialog with the firm to increase productivity. To understand the transformation from company-centric to co-creation it is important to understand what co-creation is not. It is not the outsourcing of activities to customers and it is not a customization of product or services. The change is about the co-creation of value through personalized interactions based on how each customer wants to interact with the company. This experience cannot be predicted and the task for firms is to innovate an experience environment. Traditionally, value is the exchange of products and services between the firm and the customer. In co-creation, all interactions between

the firm and the customer are opportunities to create value (Prahalad & Ramaswamy, 2004). Furthermore, the market has usually been investigated in order to get understanding of customer trends, demands and evaluate competitor's position. With this new approach, the customer segmentation will be one-to-one marketing (Prahalad & Ramaswamy, 2004).

Online communication technologies have made the launch of virtual communities, where customers can dialog with other customers as well as firms. This scenario has open up opportunities for firms to collect business value and benefits from VCCs. VCCs could be used in business processes such as marketing, product design, branding and the overall innovation process (Romero & Molina, 2011). The largest web-based community for innovation is organized by CommuniSpace, which is operating with more than 300 parallel communities. These communities are used by members to discuss and evaluate products posted by companies, or develop in a more open discussion new ideas and trends (Bessant & von Stamm, 2007). Firms must learn as much as possible about customers by being there and develop an information infrastructure focusing on the customer. It is about developing methods to understand the co-creation experience so companies can create value from it (Prahalad & Ramaswamy, 2004).

The new co-innovation model is now integrating customers with active roles in all innovation activities. Users that are actively seeking innovation are called 'lead users' and their participation in the innovation process can enhance the effectiveness through capitalizing users knowledge. Therefore, firms must work closely and continuously with their lead users to keep up with changing needs and demands for the future (Romero & Molina, 2011). Eric von Hippel (2005) argues for involving lead users in the co-creation activities and address that lead users are people that are willing to share their approaches with others. Patricia Seybold (2006) also works with 'lead customers', which she addresses to be customers that are creative (Sanders & Stappers, 2008). User should be viewed as active players in the innovation process. Their ideas and insights can provide valuable directions and help creating new products, services or markets (Bessant & von Stamm, 2007). However, with this model the firm and the consumer are both collaborators and competitors. They act as collaborators in creating value and competitors when they extract economic value.

The market represents a forum where dialogs are shared between customers, customer communities, networks and the firm. Given that customers cannot predict their experiences, co-creation of value would potentially erase forecasting. Instead, the focus could be on capacity planning, how to scale up or down the experience network and to configure resources in correlation to shifting customer desires and personalization of co-creation experiences. This new approach of value creation creates new competitive space for firms and managers need to invest in new infrastructure capabilities that enhance customer-company interactions and personalized co-creation experiences (Prahalad & Ramaswamy, 2004). However, participation in a collaborative innovation process with sharing of ideas and experiences of product of services could face intellectual property right issues and therefore important to have in mind (Romero & Molina, 2011). Moreover, transparency and access won't matter unless there is a good infrastructure for dialog. This would require investments in technology, social managers and changing managerial practices. Customers also have to learn that co-creation is a two-way street. The risk has to be shared and they must take responsibilities for that risk (Prahalad & Ramaswamy, 2004).

2.2.3.1 Experience-centric network

A value co-creation strategy is how a network of organizations intends to gain SCA by involving customers and business partners in a shared value creation process. Value should be the benefits achieved from helping customers desires and goals with their products or services i.e. the experience. Business models in organizations should be continuously reviewed in response to changing market conditions or customers demand. Value co-creation strategy therefore, a process of continuous discovery, active learning and adaption in the business eco-system for best suit the customers experience (Romero & Molina, 2011).

After targeting the right co-creators, it is important to make sure that all involved participants act jointly to co-create value in collaboration opportunities. In order to create an experience-centric network one possible proposal is to establish CNOs and VVCs. This would potentially make firms able to establish and adapt quickly to changing market condition and customer demands and benefit from customer communities with interactions between the CNOs and VCCs. Promoting the creation

of VCCs gives firms the opportunity to create new interactions channels to co-create value (Romero & Molina, 2011). Many studies have confirmed that customer knowledge as one of the most important bases for organizations (Rowley, Kupiec-Teahan, & Leeming, 2007). It is a valuable source of information to improve product & services since these forums analyses, criticize and give feedback on them. Trust is one of the major pillars in the experience-centric network that links the customer and organizations together. Interaction channels could be multiple customer interaction channels such as: web-chats, phone calls, emails, and face-to-face etc. Customer interactions are the most important in the co-creation process. Therefore, firms need to support interaction channels to avoid losing customer's value creation by creating different customer interaction hubs. The success will depend on the organizational networks capability to innovate, speed up and focus on core competencies, capture new markets and differentiate from competitors by creating a unique experience with the customers with potential profitable business growth. Following sector suggest a framework (Figure 12) presented by Romero and Molina (2009) with concepts, methods and technologies necessary for creating a successful experience-centric network (Romero & Molina, 2011).

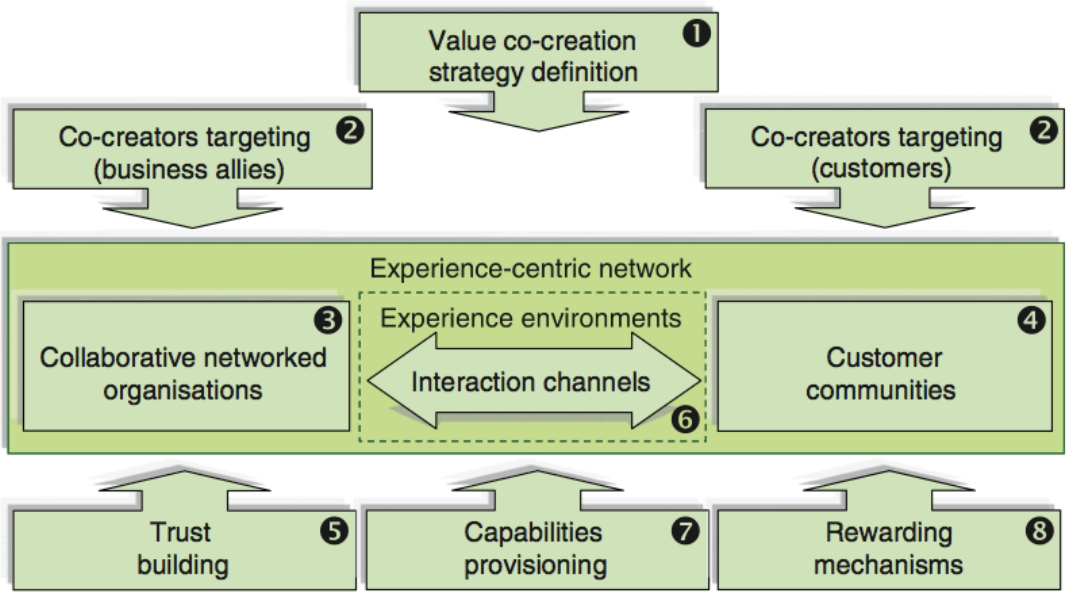


Figure 12 Experience-centic network framework (Romero & Molina, 2011)

2.3 Summary

The co-innovation model is a platform where ideas can come from various internal and external sources to create more value for all stakeholders connected to a firm. It is built upon three major pillars i.e. convergence, collaboration and co-creation. With this platform, organizations have five areas where it can create value in the innovation value chain (Lee, Olson, & Trimi, 2012). In this thesis, focus is about creating customer value since it is the area ABB want to improve. Today customer demand is more complex: they might require experience of the innovation and look for opportunities to learn, here value co-creation plays an essential role together with the customers. Convergence creates network of ideas to meet an existing demand and offer new customer values and innovations, which makes imitation difficult and therefore competitive for firms. The characteristic of collaboration in co-innovation is a shared purpose and it is about knowledge production through internal and external collaborations with trust, commitment and without boundaries (Lee, Olson, & Trimi, 2012) (Lawrence, Goldwasser, Choate, & Blitz, 2008). Different mode of collaborations exists and involves different strategic trade-offs; firm should choose the best choice for their capabilities (Pisano & Verganti, 2008). Co-creation in a firm involves all stakeholders, especially the end-customers. The core principle is to engage people to create experiences together and today customers seek to interact with firms, thereby co-create. Furthermore, customers are not as dependent anymore for information from the firm since they now has alternative sources such as customer communities (Prahalad & Ramaswamy, 2004). Firms could take advantage of this and co-create value with personalized interactions between the customer and the firm (Romero & Molina, 2011).

3. METHOD

The aim of this chapter is to provide understanding on how the research has been carried out, chosen companies and how the research is designed.

3.1 Research design

In order to answer the research questions the author used qualitative methods since the method is good when researchers try to get a deep understanding of a certain topic. A qualitative research usually emphasizes words rather than quantification in the collection and analysis of data and mainly uses an inductive approach to the relationship between theory and research to generate theory. However, there are examples of studies in which qualitative research has been employed to test rather than generate theories (Bryman & Bell, 2011). The author of this thesis has used the qualitative approach in order to test theory about co-innovation at ABB's innovation process.

In this paper the author has been using a deductive approach for the generation of theory. Theory is based on a review of literature and the author deduces a hypothesis from it to drive the process of gathering data (Bryman & Bell, 2011). The theory is used as a background for the qualitative investigations and is developed from Lee, Olsen and Trim's (2012) concept of the co-innovation platform. The theory will be used to evaluate the innovation process at ABB's division Process Automation. The study of the current innovation process is necessary in order to compare it with theory about co-innovation, and draw conclusions about how ABB can create customer value by integrating customers into the process. To describe and understand the benefits and drawbacks of customer integration, aspects regarding customers become central to the research. Hence, the study at ABB illustrates the innovation process for the product and services and focuses on customers. Furthermore, to avoid complexity, the author of this thesis will be using a reference customer as background. In this thesis, investigate the customer involvement with the customer Boliden in the mining industry, a sub-division of Process Automation.

3.2 Research design

The research design chosen in this thesis is a single case study design of ABB (Yin, 2009). The case study is a research strategy that focuses on understanding the dynamics present within single settings and can employ multiple levels of analysis within a single study. Furthermore, case studies can be used to achieve various aims: descriptions, testing of theory or generate theory (Eisenhardt, 1989). A case study is used to explore a specific case in detail, such as a company or organization. The author uses a case study of ABB in order to generate intensive examination of ABB's innovation process with involved actors, in this case: managers, researchers, business units and customers in relation to a theoretical analysis (Bryman & Bell, 2011). More precisely, to understand the innovation process at ABB and testing it to the theory, comparing it with co-innovation. The author of this thesis was able to easily collect empirical data and understand the social phenomenon at ABB since the author was located at ABB's corporate research center in Västerås. Therefore could more easily contact involved actors.

3.3 Research method

In order to gather qualitative data the author primarily conducted interviews. The author conducted semi-structured interviews with key personnel from different functional units i.e. managers and researchers. By using a semi-structured interview, the author enabled the interview process to be flexible since the author was able to obtain rich information from the participants that could be investigated further. This method made it possible for the interviewee to address issues and events important for the case study, which allowed room for topics that would be interesting for the author. Instead of using a structured interview process the author could both ask relevant questions but also made room for interesting topics. Furthermore, it was possible to ask follow up questions and compensate the interview guide with interesting topics for the following interviewee (Bryman & Bell, 2011).

The author of this thesis made a list of questions on specific topics to be covered that was applicable on both researchers and managers: an interview guide focusing on answering the first research question and as well different topics related to the theory that could be complemented with interesting topics from previous interviews (Bryman & Bell, 2011). Before doing the interviews, the method of narrative inquiry was used

in order to understand the organization and different positions at corporate research and to prevent subjective impacts from the interviewees. Narrative theory is to get an overall understanding by searching for deep structures in different narratives. A narrative describes a progression or sequence of events (Pentland, 1999). Information that was unclear or lacked information was complemented by interviewing top management at Corporate research e.g. Corporate research company structure and how the funding within ABB's organization work. The questions were also designed to ensure and verify the data collection received from the narrative inquiry method. All interviews where recorded and afterwards transcribed in order to collect correct answers with high reliability. Almost all interviews at ABB were done face-to-face and took approximately 60 minutes per interview located at corporate research in Västerås. Some interviews were made at distance, and therefore by telephone.

Table 1 below presents an overview of the semi-structured interviews and observations.

Company	Position	Location	Type	Duration	Language
CRC	Researcher	Västerås	Face-to-face	60 minutes	Swedish
CRC	Researcher	Västerås	Face-to-face	60 minutes	English
CRC	Manager	Västerås	Face-to-face	30 minutes	Swedish
CRC	Manager	Västerås	Face-to-face	60 minutes	Swedish
CRC	Manager	Västerås	Face-to-face	60 minutes	Swedish
CRC	Manager	Västerås	Face-to-face	60 minutes	Swedish
BU	Manager	Umeå	Telephone	60 minutes	Swedish
BU	Manager	Västerås	Face-to-face	60 minutes	Swedish
Boliden	Manager	Skellefteå	Telephone	60 minutes	Swedish
CRC	Customer meeting	Västerås	Participant observation	3 hours	Swedish

Table 1 Overview of the interviews and observations conducted

3.4 Data collection

The data were collected from both primary and secondary data. The primary data were the semi-structured interviews and participant observations. The secondary data were collected from academic journals, Google scholars and books for generation of

theory. ABB's intranet, company reports, presentations and courses at CRC were used for the empirical findings.

3.5 Data analysis

After the collection of data the author coded the information into transcriptions, which was made possible since the interviews were recorded. Thereafter, the data were categorized into different documents in order to generalize data. First and foremost facts were distinguished from feedback; thereafter feedback was categorized from managers, researchers, customers and managers from the business units. This made it easier to analyze data and to ensure reliability and validity.

3.6 Research quality

3.6.1 Reliability

All interviews were recorded to ensure the quality of the interviews and observations with good sound quality. Directly after the session the data was documented into transcriptions. Interviews were placed in a quiet environment to minimize the risk of distractions. Furthermore, to ensure that the information was reliable the author of this thesis conducted several interviews with people having the same job positions.

3.6.2 Validity

The author of this thesis tried to work systematically to ensure validity. The research questions were well formulated in order to work systematically. Since the interviews took place at different times and locations the author had the possibility to make improvements over time based on experience from the previous interviews. Before the interviews, the researcher collected the necessary knowledge to understand the process spoken and also used the interviews to ensure that ABB's internal documents were correct. Furthermore, the interviews were coded by categorizing responses to feedback and facts in order to avoid misconceptions and misunderstandings of the innovation process by the interviewees. The author of this thesis also tried to get multiple perspectives on the process by interviewing people with different positions from different groups.

4. EMPIRICAL DATA

This chapter aims to present the collected empirical data generated from the case study at ABB. This chapter answers the first research question and is divided into three different headings. The first part explains ABB's organization structure and how the different projects at corporate research are financed. The second explains the innovation process and the third feedback regarding the process.

4.1 ABB Corporate Research Organization

ABB's operations are organized in five global divisions, which in turn are made up of specific business units (BUs) on specific industries and product areas. Each global division has a manager reporting to the Chief Technology Officer (CTO), who in turn reports to the Chief Executive Officer (CEO). In addition, there is also a global lab manager supporting the global research centers. These managers are organized as the technology core team. Thus, managers from the five global divisions: Power Products (PP), Power Systems (PS), Discrete Automation and Motion (DM), Low Voltage Products (LP), Process Automation (PA), the Global Lab Manager and the Chief Technology Officer. They meet each other once a quarter and raise general issues and strategic directions (Figure 13).

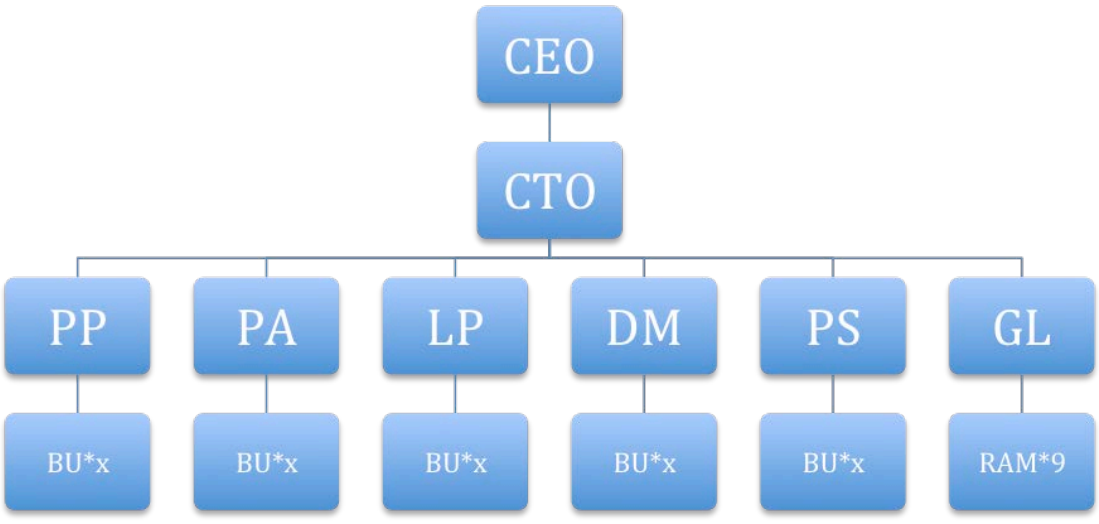


Figure 13 ABB's organization structure

The Global Lab (GL) includes managers from all research areas i.e. Research Area Managers (RAM) who are responsible for their specific research area, the global lab

manager reporting to the technology core team and the management position R&D Strategy who is responsible for the alignment to the ABB corporate strategy and that the research target at ABB's scope. Hence, the Global Lab is the management for corporate research to communicate with the various business areas (ABB's Businesses, Research areas and Research centers are listed in the Table below). The Corporate Research organization is structured as a kind of purchasing-organization, which the research centers tasks is to offer new products, service, or processes to the different business units. The R&D activities performed at the research centers involves pre studies, scouting, technology development and product development support. The research centers represents only 10 percent of the total budget for R&D activities at ABB since the different business units also conducts R&D activities. However, the business units are focusing on product development and manufacturing. When a project at corporate research is considered ready to be implemented into a new or existing product, then the project is handed over to the related business unit.

Businesses:	**Research areas:**	**Research centers:**
1. Power Products	1. Software	1. Sweden
2. Power Systems	2. Communication	2. Switzerland
3. Discrete Automation and Motion	3. Mechanics	3. Germany
	4. Control	4. Poland
4. Low Voltage Products	5. Sensor	5. USA
5. Process Automation	6. Power Electronic	6. India
	7. Switching	7. China
	8. Electro Magnetics	
	9. Materials	

Each research center receives funding on annual basis from a budget process in which the CTO along with the CEO decides how much may be used of ABB's central fund, CHTET. CHTET owns all the technology at ABB and to develop a new or existing technology the research centers receives funding from CHTET in their corporate fund (CF), which in turn derives revenues from ABB sales. It is the CEO who decides how much to invest in R&D each year. The funding from CF for each center is then distributed to the different research areas in terms of different Full time equivalents

(FTEs). Most of the funding comes from CF but there is also a discretionary fund. The discretionary fund is a fixed amount each year, which allows managers to invest resources on anything they want to e.g. pre-studies or investigations on a specific project. The discretionary fund is used for interesting areas that lack support from either a research area or the business units, but deemed necessary to investigate further. It may also be a business units that want's a project done, it could be a really interesting idea or a short term solution they need assistant with, then corporate research get funding from the business unit. The business units generally do not pay for the innovations, they pay for product development. However, the business units may account for certain costs of projects e.g. materials to produce a new prototype such as a new robot. The costs of this prototype can exceed what is budgeted for at corporate research. Then, a specific business unit would finance the prototype costs. The payment is predetermined, but can be complemented.

ABB has recently introduced vertical programs in order to exploit resources together between the different research area programs. A vertical program should be based on long-term fundamental technologies that are important for ABB today but also in a long-term perspective. A vertical program is an initiative taken in certain areas with a combination of resources e.g. Software, Communication and Mechanics. Hence, it is a project portfolio in a specific strategic area. These strategic programs use funding from the full time equivalents distributed from the different research areas, therefore, some control for a particular research area is lost since now its allocated to the strategic programs.

4.2 ABB's Innovation process

Gate Level	**Phase**
G0-G1	Definition
G1-G2	Planning
G2-G5	Execution
G5-G6	Closure
G7	Return on investment

The project management of ABB's Innovation process is built upon ABB's Gate model, which is a decision and management model for developing new technologies

and new or enhanced product, service or processes i.e. new innovations. The Gate model is designed to enhance and make sure that ABB invest on the most promising R&D projects, that the projects are in line with ABB's vision and goals as well as reflecting the strategies between the ABB group, different divisions, business units and not to deviate from it during the development phase. Furthermore, the ABB gate model is used in order to make decisions on continuing, refine, enhancing, redefine or stop a project if necessary. The Gate model is mandatory for all product and technology development projects and the different gate levels are categorized as the table above.

4.2.1 Internal Ideas

The first two phases in the gate model are definition and planning, it is about creating new ideas and evaluates them in order to fulfill ABB's goals and scope. It is of utmost importance that new innovations are discussed and evaluated as potentials for new R&D projects. Ideas can come from many different sources, both internally and externally. Sometimes the business units have a specific problem and seek corporate research for support, which penetrate internal idea generation. Internal ideas basically come from the people working at corporate research using many different sources, but mainly by putting people together in a new context using creative people with large social networks. These networks could include another employee at ABB or other company's staff. Each individual is important because of their unique network, the employees participate in creating their own duties, it is not as controlled. There are different groups that work in different ways to create ideas and to generate projects. There is no organized method how the work should be done; it depends on the individuals and the group managers.

The generation of ideas internally includes many different processes, and operates differently depending on which positions at the ABB organization. The starting point of project generations is strategy, where managers meet each other with a kick off session at the start of the year. The workshop includes research area managers from the other research centers worldwide discussing on a strategic level. It may be a new area of technology, a new market or application not worked with before and so on. The strategy workshop is also about ensuring that the portfolio is in line with ABB's global strategy. Strategy work also takes place at the group level where corporate

research are trying to work systematically, and create opportunities for people to use their ideas. The strategy days starts with analyzing ABB in its entirety, which business units exists, who are they working with and what relationships exists, which business units do the different research areas working towards and so on. Furthermore, the groups skills are being evaluated and being graded. What skills will be improved, what skills are enablers. Once this is done, it is clear which areas to focus on and what tools the group possesses in terms of competence. Thereafter, project generation is based locally in the different research areas with workshops usually generating over 100 proposals each year. These ideas are then being evaluated and prioritized, based on ABB's scope, for various stakeholders at the business units. If an idea doesn't fit or is in line with ABB's scope, then there is the opportunity to work with the proposal further. This means that corporate research would take the initiative to finance the project until its suitable for ABB's divisions. This depends a bit on which manager is responsible for this idea selection and what researchers willing to work with it.

All ideas will be listed and followed up. Certain ideas have moved on, others are on hold, others ended. The list is monitored each year through a strategy day dedicated for the project generation. It only includes researchers at the group and invites guests from the business units who talks about their problems as an introduction, or research area managers who talks about their Strategic Technology Plans (STP). Then new exercises are implemented to generate new ideas. The research area manager who is responsible for the strategic competence in various fields creates the STP, where the strategic competence should reflect the market needs and future markets. Hence, the research area manager is the link between them. Therefore, an STP in each research area is made together with researchers and will then be presented to the steering committee annually. Each research area has its own steering committee in the Global Lab. Based on the STPs and its priorities, the steering committee approves the STP and targets and actions are defined for the global labs and the local research centers in strategy and development sessions. The result is formulated as competence and input for financial planning to the research centers providing basis for the budget for the next year. The approvals take place annually in the ABB Technology forum with representatives from the ABB divisions and Global Lab i.e. encounters between all research area managers at ABB and technology managers from the different business

units and top management. It has two proposes; First to disseminate information and to share what is happening at the different local research centers and the business units, their strategy and portfolio management design. The second is to gather contacts and create networks. Researchers at specialist level are also involved (corporate fellows) but no researchers.

4.2.2 External ideas

The external ideas are based on the personal social networks and usually generated from meetings and customer discussions i.e. conferences, customer visits on-site etc. Then problems and ideas emerge and ABB can take the information home to analyze if the possibilities are related to ABB's offerings, what is the problem, could it be solved, is it profitable and what can ABB sell. The external idea generation involves a lot of meetings, both internally and externally, many gatherings and external meetings from different locations. Thereafter, the information acquired is used in the project generation workshops. A new idea is not necessarily a new technology, it could also be a feature used in another research area, and there are plenty of opportunities. The methods of collecting inputs for idea generation differs between the various research areas since it depends on who is involved and what networking opportunities that exists.

There are several different processes to obtain market inputs and what the business units require etc. Previous background on ABB can influence especially if one has been working at a business unit before since it potentially allows for good visibility. In the research area robotics, customers are quite often involved by visiting ABB's different labs in Sweden and the U.S., which provides a good exposure and very good market inputs. For other research areas, much could depend on what the business units say, which can lead to minimal exposure to the end customer. Market trends can be collected easily with lots of reports that one has access to. Scouting is solved by having a certain amount of capital reserved for each local research center, where you decide on what to investigate. There is also a 'sharing point' for researchers, where they can report things they found interesting, it may be a new product on the market or some new technology, all this is collected in reports and documents. If there are enough reports in the same area, then you know that it should be further investigated.

It is different in each research area, but purpose for everything is to create value for ABB, nothing is done just because it is interesting or exciting, it must generate value for ABB. Usually, the buyer must be a business unit, but sometimes the research areas would go beyond the product scope, it is also important to come up with own ideas and question the product portfolio. If an idea is not in line with a business unit or ABB's scope, then the discretionary fund could be used for the project. ABB is a typical technology-driven company where technology push is the majority of the product offering, but market pull exists to a certain extent. There is logic behind everything, there has to be a business for all projects. It is a mix since ABB is trying to create market pull with its technologies, but it is mainly technology push. However, the end-customer contact has improved over the years. They are not involved early in the innovation process for developing ideas, at this stage ABB only present what they can offer and make field studies, especially for the user experience. For the end-customers and user experience ABB use a model named 'user centric design' i.e. placing the user in focus. Corporate research in Sweden has approximately 50 percent of the projects together with end-customers. All projects in this model require getting out and meet a number of customers and users. End-customers are used most for market demand and to integrate them later in the chain.

4.2.3 Evaluation of ideas

Using the gate model enhances evaluation of ideas; a group manager or research area manager makes the decision and evaluate ideas, as they control the funding of projects. Thereafter, the ideas should be presented to the corresponding steering committee. However, the business units sometimes finance the project if they need help. Corporate Research is trying to mix people from the business units and corporate research when evaluating ideas, since it is being delivered to the business units. The key question is whether there is a receiver and if there is any relevance. Discretionary fund could also be used when ideas don't have a receiver from start. It can be used to finance the idea proposal and local managers take the decision. That kind of activity tends to be a pre-study, which in turn will lead to a project. When using the discretionary fund it is the management from the department who evaluate ideas. If one has a suggestion that would use discretionary fund they present the proposal to the management team and usually gets a quick decision. Hence,

employees draft a first idea proposal and seek support for this idea and refined through discussions with colleagues, managers and potential stakeholders are identified. The stakeholders are resource owners, financers and potential receivers of the end result i.e. CHTET, business units or involved partners such as (universities, external co-operations and customers). However, end-customers are not involved in evaluating the ideas, they are only receivers. In order to reach out to the end-customer one needs approval from a business unit, which have the contacts with them.

To start a project, first and foremost it needs funding. A research area manager takes the decision and they need to know if there are any receivers on the business unit area, it is very common to require it. If it exists, start the project. If an idea has no receiver then the research area manager takes the decision whether to start a project or not to find a receiver later. This means that you'll do a pre-study before G0 in the gate model to gather more valuable knowledge. Therefore, ideas can be very different developed; sometimes they can be very well developed and sometimes very indistinct. The financing of a project is mainly from CHTET to work out new ideas. Hence, it is from day one. The budget is already planned for the next year after the project generation day when the management team has a clue about what they are likely to work with. It is not only the nature of projects that determines projects; rather it lies in the group's strategy with focus and continuity to plan the allocation of resources. For a researcher to obtain financing, it is quite different. If it is something that is in line with the strategy and interesting for the research area manager who knows that there is a receiver at a business unit, then it would not require so much conviction. But if it is a completely new area, it could take longer time. The steps involved before entering G2 in the gate model is summarized in the figure below (Figure 14)

Figure 14 Process of defintion and planning in the gate model

4.2.4 Execution phase

Next level in the gate model is the execution phase where opportunities for new innovations are identified from internal and external sources. This process is designed to ensure the execution of projects and that they are in line with the portfolio. A project is complete when it has either been delivered to a business unit or when stakeholders have agreed to stop the project. ABB's focus is to create technologies and then the creation of customer value. The portfolio is balanced partly to solve both short-term and long-term problems, the short-term solutions are often to support the business units but ABB mainly focus on long-term developments. Furthermore, it is a small part that tends to look at disruptive innovations. Opportunities are identified when problems are realized, the customers perspective and understand the business view i.e. user experience, stakeholders, influences, market development, what would change the market, technical consequences and how to align. It is different depending on which research area, some are looking for the end customer's problems and are developing prototypes tested on site, while other areas are trying to test new technology and create interest in the organization.

ABB look at the opportunities at various levels. One thing is to look at various trends whereas ABB explores social trends, market trends and technology trends. For example in the research area Mechanics at ABB, they are not first movers but rather fast followers. They mainly use development from the aerospace and automotive industry and other research areas take inspiration from the computer- or gaming industry. ABB is trying to find big technology trends that will get ahead and see what consequences this brings to ABB and what they can use. Finally, inspiration is also taken from the manufacturing industry. If the automotive industry begun to mix different materials to reduce weight, then you know that it will be cost effective which has consequences for the ABB products as well. This also requires development in the automation process, if they are looking at the manufacturing techniques then ABB need new automation solutions for it. Customer value is achieved today by technology development tested at the customer, making prototypes on site. On site ABB can access data at show what they can do with the data, that is when interest is created. However, there is not a default way how to work, this approach is different in the various research areas. The first customer visits may be to get requirements and to bounce ideas with each other. Then data is collected and at a later stage demonstrated

through simulations, demonstrations are necessary to show the customer value. However, there are no physical finished products at this stage. When the prototypes are presented to the client, ABB gathers feedback in order to create new ideas. Moreover, customers could also join and explore opportunities in the form of collaborative projects with universities.

4.2.5 R&D Portfolio Management

When ideas are generated it is managers decision which ideas will turn into R&D projects, which type of project to focus on and whether the project should be carried out internally or externally and what resource are needed. The gate model helps and determines which R&D projects to be carried out internally or externally together with the steering committee, business units and corporate research managers. Usually it is a research area manager or a business unit who decides. It depends on the nature of the project; if there are not enough resources or capabilities at corporate research may collaborations be initiated in consortium projects, universities or research institutes. Consultants may also be included if resource problems exists, other companies may be involved in the consortium projects but may not be a competitor.

Projects conducted at ABB are pre-studies, cooperation projects, technology scouting and technology- and product developments. Pre-study and technology scouting are similar projects; a pre-study is the step before ABB has an idea you want to investigate further. Technology scouting is investigating a particular technology that eventually will become an idea for further development. Thus, both projects are different pre-studies before anything concrete. When the idea is tangible, one can look at the features and solutions. Technology development is where ABB has a tangible idea; the difference between product development and technology development is that they are in different phases. Product development is a product idea, and technology development is often developed into a product idea. The stage g5 for technology development in the gate model usually corresponds to g2 in product development. Corporate research hands over the project to the corresponding business unit when it is tested on site using programs such as MATLAB. It is the business units who are in charge of materials and manufacturing. Finally, there is also a product development support where corporate research supports the business units under technology transfers.

The design and development phase must be organized efficiently to reduce innovation lead times and reduce costs. Testing the project ideas relatively early in the phases, especially if R&D is related to a non-existing market is essential. However, R&D activities to non-existing markets are small. Testing takes place first of all internally and then at the customer. Within certain research areas they have own labs, others don't. Analysis at the customers has to be prepared internally by simulation models before testing at the customers. Hence, tests at the customer is MATLAB models that analyzes real data, there is no physical product. For testing on-site Corporate research must go through a business unit to avoid the risk of damaging any relationships. Corporate research usually hands over a technology demonstrator or a kind of prototype to the business units. There may be technical reports, both hardware and software. Then what the business units decide is entirely up to them, a project can be ended at this stage, it depends a bit on how the project is handed over. Approximately 10 percentage of the budget is to support product development after it has been handed over. There is a risk that the businesses don't know how it should be managed, how they should get it into their products. Therefore, corporate research conducts support for product development. The figure below summaries the steps taken until step G5 in the gate model when the project is handed over to the business unit (Figure 15). The handover is done during design and development, as previous discussed, G5 for corporate research corresponds to G2 for the business units since they are doing product development and manufacturing. Commercialization is done by the business unit and when the project is delivered to the end-customer it is time for evaluation and capture return on investment. Corporate research use this information as feedback and to see how the project succeeded.

Figure 15 The execution process in the gate model

4.3 Feedback from involved actors in the innovation process

This section aims to provide thoughts and opinions on ABB's current innovation process from various parties involved. It involves actors from corporate research, business units and Boliden. These findings involve constructive feedback collected from the different interviews. The interview with the business units of ABB where conducted after the interviews with corporate research and Boliden since the business unit is the level between these two. The author wanted to examine the beginning and the end of the innovation value chain first. By doing so, the author could discuss problems realized from both sides with the business unit.

4.3.1 Researchers CRC

According to a researcher at CRC he states that product management traditionally in ABB is weak, this because it is quite understaffed compared to the job they need to do. The developer sometimes has never seen the customer or talked to some of the end customers. The research areas work differently depending on the groups but going out to the end user, talk to them and observe them is a very typical eye-opener both for corporate research and the end customers. However, there is always some hesitation from the product management, because they don't want to expose the developers to them. Furthermore, ABB as a company has a very risk adverse profile, the moment something is out of the natural boundaries what the business is doing today the answer is already, no. Another thing that has to do with innovation is that researchers are only informed if they need to know something. Therefore missing an open communication culture.

Communication between the global lab and the different research areas are according to researchers good, what is not working properly is between the researchers and the research areas because the research area manager controls the communication with them. Communication between researchers in different research areas within corporate research is easy, but since there are six other research areas in other countries it is problematic. Researchers are not allowed to travel to these locations, so it is very difficult to collaborate with them, another issue is bad collaboration tools and therefore videoconference on laptops becomes problematic. Communication between researchers and business units is difficult as well, especially if you have just started because it is all based on personal relationships. Furthermore, traveling to the

business units is not being allowed. The knowledge doesn't reach out to the researchers, which causes the problem of not being able to present ideas to the business units. Moreover, the business units have all contacts with the end-customers and to meet them, approval is required from the business units. Sometimes researchers are used as a marketing instrument when customers have very complicated problems. These meetings are really important for the researchers because it gives direct exposure to the end-customers.

For starting a project the management always want's everything up front, that could be a problem. For discretionary projects only one paragraph is enough of the description of an idea. However, normal projects require more detailed descriptions about ideas in terms of business impact, potential business unit partners, budgets etc. It depends on the individual research area manager what processes is needed and could sometimes require a lot of pre-work of reporting. Researchers are feeling a lack of trust at the company and since technologies change so rapidly, for research, this is deadly. The quote below is from a researcher what he thinks about the start-up of projects:

> *"To really start a project it takes just up to three to four months … the innovation process is chaotic by nature and is very hard to control. You really need to trust the people, and the trust is fundamentally missing in this company"*

Long-term projects are only possible if there is a receiver at the business unit or if the organization is mature enough to have the capacity to take it in. Therefore, problems occur when a business unit for example is working on a major platform, which requires a lot of resources. The result will be that they cannot take any results from corporate research because they are too busy. One of the problems corporate research typically has is that the business units are not ready to receive the result. They do not have the resources enough or don not allocate it properly. It creates an enormous backlog of ideas and projects that still needs to happen for them. These transitions are incredibly important since ABB is mainly working to create new technologies and then try to create customer value from the technical solutions. Moreover, to reach

customers, corporate research has to go through the business units, both in terms of communication and product delivery.

Sometimes it turns out that R&D at corporate research is doing something that is not aligned with the business unit. This is a problem, to get funding you will need a business unit partner, and if the idea is not in line with their business the project will probably be ended. Only discretionary fund support these projects, but only for smaller once. Introducing a new system or new product is one of the most difficult thing to do, you will need to collaborate with the customers to get their point of view and there is no fixed methodology for how many times corporate research meet the customers. Customer meetings are incredibly important to demonstrate products and to create customer value and to understand customer values. Corporate research doesn't go out to end-customers, only the ones with a good working relationship. Sometimes you do not visit the end-customer until after you have tested internally, market pull and market research is done only to see which business that exists. It is not to go out and visit customers, that asset does not exist. According to a researcher ABB has very poor direct contact with end-customers. It is good in the mining industry due to previous collaborations with Boliden, but otherwise ABB is suppliers very often. Corporate research tries to connect with customers but cannot access them; first you will have to go through the business units to reach out. It is at the customer you identify needs but it is very rare that corporate research have that contact. However, a possible trend would be to integrate end-customers earlier in the value chain. ABB as a company thinks in terms of technologies and do not think in terms of user needs. What is needed to help the innovation process to create customer value is better communication, collaboration and the way things is structured. A lot of innovations is being done but without any receiver. The quote below is from a researcher what he thinks about ABB's method of first developing technology solutions and then tries to get customers interested:

> *"I think the opposite, I don't like to create new technology solutions, but I like to create customer value … I think the trend is more towards creating customer value, but we are extremely slow … we are really looking inwards in a way when it comes to innovation"*

4.3.2 Managers CRC

According to a manager product management differ depending on which research area manager is in charge, if a manager has a background from a business unit, it provides extremely high input since you will have the possibility of attending on their workshops and use their network of contacts. It also enhances the process of get in touch with customers. Corporate Research has fairly many projects where the customers is involved, but not for creating projects or ideas and therefore very poor in developing together with customers. Most of the ideas are generated internally, but the ideas are created for a reason. Establishing contacts, being subjected by impact, influences, knowledge, experience and so on generates ideas. It is important to create an environment where one can get ideas and create a passage for their creativity. Furthermore, it is important to mix people with different ages, backgrounds, nationalities, educational level etc. a trend is that people want to be more and more unique to differentiate themselves from everyone else, which means that if you are manufacturing a car you will have to manufacture is with a personal touch. It is a long-depth trend in society today and has consequences for ABB. To create customer value it is much dependent on understanding what the customer wants, and what is worth to the customer. Reliability is something that is required and to build trust. To create a new scope it depends a lot on who is the research area manager in charge and his network of contacts, time frame and personality e.g. a profitable project in the mining industry had probably never taken place without the research area manager in charge back then. He trusted the researchers and the groups potential. That is needed, the problem is that top managers wants to take more risks, look at new markets, new areas etc. However, when it comes down to it, they often require a business unit to fund a specific project. Without any receiver, corporate research cannot go in and the project will be cancelled. Managers address that one problem is that every project must have a receiver to get funding, as quoted below:

> *"R&D to a non-existing market is very small, too small. I wish more of it but the budget controls our scopes"*

Communication internally is incredibly dependent on the individuals. It really depends on what contact the researchers or managers have, both between research areas and business units. However, there is no structure that encourages

communication, it is the money that controls everything. Communication between researchers and the customer must go through the business unit to contact the end customer, usually in a project. Communication with the customer differs depending on how developed the relationship is. Furthermore, if it is a major business partner, then corporate research cannot talk with them without permission from the business unit, as quoted by a manager below. In that case, it is very strict who should be involved and how to communicate. The communication with the customers is based on the individual level. Some researchers wants to gather information before they make the contact and others contact the customer just for that information.

> *"I would like more contact with the end-customer, but it is risky. Then you'll need some control and regulation, it could be devastating if a* researcher *does anything wrong"*

Managers argue that corporate research receivers: the business units, sometimes have problems to receive projects from corporate research. It is not the execution at corporate research of R&D projects that do not work; it is somewhere later in the value chain that it doesn't work. Therefore, the problem arises that some products will be stored at ABB if they are not transferred to a business unit, as quoted by a manager below. It doesn't work in practice to hand over the projects. However, it would be optimal if the business units could work with corporate research earlier in the process. The biggest challenge for corporate research has always been to ensure that the projects made will be used later as well. It is often a resource problem in the business unit. The business units are often busy with ongoing projects; they may also lack understanding of some new things that requires an organization to take care of it. It might require selling in a new way. Collaboration with different firms exists in different forms, but with no competitor. Corporate research sometimes start up collaborations together with the business units, they appreciate collaborations. Collaborations with other companies exist in a certain degree. However, according to a manager it is very a very complicated process from a legal perspective. Customer involvement are fine in some areas, the problem and potential is to improve the ability to collaborate: to make development together easier. It could be to make technology development together with the business unit or focus on more external partnerships where development projects are running with external partners. It may be the end-

customer, but it could also be with a subcontractor or other partners. There are many different scenarios.

> *"The business unit doesn't always succeed to receive our projects. That is the problem, often it feels like they don't have the resources or conditions needed to keep up … I've never seen a project being sold on to a third party, it may be on hold. Some years, it will be stored but not sold on."*

Corporate research is searching for better collaboration throughout the entire innovation value process. For that, discussions about what is required is needed early in the project process; what it takes to receive projects and adapt to each specific project depending on which resources is require, quoted below by a manager what is necessary for that. Corporate research wants researchers to have the opportunity to continue at a business unit, it is not so common e.g. through product development support or join the technology to the business unit. This would give corporate research opportunities for communication and keep valuable knowledge. It is one of corporate research goals to transfer employees to the business units. First, it creates an opportunity to bring in new talented people; secondly, it enhances the network and the relationship with the business units, which gives corporate research better opportunities for cooperation's. The innovation process can be improved as quoted by a manager below. Corporate research are missing guidance to collaborate, a lot is based on personal relationships. To begin with, an organization that supports communication is essential. Barriers must be removed making it able to react quickly.

> *"We must become better to collaborate, external collaborations. Then we must create an environment in which CRC could work with the business unit jointly on technology development projects"*

4.3.3 Customer Boliden

According to the interviewed manager at Boliden the cooperation with ABB has generally been good, several ways to contact exists. Either ABB makes the contact or Boliden does. Meetings are held on regular basis to reconcile the projects and to discuss new projects, often an idea that ABB would like to test on-site. ABB and

Boliden pays for its own participation separately i.e. software is usually purchased by ABB and material by Boliden if it is needed for a prototype on site. According to the manager value is created when the product is finished, during the exchange. However, knowledge is gained along the way during the development, knowledge is developed together. Therefore, customer value is not only during the usage of the product. Even though Boliden does not generate ideas for new innovations internally, they are positive to collaborate with other companies. Boliden do not want to develop their own products, but is positive for cooperation with other companies to develop together. A quote based on this to help ABB's offerings from the manager at Boliden below:

> *"It is not unusual that we have ideas and willingness to make cooperation projects. Ideas develops everywhere, the same idea can be born in many different places. We want to encourage engineering companies to support several mining companies. Success in other mines is success for us as well"*

According to a manager at Boliden they are interested using collaboration with other companies to create new products for Boliden, especially companies in Sweden because it is more difficult to collaborate internationally. Therefore, focus is on ABB and some other companies. It is not uncommon that it exists products that Boliden wants to modify to fit the mining industry and therefore willing to communicate with R&D departments at various companies. Universities is not technically developed enough, good support is very important and therefore Boliden is focusing on cooperation's with companies. Boliden can communicate both virtually and in physical participation since they have a good ICT infrastructure. Videoconference is becoming more common since it is really good at long distance. Boliden reaches out to ABB by scheduling appointments and is positive to further collaborations in various forms and is willing to add resources and time on it. When the author of the thesis explained the different collaborations modes for the manager he stated that it would be interesting to use different collaboration forms, both innovation mall, elite circles and consortium projects. Participate in innovation workshops would be interesting in order to help ABB to create new innovations, both resources and time. Innovation workshops would also be interesting if more companies are involved, especially with other mining companies. A good thing in the mining industry is that

there is no competition between involved actors, instead they benefit from each other. The quote below is from the manager about this. Consortium projects with other companies would be interesting if companies as product owners make the contact. Boliden doesn't want to own the product, they can offer testing and generation of ideas but don't become product owners.

> *"We are in favor of cooperation with more participants from the mining industry. It is only positive. We would like more users if we produce a product since it reduces the risks. With higher uncertainties there is a risk of projects being ended. Hence, we're happy to work with ABB with purpose to sell to more companies in the mining industry"*

The mining industry is a special market; Boliden is selling products in a world market with little customer contacts. If prices decreases is bad for Boliden and vice versa. The need for customer interaction doesn't exist. However, the communications within the mining industries actors are good, but would like to increase it. Regular meetings doesn't exist, it would be appreciated if one could share their thoughts and experiences with each other. The important thing is to know which actors to communicate and interact with; one must be able to trust the person. Sharing information is no problem; it is more a matter of time and trust. Standardized contact with corporate research at ABB would be appreciated. It is good with more contacts in different places. Workshops together could potentially help other companies' innovation process in order to create valuable innovations. Then one can tell about Boliden's challenges and create solutions to various problems.

4.3.4 Business units at ABB

According to a manager at the business unit most of the ideas are generated from the customer and that is where one gets inputs for solving problems and if it is in line with the strategy. How aligned the business strategy is between the divisions depends very much on personal contacts. However, there is no system for creating it. To make an idea become a project and delivered to the business unit, they require a business case that shows how to make money from it. Hence, the business units are customer oriented. Then funding is necessary, it exists a small development pot for projects without a receiver but it is limited. Furthermore, it must be requested in time, which is

difficult. It is easier to have a good idea from a customer to seek funding. There will be new ideas both from internal and external sources since it is connected. However, it is incredible dependent on the personal networks. Customer involvement is starting to take place at the business unit in which to find customers who wants to innovate together. Then it is more synchronized and that is critical for success. It is different if one develops a product, then you know what to solve, but ABB develops solutions with several different products, then you will have the end user involved in the development. Meetings with customers along with corporate research are appreciated from both sides where problems and solutions can be discussed. ABB is lacking a methodology for making innovations; corporate research must find a person who likes the idea at a business unit if a good idea is generated before reaching out to customers.

According to the business units the communication between the business unit and corporate research is also very dependent on the individuals. Many in the business unit have never visited corporate research, which could be improved. If a personal network exists and one knows how the organization works, then the communication is easier. There are different opinions about corporate research; some people see it as a resource, which is bad, other as a tool to develop technology and receive feedback on long-term project, which is better. The biggest barrier between corporate research and the business unit is financial problems; corporate research receives funding for product development support but not the business unit. More resources must be simplified and plan accordingly before receiving the project. Reallocation of resources would be positive in order to solve these economic problems. The handover phase is problematic because the software sometimes doesn't work with our products and could be really time consuming to understand. Being dependent on personal network is one barrier, another one is that corporate research and the business units work in different time horizons. Better joint planning is necessary, corporate research and business units are not aligned in their tasks. All business units make an STP, but none are related to corporate research STP. Sometimes the business units and corporate research talks with each other to see if it works together, sometimes it is a match, then it will be great projects. However, sometimes the projects won't match before the planning of activities is made at respectively divisions, and therefore not aligned.

Collaborations with customers to create new products are based on their problems, and more regular meetings would be appreciated with customers. The collaboration with Boliden is good but more customers are desired e.g. workshops together with customers are very positive and valuable. The organization is well structured for current customers products but perhaps not for the generation of ideas together. The cooperation with Boliden is good because it is a customer who wants to co-operate, it is important. They believe in long term, the second is that the cooperation has a long history. To achieve a good exchange you will let the customer talk about their problems while corporate research describes their technologies. Then ideas and solutions are created from both sides. Developed products that would be out licensed do not exist. According to the manager he argues that the reason of the backlog of ideas is due to communication problems with corporate research. It may be due to processes not designed correctly because the business units cannot receive ideas while corporate research delivers too much. The manager argues that it is better to transfer resources from corporate research to the business units and create a balance. It is not the ideas that are bad but there may be due to insufficient resources. Therefore, transferring of resources would be positive for the business unit. Using a talent pool where the business unit could borrow resources temporarily and then back to corporate research, this also facilitates the transfer of knowledge. More continuous contacts internally to facilitate the personal networks would be required. It is created individually, but help from the company would potentially enhance the alignment between the various divisions. Above all, one needs to plan together what methods, what collaborations, what results are necessary for technology development to proceed. The strategy is aligned globally, but it is implemented differently and therefor difficult to connect.

The manager argues that to assist the innovation process it would take more effective transitions to create more customer value, it takes too long time between idea and product, and we need more aligned intermediaries. The planning for project handover is bad because corporate research work independently on projects, and since the business units is not participating from the beginning; the handover becomes too large to receive. The problem is that corporate research and the business unit doesn’t cooperate initially. The project transfer is thus dependent on cooperation together throughout the process, even though the business unit cannot contribute much in

technology development, they must participate in order to gain knowledge. The handover phase without cooperation doesn't work in practice and the business unit probably starts with the project too late. The process needs to be more aligned. The quote stated by a manager below highlighted a project that where aligned:

> *"I've seen two projects working very well because the project planning was made at start together. We decided that we were most active in this phase and corporate research is most active in this phase. Then you'll have a long commitment of several years together and it works really well"*

According to a manager at the business unit he argues that the exchange of value is created when the customer tells about their problems while corporate research participate as well and share their solution, this method usually crates most ideas and interest. The business unit has workshops but not for idea generation. However, it would be interesting if the customer and corporate research made it together with the business unit. Furthermore, it would also be interesting to create a forum for sharing problems, solutions and so on. If it would work to communicate virtually, perhaps it would be easier to schedule meetings more regular. The business unit is also in favor of external partnerships to share ownership of products. To become more faster, lack of capabilities must be complemented.

5. ANALYSIS

This chapter compares and analyzes the theoretical framework to the empirical findings. It answers the second research question.

5.1 ABB's Innovation model

Comparing the theory with the empirical data confirms that ABB's innovation process could be categorized as a closed innovation model. The empirical data shows that collaboration for idea generation exists by using internal sources in ABB's organization. None external source outside ABB is used for idea generation at corporate research. The ideas are based on strategy from top management; which business units exists, whom are they working with and what relationships exists i.e. who is the end-customer and what is ABB's scope. External ideas outside ABB can enter corporate research but are based on social networks from either a well-established relationship with a customer or using connections located at the business units. However, end-customers are not involved early in the innovation process for developing or evaluating ideas. These steps are done internally, ABB only present what they can offer and make field studies for user experience and collect information from the customers to analyze what they can do with it. All steps are being done internally for idea generation to commercialization.

A closed innovation model is categorized as a process when the firm does everything itself from idea generation, idea realization and development and commercialization. If an idea is rejected, there is a risk that many promising business ideas would never be used (Herzog, 2008). ABB's process is organized using a gate model which task is to make sure that the R&D projects or ideas are in line with ABB's visions and goals as well as reflecting different division's strategies and business unit's scope. Ideas generated are being prioritized based on these prerequisites, which makes some ideas accepted, others will be on hold and others will be ended. Feedback from researchers and managers confirmed that it is common when an idea doesn't fit with a scope, it usually will be ended. This creates an enormous backlog of ideas, which is typical using a closed innovation model (Herzog, 2008).

Collaborations exist in different forms if corporate research not has enough resources or capabilities. Hence, collaborations may be initiated in consortium projects with

universities or research institutes. Consultants may also be included if resource problems exists, other companies may be involved in the consortium projects only if it is not a competitor. However, according to a manager it is a very complicated process from a legal perspective. These collaborations can be recognized in the collaborative innovation model, which goal is to give R&D personnel greater access to external sources for new innovations through shared knowledge and experience (Swink, 2006). However, the author argues that the process at ABB cannot be categorized as a collaborative innovation process since it is doubtful whether it is a successful process or not. Managers and researchers at corporate research are missing guidance to collaborate; a lot is based on personal relationships both internally and externally. Employee's want an organization that supports communication further and enhance collaborations with external partners. To achieve successful collaboration firm's physical barriers, knowledge barriers and organizational barriers must be dealt with (Swink, 2006).

Comparing the process with the open-innovation model confirms that ABB is not only collaborating with other companies but also universities and research institutes. ABB also take inspiration from social trends, market trends and technology trends but all ideas are based on internal workshops. Managers state that the biggest challenge for corporate research has always been to ensure that the projects will be used later as well.

However, no innovation projects leaves the process through technology licensing or spinoffs to other firms or markets. Instead, there is a problem of transferring the projects to the business units because of resource problems or not enough knowledge. The author considers that the process cannot be associated as neither collaborative nor open-innovation since no innovation projects leave the process and are facing collaborative barriers. Instead argues that the process is most similar to a closed innovation model.

5.2 Co-innovation

5.2.1 Convergence

Since ABB recently has introduced vertical programs (Chapter 4.1) in order to exploit resources together and synergy effects, there is a possible opportunity for gaining advantage from convergence. Synergy effects are very applicable on co-innovation to create new innovations, new business models and value chain processes and usage of them can create new customer values (Lee, Olson, & Trimi, 2012). This can be compared with the organizational convergence where collaboration is possible across the world to combine skilled people in different locations. The vertical programs are locally based at corporate research, but with the possibility to collaborate remotely this enhance the value chain activities with joint ventures between suppliers, distributors and even competitors. This strengthens the argument for not only perform organizational convergence locally. Therefore, the author argues that organizational convergence, in this case vertical programs, should also evaluate the possibility of involving business units, other research centers or customers. The motivation of going outside the local organization and externally is the opportunities that could be created by the industry convergence (Herzog, 2008).

Chesbrough states today that many options and opportunities for the commercialization lies outside the firm's boundaries and these opportunities have been discussed in the empirical (Herzog, 2008). Feedback from manager's address that new ideas are not necessarily a new technology, it could also be a feature used in another research area. This could be applied for the vertical programs searching for organizational convergence. Moreover, the empirical findings from the customer Boliden confirm Chesbrough statement about opportunities outside the local organizations. The company indicated that it is not uncommon that it exists products that Boliden wants to modify and make it fit to the mining industry, therefore willing to communicate with R&D departments at various companies.

ABB is trying to find big technology trends to use in their offerings. Therefore, the author argues that with customers' willingness to cooperate, ABB could potentially more easily create synergy effects and find collaborative partners together with Boliden. Since every idea is created for a reason, and must have a receiver; creating

joint ventures together with the end-customer would enhance the process of creating industry convergence. Corporate research cannot continue with a project without any receiver and this creates backlog of ideas according to employees. This argues for involving customers earlier in the innovation process. ABB is working successfully in their internal idea generation workshops and is using sharing points for these ideas between researchers. However, ABB is facing problems finding receivers of these ideas. Therefore, the author argues that it would be a possibility to construct these sharing points and workshops together with customers as well. Hence, the author suggests that the vertical programs should extend beyond the internal organizations resources and search for synergy effects that would reflect a demand from the customer to create industry- or organizational convergence. Since the budget controls the scope, working together with customers and compensate missing competence in industry convergence would enhance opportunities for the R&D to non-existing markets. However, since the vertical programs uses full time equivalents distributed from the different research area, some control for a particular research area is lost since it is now allocated to the strategic programs. The author argues that this may cause barriers and possible lack of resources for the different research areas, which do not favor a co-innovation platform (Lawrence, Goldwasser, Choate, & Blitz, 2008).

5.2.2 Collaboration

To manage co-innovation, the theory states that three building blocks are recommended. The first, **alignment** is about ensuring that the business strategy is communicated throughout the organization both **horizontally** and **vertically** (Lawrence, Goldwasser, Choate, & Blitz, 2008). To ensure vertical alignment at ABB, the company has various processes for ensuring that everything is connected to the strategy. In addition to the five global divisions, global lab is included in the organization with meetings each year to address key challenges and strategy directions. The global lab also involves a positions that is responsible for the alignment to ABB's corporate strategy and that the research centers targets ABB's scope. Furthermore, the innovation process uses the ABB gate model which ensures that projects are in line with ABB's vision and goals and do not deviate from it during the development phase. These directions are included in project generation and before generating ideas discussions is made at a strategic level. Once this is done, it is clear which area to focus on and what tools the group possesses in terms of competence and

thereafter project generation is based locally at the different research areas with workshops. The ideas are then being evaluated and prioritized on ABB's scope. Based on this information, the author argues that ABB's organization is constructed to communicate the business strategy **vertically** successfully until it is time for the handover the project, which includes barriers to support horizontal alignment discussed below.

There is no organized method of how to enable collaboration for innovation across functional groups. Instead, much depends on the individuals, group managers and their personal networks. After the workshop locally is done, the evaluation to continue to work further depends on which manager is responsible and what researchers willing to work with it. The author argues that this scenario is another factor that backlog of ideas are created at corporate research.

Feedback from employees confirms this; researchers are addressing problems with communications between researchers and the business units due to this reason. Furthermore, researchers have restricted access for travelling to the business unit. This issue is making it problematic for transferring the knowledge from the business units to the researchers at corporate research. Therefore, the author is missing elements to support innovation that is aligned across different functions. Managers and the business units address this problem as well. The managers at corporate research states that the business units have problems with receiving projects and therefore problems arise that the ideas will be stored at ABB if they are not transferred to a business unit. In turn, the business unit explains being dependent on the personal network is one barrier for communication, another one is that corporate research and the business unit work in different time horizons. Based on this information, the author of this thesis argues that there exist two major barriers to support horizontal cooperation at ABB i.e. communication problems and not being aligned in how to implement the projects **horizontally**. Horizontal alignment typically requires the creation of new units or redefinition of existing ones. Structures and processes that do not longer are effective needs to be eliminated in order to support collaborative innovation (Lawrence, Goldwasser, Choate, & Blitz, 2008).

The author argues that one solution for supporting the vertical alignment could be to work earlier together and plan accordingly in order to support the transferring of project from corporate research to the business units. The second, **boundaries** are the reason for most strategic partnerships to fail. Therefore, ABB need to solve issues of collaborating across functional groups (Lawrence, Goldwasser, Choate, & Blitz, 2008). Normally, the business units make an STP of what they are doing and corporate research makes one as well. However, according to the business unit they are not aligned properly. The business unit states that they have meetings with corporate research to compare each STP, and if they match it usually turns out to great projects. This strengthens the argument to collaborate earlier in the process. The scope for transferring ideas from one sector to another is huge. Innovation happens when you connect different actors of knowledge (Bessant & von Stamm, 2007). Therefore, the author suggests that to become more aligned **horizontally** the business unit and corporate research should work together and plan projects together. This would potentially solve the problems of being independent in their projects. What methods are needed and how they should work together to facilitate the transfer of projects needs to be discussed. These transitions of projects are incredibly important for ABB in order to create customer value and with today's approach communication-, resource- and knowledge problems are created.

To facilitate the cooperation and problems, the author believes that the divisions involved could rotate resources between corporate research and the business units i.e. both researchers and managers. This would potentially enhance the collaboration and erase the knowledge barriers between the different units. The business units stated that one barrier for the handover of projects were because of lack of knowledge and how it could be implemented into their products, which required a lot of resources and time. Using rotation of resources would potentially rotate knowledge between the units as well and solve this issue. This could potentially be an organizational element to support innovation since it enhances the transition of projects and the communication between functional groups. Furthermore, this could potentially enhance the establishment of the personal networks, which ABB's structure is highly dependent on. Enhancing the personal network makes technology integration and visibility across organizations easier to enable communication and sharing of information between different partners (Lawrence, Goldwasser, Choate, & Blitz,

2008). Hence, the business unit and corporate research could with this approach cooperate from the first two phases in the gate model to create ideas and evaluate them in order to be aligned with ABB's goals and scope as well as between different functional groups.

The suggestions discussed above could create a learning environment, which also could improve the collaborations in the future. As the theory states, the third building block would require **commitment** in order to align the different functional groups and remove all barriers. Creating a collaborative culture takes time and will require leadership communication and reinforcement for the development (Lawrence, Goldwasser, Choate, & Blitz, 2008). The business unit addressed the financial issues of transferring resources to their department, corporate research receives funding for product development support but the business units do not, which causes problems of hiring resources from corporate research. Therefore, using a rotation model could potentially solve this issue since the business units won't have to hire that resource on permanent basis. Corporate research wants researchers to have the opportunity to continue at a business unit because it enhances the personal networks and the relationship with the business units. Another thing is that it would create an opportunity to bring in new talented people. Therefore, the authors suggest that corporate research should invest **commitment** for rotating resources. It could be possible to create opportunities for the business unit to employ a researcher on a permanent basis since the collaboration makes them more aligned. The author suggest that one possibility for corporate research is to use the funding for product development support for this or use the discretionary fund to support these activities.

5.2.3 Co-creation

Important to observe when choosing innovation relationships is that different modes of collaborations involve different strategic tradeoffs. Choosing the right collaboration mode must take into account firm's strategy on building and capturing value and firms can use combination of collaboration modes to support these strategies (Pisano & Verganti, 2008). Corporate research is using different strategy tools to analyze ABB in its entirety and to make sure which business units exits, whom are they working with and so on. Once this is done, it is clear which area to

focus on and what tools the group possesses in terms of competence. The author argues that after the collaborations barriers has been eliminated and functional groups internally at ABB are working more aligned and cooperating together. This cooperation would possibly change the organizational structure and principles used before. If corporate research and the business unit work together in project planning it would need competence mapping between functional groups as well. The author states that decisions about which projects to focus on would require different strategic collaboration modes depending on which customer or project focused on. However, the author consider that ABB should evaluate the modes of collaborations suggested by Pisano and Verganti for each specific project in order not missing out on valuable opportunities for innovations i.e. either innovation malls, innovation communities, elite circles and consortium projects.

Open modes however are not as effective as closed collaborations in identifying participants and closed collaboration modes are preferred when interacting closely with actors (Pisano & Verganti, 2008). This would be the case for ABB since a co-innovation would require close interactions between corporate research, business units and end-customers. Closed models have been used before at ABB when there are not enough resources or capabilities. Then collaborations may have been initiated in consortium projects, universities or research institutes. Managers confirm this but states that no collaboration is made with competitors and sometimes collaborations are done together with the business unit, which is appreciated. Collaboration with other companies exist in a certain degree but ABB address that it is a complicated process form a legal perspective. The business unit addresses the problem about backlog of ideas could be a reason due to lack of resources. Hence, it is not the ideas that are bad. The author agrees with this assumptions from the business unit and suggest that all participants need to collaborate more closely for creating customer value i.e. plan together what methods, what collaborations and what results are necessary for the innovation process early in the gate model.

The business unit is also in favor for external partnerships to share ownership of products. To become more faster in delivery to the end-customer lack of capabilities and resources needs to be complemented. Otherwise there is a risk of projects being ended. The customer Boliden is in favor for further collaborations in various forms

and are willing to add resources and time on it. Sharing information is no problem for them, it is rather a matter of time and trust and they want to know who is involved. Standardized contact with ABB would be appreciated and they are interested in collaborating if companies as a product owner make the contact. Boliden doesn't want to own the product, they can offer testing and generation of ideas but do not become product owners. Based on this, the author suggests that the closed collaboration modes should be used for projects with end-customer, business units and corporate research if they are aligned with each other. Hence, when corporate research, a business unit and the customers are involved, the author argues that an elite circle collaboration would be best suited and if the participants are missing resources or capabilities consortium partners should be selected in order to capture value and deliver customer value.

Since ABB is trying to find big technology trends and see how these brings consequences for ABB from other industries the author argues that the open collaboration modes would be possible for ABB as well. Researchers are stating that they are missing an open communication culture and that the knowledge doesn't reach out to the researcher since they are missing input from customers. The author considers that these issues may partly be solved by integrating the business unit with corporate research since it enhance the valuable personal networks at ABB in order to reach customers. Moreover, the author argues that using open collaboration modes could as well attract larger number of problem solvers and ideas to the researcher (Pisano & Verganti, 2008). This argument is based on that top management in ABB want to take more risks, look at new markets and areas but often requires a business unit to fund the project. Without any receiver corporate research cannot go in and the project will be cancelled. The author argues that using innovation communities or innovation malls could potentially make ABB access interesting markets outside their scopes without being forced to invest large resources on idea generation, instead focus on their core competence.

In a co-innovation process the firm works together with all stakeholders, especially the end-customer. The core principle is to engage people to create experiences together (Lee, Olson, & Trimi, 2012). The experience defines what is valuable to the customer (Payne, Storbacka, & Frow, 2008). End-customers are not involved early in

the innovation process for developing ideas, instead ABB present to the customer what they can offer and make field studies for the user experience. Customer value is achieved by technology development tested on-site and making prototypes. Hence, ABB focus on creating technologies and then the creation of customer value. Feedback from employees confirms this, researchers has sometimes never seen the end-customer or talked to them. Talk to the end-user and observe them is an important factor to create innovations and customer meetings are incredibly important to create customer value. However, corporate research is facing problems to visit the end-customers in their innovation process, only the ones with a good working relationship works properly. Managers address the issue of not creating projects or ideas together with the end-customers and therefore very poor in developing together with them. Furthermore, customers address that the customer value in the current innovation process is created when the product is finished, during the exchange. Based on this information, the author categorizes ABB using a traditional approach. In the traditionally approach, firms act autonomously in the innovation process with little or no interference or involvement with the customer. Customers only get involved at the point of exchange using this approach (Prahalad & Ramaswamy, 2004), which can be applied to ABB's innovation process.

Today customer seeks to exercise their power in every part of the business system and interact with firms, thereby co-create. Furthermore, they are not totally dependent anymore on communication from the firm since they now have alternative sources for information (Prahalad & Ramaswamy, 2004). One can see trends of industries moving towards 'market as one' and costs of understanding and responding to customers can easily go out of control (von Hippel & Thomke, 2002). Organizations are starting to collaborate more and more, and together with customer communities, collaborative networks could represent a positive paradigm on personalization and innovation and therefore co-create (Romero & Molina, 2011). Feedback from the empirical findings confirms these scenarios. Researchers can see a possible trend to integrate end-customers earlier in the value chain and therefore address the importance of improving the innovation process to create customer value. Managers address that to create customer value, much depends on what the customer wants and what is worth to the customer. The customer Boliden are starting to realize that knowledge is valuable and is gained along the way during development together with

firms. The mining industry is applicable to the 'market as one' scenario. Communication within the industry is good and Boliden can see trends of increased communication within the market. There exists no competition in the mining industry between actors, instead they benefit from each other. The business units as well confirm that customers are becoming more interested to innovate together. Based on this information, the author suggest that ABB should seek to co-create value with firms and create personalized interaction for achieving SCA. Today it is harder to differentiate offerings, and if consumers don not see any differentiation, they would probably choose the cheapest choice for them. To prevent this, firms as well as customers may have to work against the firm-centric view and instead seek to co-create value (Romero & Molina, 2011).

The new co-innovation model integrates customers with active roles in all innovation activities. Customers that are actively seeking innovation are called 'lead users' and their participation in the innovation process can enhance the effectiveness through capitalizing user's knowledge. Therefore, firms must work closely and continuously with the lead users to keep up with changing needs and demands for the future (Romero & Molina, 2011). The author argues that Boliden could be categorized as a lead user. This based on that they want to collaborate more in various forms and are willing to add resources and time on it. Hence, ABB should take advantage of Boliden's desire to communicate with R&D departments for generation of ideas.

Firms need to create an experience environment within each customer that can create their own unique experience. It is about high-quality interactions with specific customers with an on-going dialog about pros and cons when tailoring a specific product or service (Romero & Molina, 2011). ABB has generated external ideas based on the personal networks and usually from meetings with customers. For example in the research area robotics, customers are quite often involved by visiting ABB's different labs, which provides good exposure and market inputs. For other research areas, much could depend on what the business unit say and often lead to minimal exposure to the customer. On site at customers ABB can access data and show what they can do with that data. This is when interest usually is created. The author concludes that customer value has previously been created when ABB either invite the end-customer or visit them. Which further strengthens the argument for

continuous cooperation with customers. Feedback from employees confirms this, researchers states that it has been good in the mining industry to create customer value due to previous collaborations, but otherwise ABB is a supplier very often. The innovation process needs to be enhanced to create more customer value with better communication, collaboration and how things are structured. Managers agrees that it is important to create an environment where one can get ideas and create a passage for their creativity, and it is important to mix different people. Managers also confirm that customer involvement is good in some areas. The problem and potential is to improve the ability to collaborate and to make development easier. The author suggests based on these facts that a new collaboration structure with the business unit and corporate research could possibly make corporate research able to easier access customers and create experience environments together with all participants.

The theory explains the importance of dialog, access, risk-benefit and transparency for building a co-creation system (Prahalad & Ramaswamy, 2004). The empirical findings shows that **dialog** with the customer has gone through the business unit for approval but the author believes that these issues would decrease if corporate research and the business units would get aligned and work together. Further argument for this is that managers with background from a business unit provide high input and usage of the business unit's network. Therefore, the author argues that good dialog within project groups would potentially enhance **transparency** between functional groups and establishment of larger personal networks important for ABB. Furthermore; increased dialog with Boliden could potentially penetrate idea generation. Boliden doesn't generate ideas for new innovations internally. However, they are positive to collaborate with other companies to generate ideas and it is not uncommon that it exist products that Boliden want to modify to the mining industry.

Creating an experience environment with customers is about high quality interactions with an on-going dialog to create their own experience. This makes customers able to engage in joint decisions about information, recognition of cost and **risk implications** (Romero & Molina, 2011). Boliden are willing to participate in innovation workshops in order to help ABB to create new innovations, both resources and time. They are also interested in participation with more companies, especially if other mining companies where involved. Sharing information is no problem, it is rather a matter of

time and trust and standardized contact with corporate research at ABB would be appreciated. The business unit address that most ideas are generated from the customer and therefore making the business unit customer oriented. Meetings with customer along with corporate research are appreciated from both sides but ABB is lacking a methodology for making innovations. The exchange of value is created when the customer tells about their problems while corporate research participates as well and sharing their solutions. To make this dialog work properly, customer must have the same access and transparency as the firm (Prahalad & Ramaswamy, 2004). Based on this information, the author argues that if a closed collaboration model were constructed. Then **access** and **transparency** wouldn't potentially be an issue. However, since good ICT infrastructure is a key factor for customer interaction ABB would potentially have to invest in tools to make it more functional. This based on that a researcher addressed the issue of bad collaboration tools. Boliden can communicate both virtually and in physical form since they argue that they have a good ICT infrastructure. Moreover, videoconference is becoming more common for Boliden since it is really good at long distance. Based on this, the author argues for involving customers in idea generation workshops in order to enhance the personalized experience and co-creation together. This also gives the customer **risk-benefits**, which is important stated by the theory (Prahalad & Ramaswamy, 2004).

Another important aspect of transparency and access for co-creation is trust, which is something that is similar to the building blocks of co-innovation. Boundaries are the reasons for most partnerships to fail and therefore require building **trust,** decision-making, legal ownership and solve collaborative issues. Solving these issues requires commitment for transformation and will require leadership and reinforcements to support this (Lawrence, Goldwasser, Choate, & Blitz, 2008). According to one researcher, he is feeling a lack of trust at the company. The author of this thesis argues that all participants need to establish trust in their collaboration in order to succeed. Managers also confirms that reliability is something that is required and to build trust. According to one manager, a profitable project in the mining industry had never taken place without the research area manager in charge because he trusted the researchers and the groups potential. Furthermore, Boliden express the importance of knowing all actors, who they are communicating with and must be able to trust the participants. Based on this information, the author argues for **trusting** all participants

in the collaboration mode chosen and potential barriers needs to be solved and prepared for before starting the collaborations. Leaders must focus on building a collaborative climate.

The theory address that CNO's are one possible driver for value co-creation because it allows firms to access skill, knowledge and sharing risk and resources together. Together with VVC's, an online customer community publishing and sharing experiences from innovations firms could co-create the experience by using interactive channels and establish experience-centric networks (Romero & Molina, 2011). Boliden address that the communication within the mining industry is good, but would like more of it. Regular meetings do not exits and when discussing customer communities; they argued that it would be appreciated if one could share their thoughts and experiences with other in the industry. Furthermore, the business units are also in favor for creating an online forum for sharing problem, solutions and so on. This would potentially make firms able to establish and adapt quickly to changing market conditions and customer demands. Therefore, firms need to support interaction channels with these customer communities to avoid losing customer value (Romero & Molina, 2011). Based on this information, the author argue that ABB should evaluate the creation of experience-centric networks and try to create interaction channels to different firms and customers. By doing this, the author argue that ABB could potentially attain experience from other firms and share experience by using customers networks.

6. CONCLUSIONS

The aim of this chapter is to answer the research questions by making a summary and discuss the conclusions from the research. The conclusion will give a recommendation for ABB with a framework for customer involvement. Furthermore, the author recommends further research necessary in order to succeed with a co-innovation perspective.

The aim of this thesis was to analyze how ABB can create customer value from the innovation process and to propose a framework for customer involvement. In order to do this, the author of this thesis made research on the latest innovation process evolution 'co-innovation' and analyzed ABB's current innovation process in order to compare it with the concept of co-innovation and suggest possible improvements or transformations. The research questions was:

> **Question 1:** How is ABB's current innovation process designed in the Process Automation division?
>
> **Question 2:** How can ABB increase customer value form the innovation process from the perspective of a co-innovation process?

In order to answer the second research question a case study at ABBs current innovation process was required in order to find possible problems, possibilities and capabilities. Based on these findings, the author was able to compare ABB's innovation process with co-innovation and suggest transformations in order to create more customer value. Using the same structure as the analysis, suggestions of implementing co-innovation at ABB can be divided into four categories and the main improvements necessary for ABB are the following:

1. **ABB's Innovation model**

Closed innovation process: No innovation projects leave ABB's boundaries, which create an enormous backlog of ideas. In addition of using co-innovation to create customer value, the author argues that ABB should evaluate the possibilities from the

perspective of an open innovation process. Thus, instead of creating huge backlogs of ideas try to explore technology licensing or spin-offs to other firms or markets.

2. Convergence

Organizational convergence: An initiative has already been taken since ABB recently introduced vertical programs locally at CRC. The author argues that ABB should also evaluate organizational convergence together with a business unit or other research centers.

Industry convergence: Evaluate the possibility for the vertical programs to extend beyond the internal organizations resources and search for synergy effect with external actors in order to reflect a demand from the customer to create industry- or organizational convergence.

3. Collaboration

Vertical alignment: ABB are using several steps in order to make sure that innovation targets ABB's strategy and scope. Use the Gate mode for ensuring vertical alignment.

Horizontal alignment: No organized method to enable collaboration for innovations across functional groups and also missing elements to support innovation that is aligned. The author suggest that to become more aligned horizontally, CRC should work together and plan projects together with the business units in order to solve communication barriers and problems of transferring projects.

4. Co-creation

Collaboration modes: Collaborations involve different strategic trade-offs; ABB should choose the mode depending on what resources and capabilities they have, what type of customer and project it is. Whatever collaboration mode is chosen, all participants need to collaborate closely to enhance co-creation and customer value i.e. plan together what methods, what collaborations and what results are necessary for the innovation process early in the gate model. The author suggests the closed

collaboration mode for projects with end-customer, business unit and CRC if they are align with each other.

Co-create: The author suggest that ABB should seek to co-create value with customers and create personalized interactions to create experience together. Ongoing dialog within project groups would potentially enhance transparency between functional groups and the establishment of personal networks. Barriers for interactions need to be eliminated and ICT infrastructure is a key factor for customer interaction. Furthermore, the author argues for involving customers in idea generation workshops in order to enhance the personalized experience and co-creation together.

The author of the thesis overall conclusion is that ABB's current innovation process actually contains some basis of a co-innovation process. Customer involvement exist to some extents, different collaboration modes are used in the innovation value chain and one can see a trend of searching for convergence effects due to their vertical programs initiative. However, to make the process work properly from the perspective of a co-innovation process ABB requires eliminating some major barriers and make reinforcements for co-creation. One reason for the backlog of ideas is due to the fact that ABB's innovation process can be categorized as a closed innovation model. Secondly, the transfer process of projects from CRC to the BU does not work properly because the organization is not horizontally aligned. A third reason may be due to lack of resources at the business units.

Important to note is that a change towards co-innovation will take time, one major building block of co-innovation is commitment to transformation and change. Creating a collaborative culture takes time and will require leadership and reinforcement for the development (Lawrence, Goldwasser, Choate, & Blitz, 2008). The authors argue to start with testing the perspective of co-innovation in a smaller scale and then make larger investments if the process is successful. Make efforts to continuously improve the important factors from the co-innovation platform. Furthermore, there are also other areas in the co-innovation platform where value can be created in the innovation value chain i.e. new innovations, new customer base, new efficiency of the value chain and new business models (Lee, Olson, & Trimi, 2012).

6.1 Recommendation

This thesis has presented several implications for ABB that should be taken into account in order to increase customer value from the innovation process. Based on ABB's current situation, this section will provide recommendation for ABB and purpose a framework for customer involvement using the co-innovation perspective.

First of all, the author recommends ABB to enable collaboration across functional groups. To manage co-innovation, alignment in business strategy must be throughout the organization both horizontally and vertically (Lawrence, Goldwasser, Choate, & Blitz, 2008). The author argues that the organization and strategy is vertically aligned at CRC since ABB has various processes for ensuring that everything is connected to the strategy. The strategy is communicated from the technology core team each year to strategy meetings with research area managers from all research centers. The next step is strategy workshops at group levels and later on workshops for generating ideas, then prioritized and based on ABBs scope. However, it exists two major barriers for horizontal alignment i.e. communication problems and not being aligned how to implement project horizontally. Therefore, problems occur when projects are transferred to the business units. The author suggest that one solution for supporting vertical alignment could be to work earlier together and plan accordingly in order to support the transferring of project from corporate research. These transitions are incredibly important for ABB in order to create customer value. To facilitate these problems, the author believes that resources should be rotated between corporate research and the business unit to enhance the collaboration and knowledge barriers between the units. This together with the vertical programs initiated by corporate research would potentially create opportunities for organizational convergence.

Next step for ABB would be to find customers that are willing to cooperate. Customers that are actively seeking innovation are called 'lead users' and their participation in the innovation process can enhance the effectiveness through capitalizing user's knowledge (Romero & Molina, 2011). Boliden is a good example of a lead user since they want to collaborate in various forms and are willing to add resources and time on it. Furthermore, the author of this thesis suggests involving these lead users in idea generation workshops to enhance the personalized experience

and co-creation together at a later stage. For new markets and project without lead users the author suggest that ABB should evaluate different usage of collaboration modes in order to penetrate establishment of new lead users. ABB is trying to find technology trends and see how things can influence ABB's offerings and therefore the author of this thesis suggest to use open collaboration modes to attract larger number of problem solvers and ides to the researchers (Pisano & Verganti, 2008). One example could be to use innovation malls to make ABB access interesting markets and find lead users without being forced to invest large resources on idea generation. This could potentially create new markets with lead users or find industry convergence.

When lead users and problems are realized it is important to choose which type of innovation relationship to implement. Choosing the right collaboration mode must take into account firm's strategy on building and capturing value and can use combination of collaboration modes to support these (Pisano & Verganti, 2008). Since co-innovation requires close interactions, the author suggests closed collaboration modes. If corporate research, business units and customers were aligned then elite circle collaboration would be best suited. If the participants are missing resources or capabilities for solving the problem or creating the customer value then consortium projects should be selected in order to capture and deliver customer value.

When collaboration modes are decided it is important to engage all participants to create experience together. It is about high quality interactions with every specific customer with an on-going dialog about pros and cons when tailoring a specific innovation (Romero & Molina, 2011). Therefore continuous cooperation with customers is necessary and it is important to eliminate all barriers for communication in both physical and virtual form. Therefore, it is important both for ABB and the lead user to have a good ICT infrastructure. Furthermore, when the different collaboration forms are established, it is important for ABB to make us of participant's networks. The author suggest that ABB should try to create interaction channels to different firms or customers by using the networks established from either the consortium participants or elite circles. This could enhance the marketing of products if a customer are using a VVC to publish and share experience from the co-created innovations and as well access external knowledge and feedback to the collaboration

with ABB. The same goes for the participants in the consortium projects, creating personal contacts and access collaborative network would potentially enhance the process of finding lead users or collaborative partners in the future. Find active users in communities and companies can co-create significant innovation with them (Bessant & von Stamm, 2007). The author of this thesis has developed a framework with customer involvement presented below and summaries the important steps for succeeding with a co-innovation process (Figure 16).

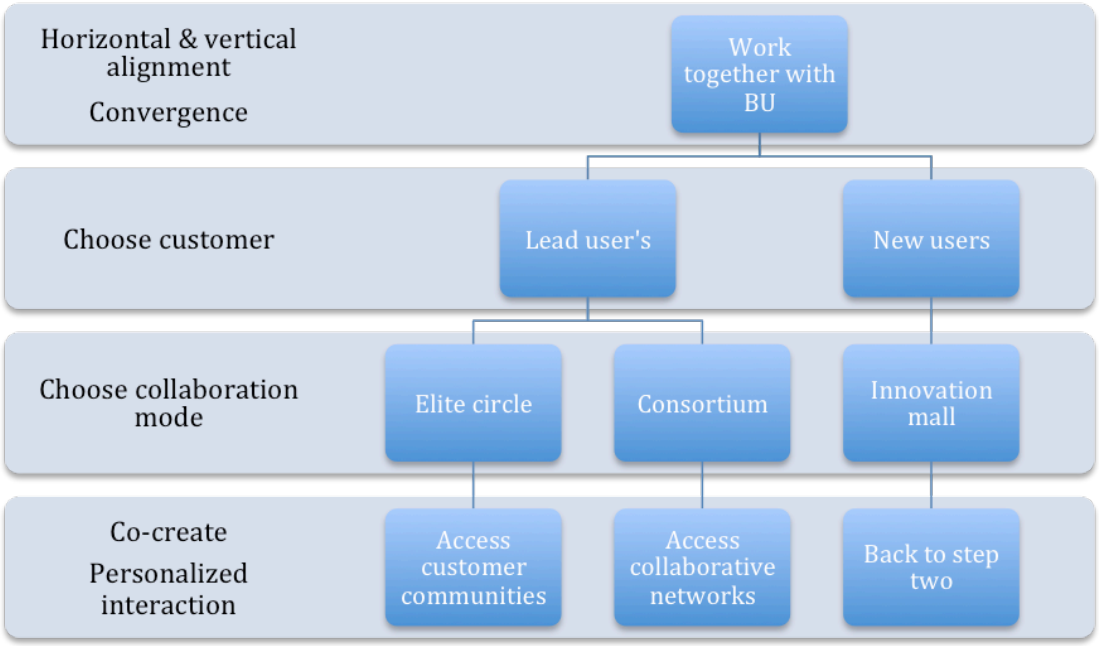


Figure 16 Framework for customer involvement using a co-innovation perspective

6.2 Future research

During the research some observations was made that the author would find interesting to investigate furthermore. Since this thesis was limited to only investigate how to create new customer value, it would be interesting to investigate the other four areas presented by the co-innovation platform. Organizations have five areas where it can create value in the innovation value chain i.e. 1) new products, services and ventures, 2) new customer value, 3) new customer base, 4) new efficiency of the value chain, 5) new business models. This would potentially enhance give a recommendation to ABB in how to conduct the co-innovation platform. Investigate how to make the value chain more efficient would potentially give suggestions on how to solve the transferring of projects from CRC to the BU.

Based on previous recommendation, one major barrier for the co-innovation process is the transferring of projects between different functional groups. The author suggest that it would be interesting looking at alternative methods or processes for solving this issues. Doing a comparative case study with another company without these problems would be interesting to conduct. Furthermore, it would be interesting to investigate if other companies are conducting the co-innovation process and compare this with ABB's innovation process. This would potentially give valuable information beyond the theory. It would also be interesting to investigate the business units and the customer's innovation processes more carefully. It would possibly give more empirical data to analyze the concept of co-innovation. Furthermore, since ABB are missing an innovation management division, it would be interesting to see if a new division could enhance the innovation process and coordinate function groups.

The author of this thesis made suggestions on rotation models based on feedback from employees and the business units. It would be interesting to search for theory about rotation models between different functional groups in order to implement it. Furthermore, the author suggested that ABB should evaluate spin offs or out-licensing of products. Since the focus of this thesis was on create new customer value, theory of these methods was not investigated. How to conduct this at ABB would potentially decrease the number of backlog of ideas in the innovation process.

7. REFERENCES

Adler, P., Hecksher, C., & Prusak, L. (2011). Building a Collaborative Enterprise. *Harvard Business Review* , 94-101.

Allarakhia, M. (2011, May 1). *Convergence Innovation: Nanotechnology Development at the Intersection of Disciplines, Ogranizations and Products.* Retrieved May 30, 2014, from BioEndeavor: http://www.bioendeavor.net/CommonData/Resources/Nano_Convergence.pdf

Bellantuono, N., Pontrandolfo, P., & Scozzo, B. (2013). Different pracitsed for open innovaiton: a context based approach. *Journal of knowledge management , 17* (4), 559-565.

Bessant, J., & von Stamm, B. (2007). *Twelve search strategies that could save your organisation.* London: Advanced Institute of Management Research.

Bryman, A., & Bell, E. (2011). *Business Research Methods.* New York: Oxford University Press.

Camarinha-Matos, L. M., & Afsarmanesh, H. (2007). A framework for virtual organization creation in a breeding environment. *Annual Reviews in Control 31* , 119-135.

Chan, K. W., & Mauborgne, R. (2005). Blue ocean strategy: From Theory to Practice. *California Review Management , 47* (3), 105-121.

Chesbrough, H. W. (2006). *Open business models: How to thrive in the new innovation landscape.* Boston: Harvard Business School Press.

Dahlander, L., & Gann, D. M. (2010). How open is innovation? *Research Policy 39* , 699-709.

Domingeuz-Péry, C., Ageron, B., & Neubert, G. (2011). A service science framework to enhance value creation in service innovation projects. An RFID case study . *International Journal of Production Economics* , 440-451.

Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *Academy of Management Review , 14* (4), 532-550.

Gupta, A. K., & Govindarajan, V. (2004). *Global strategy and organization.* New York: Wiley.

Herzog, P. (2008). *Open and Closed Innovation.* Germany: Die Deutsche Nationalbibliothek.

Lawrence, O., Goldwasser, C., Choate, K., & Blitz, A. (2008). Collaborative innovation throughout the extended enterprise. *Strategy and Leadership , 36* (1), 39-45.

Lee, S., Olson, D., & Trimi, S. (2012). Co-innovation: convergenomics, collaboration, and co-creation for organizational values. *Management Decision , 50*, 817-831.

Lee, S., Olson, D., & Trimi, S. (2010). The Impact of Convergence on Organizational Innovation. *Organizational Dynamics , 39*, 218-225.

Lichtenthaler, U., Hoegl, M., & Muethel, M. (2011). Is Your Company Ready for Open Innovation? *MIT Sloan Management Review* , 45-48.

Payne, A. F., Storbacka, K., & Frow, P. (2008). Managing the co-creation of value. *Journal of the Academy of Marketing Science* , 83-96.

Pentland, B. (1999). Building process theory with narrative: from description to explanation. *Academy of Management Review , 24* (4), 711-724.

Pisano, G. P., & Verganti, R. (2008). Which Kind of Collaboration Is Right for You? *Harvard Business Review , 86* (12), 78-86.

Prahalad, C. K., & Ramaswamy, V. (2004). Co-creation experiences the next practice in value creation. *Interactive Marketing* , 5-14.

Rejeb, H. B., Guimaraes, L. M., Boly, V., & Assielou, N. G. (2008). Measuring innovation best practices: Improvement of an innovation index integrating threshold and synergy effects. *Technovation 28* , 838-854.

Romero, D., & Molina, A. (2011). Collaborative networked organisations and customer communities: value co-creation and co-innovation in the networking era. *Production Planning & Control , 22* (5-6), 447-472.

Rowley, J., Kupiec-Teahan, B., & Leeming, E. (2007). Customer community and co-creation: a case study. *Market Intelligence & Planning* , 135-146.

Sanders, E., & Stappers, P. J. (2008). Co-creation and the new landscape of design. *INternational Journal of CoCreation in Design and the Arts , 4* (1), 5-18.

Sarala, R. M., & Vaara, E. (2010). Cultural differences, convergence, and crossvergence as explanations of knowledge transfer in international acquisitions. *Journal of International Business Studies , 41* (8), 1365-1390.

Seybold, P. (2006). *Outside innovation: how customers will co-design your company's future.* New York: NY: Collins.

Swink, M. (2006). Building collaborative innovation capability. *Research Technology Management* , 37-47.

Tidd, J. (2006). *Innovation models.* London: Imperial College.

West, J., & Bogers, M. (2013). *Leveraging External Sources of Innovation: A review of research on Open innovation.* J PROD INNOV MANAG.

von Hippel, E. *Democrazing innovation.* Cambridge: MA: MIT Press.

von Hippel, E., & Thomke, S. (2002). Customers as Innovators: A New Way to Create Value. *Harvard Business Review , 80* (4), 74-81.

Vrande, V. v., de Jong, J. P., Vanhaverbeke, W., & Rochemont, M. d. (2008). *Open innovation in SMEs: Trends, motives and management challanges.* Zoetermeer: Scientific analysis of Entrepreneurship and SMEs.

Yin, R. K. (2009). *Case Study Research: Design and Methods (Applied Social Research Methods).* London: Sage Publications.