School of Management

How to turn innovations into value in a large manufacturing company

MBA Programme Master's Thesis

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Course Number: IY2517

May 2014

Abstract

Large companies invest a vast amount of capital and time on R&D annually. With all this financial investment in R&D, it is important that the companies get value for their invested capital. By creating innovations, such as new products and services, involve high risk and will necessarily not lead to successful commercial ends. Many companies lack the competencies in selecting ideas and transform them into value. Knowledge in innovations is affecting companies, especially those that are investing heavily in R&D.

The present study explain how value can be created from innovation around the topics of innovativeness, innovation protection and market efficiency, within a large global manufacturing company in Sweden with global operations. A four dimensional measure from a prior study has been the base for the structural theoretical model that has been tested.

The authors have divided innovativeness, innovation protection and market efficiency into absorptive capacity (ACAP), open innovation, patents, secrecy, lead time advantages and complementary assets and studied modern literature to find relationships between these and how it affects firm performance. They have also done a survey and interviews to examine the present status in a large manufacturing company.

The empirical findings show support for a relationship between ACAP and firm performance, ACAP and success of strategic alliances as well as a relationship between protection of innovation and success of strategic alliances.

Acknowledgements

We would like to thank quite a few individuals. First, we want to thank the teachers, especially our supervisor Ossi Pesämaa, and students of the MBA programme at the Blekinge Institute of Technology. Then, we want to thank all the people who made this thesis a possibility by taking time to answer our questions and survey.

In particular, we want to record our thanks to the managers of Volvo Buses and Volvo Group Telematics for taking part in the interviews. Finally, we want to thank our families for their understanding and support during the time of writing this thesis.

Kristian Alsén and Peter Egeland, Sweden, 2014

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1. Introduction

1.1 Background

Large companies invest a vast amount of money and time in R&D annually. According to the EU R&D Scoreboard (2013), Volkswagen invested 9500 million euros in R&D during 2013. This makes the company number one in R&D investments of all companies in the world. The Volvo Group, which is the company studied in this thesis, invested over 15 billion SEK in R&D during 2013 (Volvo, 2013b).

With all this money being invested in R&D, it is important that companies get value for money. Creating new innovations, such as new products and services, involves high risk and will not necessarily lead to successful commercial ends (Horrobin, 2000; Girardi *et al*., 2005). Many companies lack the competencies to select ideas and transform them into value. Knowledge of innovations is thus very important for companies, especially those that invest heavily in R&D.

One aspect of innovativeness is protecting and capturing value from innovations (James *et al*., 2013). ACAP conceptually defines how ideas can be transformed, applied and developed in interaction with expected values from the market. ACAP is therefore often referred to as a facilitator of how innovations are generated (Flatten *et al*., 2011b). It influences innovation, company performance and the transfer of knowledge within the company. ACAP is used to facilitate knowledge accumulation and the use of that knowledge. Another area in the same topic is open innovation, which has become more popular. One of the most famous examples of open innovation is Linux, where more than 130,000 people have contributed to the development of the operating system (Chesbrough and Appleyard, 2007).

The present study investigates how value can be created from innovation, around the topics of 'innovation protection' and 'innovativeness', within a large global manufacturing company.

1.2 Problem discussion

In a competitive environment, it is crucial for companies to get the most value out of their innovation efforts to be able to stay competitive in the market. James *et al*. (2013) studied four different mechanisms that firms use to capture value through their innovations: patents, secrecy, lead time advantages and complementary assets. There is a need for companies to include these value capture and protection mechanisms in their strategies (e.g. patents can be used as strategic assets) (Somaya, 2003). Having a strategic plan and decision-making process for companies' innovations is necessary to gain the most out of R&D investments. It is important to have a method or process to decide if an innovation should be patented (e.g. if it has strategic value), be kept as a trade secret or made public.

Companies may create large patent portfolios and use methods such as the licensing and cross-licensing of intellectual property (IP) (e.g. patents) to gain royalties, freedom of design and access to competitors' patented technology to remain competitive. Passionate growth, namely double-digit growth, was studied by Treacy (2004). He claimed that this can be created in five different ways: by retaining your customer base, by gaining market share, by exploiting market position, by penetrating adjacent markets or by invading new lines of business. We study innovativeness, by using ACAP and open innovation, as well as the protection of innovation since this could help all the five strategies above.

1.3 Problem formulation and purpose

Innovation is defined as *"…something original and, as consequence, new that 'breaks into' the market or society" (*Wikipedia, 2014) or *"…a new method, idea, product, etc."* (Oxford Dictionaries, 2014). Innovation is thus represented by two main components: identifying a creative idea and commercialising it. A new idea in itself is not an innovation unless it is commercialised. Fernandes (2014) summarised this process by defining innovation as creating or capturing value in a new way.

Creating innovations is not enough if you cannot create any business value out of them. To stay in business, and remain competitive in the market, companies have to innovate and create value from innovations. According to DeSai (2011), the two most important factors for innovation are creativity and risk-taking. Individuals represent creativity, while the company represents risk-taking. Creativity leads to ideas but it is risk-taking that applies ideas, which generate results.

According to Damanpour and Aravind (2011), the development of innovations comes with risk and success cannot be guaranteed. This statement is in line with Rothaermel and Hill (2005), who stated that the process of discovering new innovations is both time consuming and capital-intensive and thus characterised by high levels of risk and uncertainty. Girardi *et al.* (2005) estimated that more than 66% of all innovations fail, which costs companies on average $15 million per innovation failure. One vital factor why innovations fail is a lack of knowledge such as on user needs (Braun, 1992).

As mentioned in chapter 1.1, companies invest a vast amount of capital into R&D. Therefore, this thesis aims to seek the answer to the following question: **How can value be captured from innovations?**

1.4 Research objective

The objective of the thesis is to explain consistent ways of managing innovation to create value. To reach the objective of this thesis, we examine how a company can generate and capture value from its innovations as well as protect them (James *et al.*, 2013). This approach includes both a theoretical element and testing how well the theory corresponds to a manufacturing company in Sweden.

We collect data from different strategic business units (SBUs) within Volvo AB to try to verify our findings from the literature. We interview employees that work in management positions, who are connected to the generation and protection of the company's innovations. By doing these interviews at Volvo AB, we hope to find out how a successful company in the truck and bus business handles the innovation process.

According to Birchfield (2000), *"Innovation will be increasingly important to economic wellbeing"*. We would like to understand how Volvo is adapting to create innovations and capture value from them. Because Volvo is one of the largest suppliers of heavy-duty trucks, buses, commercial engines and construction equipment, they must adapt to a changing world to stay in business and at the forefront. This leads to a complementary research question: **How is value created from innovations in a large manufacturing company?** Few empirical studies have addressed how companies capture value from their innovations. We hope to add new insights and knowledge regarding these mechanisms by acquiring information from a large manufacturing company such as Volvo.

1.5 Delimitations

We exclude the topics 'business model innovation' and 'how to create innovative organisations', which were in the scope from the beginning. The reason for excluding these topics was to have a clear focus on 'how to create value out of innovations', which is the main theme of this thesis. From the beginning, our idea was to include companies from different industries such as medical, telecommunication, automobile, trucks, buses and construction equipment. However, owing to time constraints, we had to focus on companies within the Volvo Group, and we narrowed this even further to three different SBUs (see Appendix D for more information on these SBUs).

1.6 Definitions

Absorptive capacity (ACAP)	A firm's ability to recognise the value of new, external information, assimilate it and apply it to commercial ends (Cohen and Leninthal, 1990).
Open innovation	*"Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively"* (Chesbrough *et al.*, 2006).
Patent	*"A patent is an exclusive right granted for an invention, which is a product or a process that provides, in general, a new way of doing something, or offers a new technical solution to a problem. To get a patent, technical information about the invention must be disclosed to the public in a patent application"* (WIPO, 2014)
Secrecy	Secrecy involves keeping information regarding innovations secret from competitors, the market and, in some cases, other organisations within the same company.
Lead time advantage	Lead time advantages refer to the benefits of releasing a new product or implementing a process or technology at the right time (i.e. when most value is to be gained).

Complementary assets	Complementary assets are support functions such as marketing, financing, manufacturing and sales.
Innovativeness	The skill and imagination to create new things

Table 1 *Definitions*

1.7 Thesis structure

This section provides an overview and explanation of the following chapters of the thesis. The structure of the thesis is according to the guidelines recommended in the MBA programme thesis course at BTH School of Management.

The Theory chapter is divided into three sections called 'Innovativeness', 'Protection of Innovation' and 'Market Efficiency'. The first section provides a detailed explanation of the concepts of 'ACAP' and 'open innovation'. The second section describes two different mechanisms for protecting innovations: patents and secrecy. The last section two mechanisms related to Market Efficiency: lead time advantages and complementary assets. The Theory chapter presents seven hypotheses that are verified in chapter 5.

In the Research design chapter, the chosen research methods for the thesis are described. This chapter also describes how the data collection have been conducted to answer the research questions in chapter 1.3 and verify the hypotheses stated in chapter 2.

The Results chapter describes the collected data, which consist of survey results and a summary of the interviews.

The Analysis and Discussion chapter presents the analysis of the data collected. The data were analysed from the perspective of the research questions presented in chapters 1.3 and 1.4. The hypotheses from chapter 2 are then analysed and verified.

In the Conclusions section, a summary of the research findings are presented as well as suggestions for further research.

2. Theory

This chapter of the thesis describes the current literature on the two main theories, namely Innovativeness,Protection of Innovation and Market Efficiency, and their relation to value creation. These three theories form the core of this research. This chapter provides a better understanding of our research.

2.1 Innovativeness

We study two types of innovativeness: ACAP and open innovation. The ACAP concept was first introduced in the early 1990s by Cohen and Leninthal (1990). They defined ACAP as *"the ability to recognize the value of new, external information, assimilate it and apply it to commercial ends"*. Open innovation is defined as the use of purposeful inflows and outflows of knowledge to be able to accelerate innovation within a firm and to expand markets for the external use of innovation (Chesbrough *et al.*, 2006).

2.1.1 Absorptive capacity

ACAP is greatly influenced by the level an organisation spends on R&D. As a direct result of high levels of R&D, a company also learns how to learn from others. According to Cohen and Leninthal (1990), learning capabilities and problem solving are so similar that there is little reason to distinguish the modes of development. In other words, supporting one will increase the other. ACAP works in the way that the more you learn about a subject, the easier it is to absorb additional knowledge on that subject.

To raise ACAP to an organisational level, several conditions have to be met. The level of the organisation's ACAP is dependent on its individual members. Organisational ACAP must be built on prior investment in individual knowledge. It is not just the sum of individuals' ACAP – it also depends on the transfer of knowledge across the organisation. ACAP is also about an organisation's ability to exploit it. It is important not only to have deep technical knowledge, but also to know where and how additional information can be found, both inside and outside the organisation.

The ideal organisation is a trade-off between diversity and commonality. Commonality helps communication but it should not be carried so far that diversity among individuals is diminished. ACAP is thus something you cannot easily build, according to Cohen and Leninthal (1990). If the company does not develop its ACAP, it may not recognise new technological opportunities present in a given field. In addition, not investing in ACAP in an early stage will make it more costly to develop it later.

Cohen and Leninthal's (1990) basic model of how ACAP works shows that technological knowledge is dependent on own R&D, external knowledge and spillovers from competitors' knowledge. External knowledge and spillovers from competitors' knowledge are in turn dependent on R&D. Putting money in own R&D fills a double purpose, namely increasing technical knowledge and raising ACAP. Cohen and Leninthal's (1990) conclusion was that firms are sensitive to the characteristics of the learning environment in which they operate. ACAP seems to play a role when allocation funding to innovations. However, it is an intangible asset and thus it is very difficult to specify an optimal level for ACAP.

Jimenez *et al*. (2012) defined ACAP in the service context. For international joint ventures, they studied measures for each of the original components of ACAP, such as ability to understand a foreign parent's knowledge, ability to assimilate a foreign parent's knowledge and ability to apply external knowledge as defined by Lane *et al*. (2001). According to Jimenez *et al*. (2012), ACAP is dependent on R&D spending, firm characteristics and knowledge as the main factors operationalising ACAP. Their conclusion was that ACAP has been a part of strategy and innovation discourse for a few decades and has evolved as business practices have emerged. R&D measures are still dominant and thus hybrid operationalisation (mix of R&D and other factors as patents, organisational and network factors) holds promise in explaining ACAP.

The study of ACAP, knowledge flows and innovation in US metropolitan areas by Mukherji and Silberman (2013) showed that a region's ability to absorb external knowledge has a positive impact on its innovations. The study also found that technological compatibility is more important than distance as an explanation for knowledge flows. Increasing the ability to implement ACAP is another way of strengthening entrepreneurship and having a positive effect on economic performance. The study showed that ACAP driven by interconnecting both geographically and technologically is important when it comes to regional economics.

Hurmelinna-Laukkanen *et al*. (2012) identified how to manage an R&D network extending outside the traditional firm. An R&D network can consist of several players, where the most common are customers, suppliers, government institutions and even competing actors. The study described how ACAP, innovation appropriability and network stability affect alliance success and innovation performance in a firm. In order to manage an R&D network, traditional top-down management is not viable since the network reaches outside the organisation's borders. Management is replaced by orchestration, which is a type of organisation in which everybody plays his or her own role orchestrated to maximise the overall network. The conclusion from the study was that ACAP is relevant for both network and firm success and that appropriability is highly relevant for firm success, but not so important for the network, while stability is relevant for the network but not for the firm. Managers should pay close attention to orchestrating activities and facilitate knowledge exchange and ACAP activities, as this seems to be important for getting as much value as possible from the network.

Flatten *et al*. (2011b) developed a four-factor measure of ACAP to help researchers ensure valid results and to facilitate comparisons between studies. This measure assesses *"…the degree to which a company engages in knowledge acquisition activities, assimilates acquired information into existing knowledge, transforms the newly adapted knowledge, and commercially exploits the transformed knowledge to its competitive advantage"*. The figures in Appendix I show the different questions that the authors developed for measuring ACAP as well as firm performance and the success of strategic alliances. We use these questions in our data collection to examine how Volvo AB is using ACAP and how ACAP relates to Volvo's performance. We also compare our result with the study by Flatten *et al*. (2011b).

Hypothesis 1: There is a relationship between ACAP and firm performance.

2.1.2 Open innovation

Open innovation requires that firms use ideas that come from both external and internal sources. They should also be able to use internal and external paths to the market, as they look to advance their technology (Chesbrough *et al*., 2006). In the past, R&D was a strategic asset to compete in the market. Large companies such as DuPont, IBM and AT&T built large internal R&D units to develop new inventions to prevent competitors entering the market or to gain competitive advantages by developing new products. Internal R&D was both an asset for innovation and a barrier for competitors (Porter, 2008). However, by the end of the 20th century, a new model started to evolve, namely *"The Open Innovation Model"*. According to Chesbrough and Appleyard (2007), the most important factors for this were the growing number of mobile and knowledgeable workers and the availability of venture capital. Suddenly, workers were not obliged to belong to a large R&D department to perform advanced development. People who found that the company they worked for did not exploit their ideas fast enough could start up their own firms, either as a start-up company with their origin company as an investor or a completely new one funded by venture capital.

One of the oldest and most famous examples of open innovation is the computer operating system Linux. This was first developed in 1991 by Linus Torvalds and by 2003 more than 130,000 people had contributed to its development (Chesbrough and Appleyard, 2007).

There are seven types of business models divided into four groups that make the open innovation model work (Chesbrough and Appleyard, 2007), as seen in Table 2.

Category	Model	Description	Example
Deployment	Support	Revenue derived from sale of customer support contracts.	JBoss
	Subscription	Revenue derived from annual service agreements bundling open source software, customer support and certified software updates delivered via Internet.	Red Hat Enterprise Linux
	Professional Services/ Consulting	Revenue derived from professional services, training, consulting, or customization of open source software.	IBM
Hybridization	Proprietary Extensions	Firms broadly proliferate open source application and monetize through sale of proprietary versions or product line extensions. Variants include mixed open source/proprietary technologies or services with free trial or "community" versions.	SugarCRM
	Dual License	Vendor licenses software under different licenses (free "Public" or "Community" license vs. paid "Commercial" license) based on customer intent to redistribute.	MySQL
Complements	Device	Vendor sells and supports hardware device or appliance incorporating open source software.	Mazu Networks
Self-Service	Community Source	Consortia of end user organizations or institutions jointly develops application to be used by all.	The Sakai project

Table 2 *Open Source Software Business Models* (Chesbrough and Appleyard, 2007)

Open innovation is a new way of working, away from closed R&D departments, which faces new issues. Chesbrough and Appleyard (2007) identified some of these issues. First, you need to attract a broad community of contributors and make sure they contribute over time. As long as the contributors feel they share the goals of the community, they will belong to the community, but since they are not employed by the community, they are free to leave as soon as they perceive the goals have changed in an unwanted direction. The second issue is that you have to compete for contributors; the supply of skilled contributors is finite. A third issue is how the community is led and how its agenda evolves over time. Most open innovation communities have a meritocratic organisation where those who contribute

most have the most power to decide. If large companies dominate the community, the meritocracy erodes and large independent contributors leave the community to seek other challenges. Finally, there is a question of how large companies can contribute to the development and investment in knowledge without having control of their IP. If they cannot find ways to profit from participation in open communities, they will not continue to participate.

Wallin and von Krogh (2010) described a five-step method for integrating knowledge in open innovation for a company:

1. **Define the process steps**
   By defining the process, all stakeholders will be aware why and how the engagement in the open community should be formulated. When top management, who has initiated the programme, supports the programme and the contributors are pleased with the programme, middle management sometimes feels that it loses control and that it is being sidestepped in the process. That is why it is important to establish a clear picture of the process in the company so that everyone understands the purpose and goal of the open innovation initiative.
2. **Identify relevant knowledge**
   Important questions to ask are what type of knowledge do we need and where can we find it. Do we have it internally, in our customers, suppliers or our competitors?
3. **Chose an appropriate integration mechanism**
   There are several ways to form an open innovation community. First, there can be rules when an innovation is developed outside the company to free up internal resources and to commercialise products not fitting the company's existing portfolio. Second, knowledge can be integrated by sequencing tasks. That means that some parts of the process are carried out outside the company, such as using focus group studies that the company does not possess itself. Third, routine tasks and processes can be outsourced, such as testing. Fourth, group problem solving and decision-making is where the company loses absolute control. The innovation community is responsible not only for solving problems but also for choosing which problems to solve.
4. **Create effective governance mechanisms**
   It is important to have a governance model that deals with many different questions such as who can participate, how are participants selected, how are contributions evaluated and selected and how are losses and profits shared? How has the decision power been shared between internal company employees and external contributors? Who is responsible for quality control? How should conflicts be solved?
5. **Balance incentives and controls**
   People participate in open communities for different reasons, from just the joy of contributing to earning pay and career progression. Apart from paying contributors according to their share of the innovation, one part of compensation is the possibility of sharing resources such as forums to discuss programming and new technology, methods and tools internal to large companies.

Ili and Albers (2010) studied if the automotive industry uses or should go outside their internal R&D departments to cut costs and increase innovation speed. They found that the industry would benefit from open innovation because of its trend for globalisation, technology intensity, technology fusion, new business models and knowledge leveraging, which suggests open innovation according to Gassmann (2006). Ili and Albers's (2010) survey in the German automotive industry showed for the first four trends that between 62% and 93% fulfilled that trend within 10 years. However, they only used open innovation for between 16% and 35% (35% sources for ideas).

The most involvement from outside sources are from customers, competitors, suppliers and lawmakers, which have a direct contact trigger for ideas and innovation. Most licensing partners are with competitors or from same industry but in other geographical areas, mostly to avoid conflicts, which is a defensive tactic. To increase innovation speed, they need to go from outside-in methods – searching for innovations outside to make their own– to inside-out methods, where they exploit their in-house knowledge by actively licensing their IP. Only the supplier exploits the patents not suitable for its portfolio and draws a profit from it.

Barriers to open innovation are the opinion that external ideas do not fit the brand image, time and cost restraints on the R&D department, absence of top-down targets to integrate external knowledge, missing incentive plans and the feeling that *"firms do not want to motivate their own R&D to develop innovations for someone else"* (Ili and Albers, 2010). We study how Volvo is using open innovation via the relationship between ACAP and success of strategic alliances. To be able to measure this, we use the questions in Flatten *et al*. (2011b), which is related to success of strategic alliances, as presented in Appendix I.

Hypothesis 2: There is a relationship between ACAP and success of strategic alliances.

2.2 Protection of Innovation

In this subchapter, we describe two different mechanisms to protect innovations: patents and secrecy (James *et al*., 2013). We would like to examine how Volvo utilises these mechanisms to protect their innovations.

2.2.1 Patents

The World Intellectual Property Organisation defines a patent as follows (WIPO, 2014): *"A patent is an exclusive right granted for an invention, which is a product or a process that provides, in general, a new way of doing something, or offers a new technical solution to a problem. To get a patent, technical information about the invention must be disclosed to the public in a patent application".*

The protection of a patent means that an invention cannot be commercially made, used, distributed or sold without the consent of the patent owner. Patent rights are usually enforced in court, which has the authority to stop patent infringement. The same court can also declare that a patent is invalid if a company or person challenges it successfully. The patent owner has the right to decide who are allowed to utilise the patented invention within the protected time period. The patent owner can also sell the

rights of the patent, so that someone else becomes the patent owner. Another option is to set up a license, where agreed terms state that the licensee can use the patented invention (WIPO, 2014).

According to WIPO (2014), *"Patents provide incentives to individuals by offering them recognition for their creativity and material reward for their marketable inventions. These incentives encourage innovation, which assures that the quality of human life is continuously enhanced"*.

One might think that it is obvious that companies would always try to capture value and protect their innovations by the use of patents whenever they can. However, when investigating the concepts of patents deeper, and how they are utilised, it is quite clear that patents are not always used as a protection mechanism. It depends on different factors such as costs, infringement enforcement in different countries, the effectiveness of patents within the industry, complexity of the innovation, company size and existence of a legal department. In the following sections, we describe these different factors and shed light on when it is beneficial to use patents as a protection mechanism.

There are several different types of costs for handling patents that companies need to take into consideration, such as application fees, follow-on patent issuance and patent maintenance fees, ongoing costs for identifying when an infringement occurs and legal costs to defend the right to exclusivity when an infringement has been identified (James *et al*., 2013). Litigation costs are an important aspect to take into consideration. It can become very costly for a company who loses in court over patent infringement (e.g. in 2012, Samsung Electronics Co. was ordered to pay 1.05 billion dollars to Apple Inc. due to the infringement of five patents that Apple Inc. owned) (The Wall Street Journal, 2012). Lanjouw and Schankerman (2001) found evidence that litigation rates differ among industries. For example, in the drugs and health industry a litigation case is filed for every 50 patents created, but in the chemicals industry a case is filed for every 200 patents. The authors indicated that this shows that patents are relied upon more frequently to protect pharmaceutical innovations.

Lerner (1995) drew the following conclusion regarding litigation costs: *"Firms with high litigation costs appear less likely to patent in the same subclass as rivals. These firms seem particularly reluctant to patent after awards to firms that have low litigation costs"*. Lerner also argued that corporate disputes such as patent litigations are often very similar. Further, small firms are usually at a disadvantage when it comes to protecting their IP and litigation costs, as they typically have only a few patents in their patent portfolios, and this is usually not enough to reach quick settlements with competitors in court, or even before going to court (Lanjouw and Schankerman, 2004).

How the infringement enforcement is handled in the specific country where the potential patent would be valid is yet another attribute to consider for companies. James *et al*. (2013) drew the following conclusion regarding this topic: *"Firms are less likely to use the patent system to protect their innovations when countries have weak intellectual property laws or when institutional enforcement of a firm's innovations is weak"*. Zhao (2006) identified a list of countries with both strong and weak IP rights (IPR). From this list, one can see examples of countries with strong IPR such as Sweden, the USA and Japan and weak IPR countries such as China, Ukraine and Russia. From Table 3, we can see the top 15 countries when it comes to filing patent applications. When comparing countries in this table with the

previously mentioned list (Zhao, 2006), we see the correlation between countries with strong IPR and a high number of patent applications with a few exceptions such as China and the Republic of Korea, which are classified as weak IPR countries according to Zhao (2006).

Country of Origin	Year of Filing						
	2008	2009	2010	2011	2012	2012 Share (%)	Change compared to 2011 (%)
United States of America	51,643	45,628	45,029	49,060	51,207	26.3	4.4
Japan	28,760	29,802	32,150	38,874	43,660	22.5	12.3
Germany	18,855	16,797	17,568	18,851	18,855	9.7	0.0
China	6,120	7,900	12,296	16,402	18,627	9.6	13.6
Republic of Korea	7,899	8,035	9,669	10,447	11,848	6.1	13.4
France	7,072	7,237	7,246	7,438	7,739	4.0	4.0
United Kingdom	5,467	5,044	4,891	4,848	4,895	2.5	1.0
Switzerland	3,799	3,672	3,728	4,009	4,194	2.2	4.6
Netherlands	4,363	4,462	4,063	3,503	3,992	2.1	14.0
Sweden	4,136	3,568	3,314	3,462	3,585	1.8	3.6
Italy	2,883	2,652	2,658	2,695	2,836	1.5	5.2
Canada	2,976	2,527	2,698	2,945	2,748	1.4	-6.7
Finland	2,214	2,123	2,138	2,079	2,353	1.2	13.2
Australia	1,938	1,740	1,772	1,739	1,708	0.9	-1.8
Spain	1,390	1,564	1,772	1,729	1,687	0.9	-2.4
All Others	13,725	12,655	13,346	14,298	14,466	7.4	1.2
Total	**163,240**	**155,406**	**164,338**	**182,379**	**194,400**	**100.0**	**6.6**

Table 3 *Patent Cooperation Treaty (PCT) Applications for the Top 15 Origins* (WIPO, 2013)

Somaya (2003) described the concept of using patents as strategic assets, which firms should consider when thinking about how to create value from their innovations. The author elaborated on the term 'licensing strategy' and argued that firms should consider the potential licensing benefits before applying for a patent. Further, firms should try to license low-stake patents that have little strategic value.

When it comes to creating patents, firms should also consider either having their own patent law experts in-house or buying the service from contractors and law firms. Somaya *et al.* (2007) found evidence that favours having in-house patent law experts working with R&D departments when identifying inventions and generating patents. Of course, having in-house law experts could be very costly for a small firm. This seems to be more suitable for larger companies with higher financial resources.

The licensing and cross-licensing of patents are two popular methods utilised to create value from innovations. In certain industries such as the electronics and semiconductor sectors, it is quite common for the development of new products to be based upon previous innovations. This means that companies within these industries can have patents that block further development without infringing on each other.

To solve this, they can utilise cross-licensing, which in simple terms means that if company A can utilise the technology protected by the patents owned by company B, then company B can use the patented technology owned by company A. If company A does not have any valuable patents that company B is

interested in, then it could try to license company B's technology for a royalty fee. Depending on the value of the patent, this could get very expensive for company A (Grindley and Teece, 1997).

It is important for company executives to understand the value of using licensing and cross-licensing as a part of the company's business strategy. To become successful at cross-licensing, a company should create a patent portfolio of high-quality patents. These patents should cover both areas that are of interest to the company and those of interest to competitors in order to have good bargaining material in licensing and cross-licensing negotiations. It is more important than ever to focus not only on product manufacturing but also on IP licensing to get the most value out of innovations and technology (Grindley and Teece, 1997).

Hewlett-Packard (HP) sees IP as very important and it has created a formal IP strategy to handle its large patent portfolio. HP has a number of different procedures to be able to identify areas of technology that could be covered by patent protection and to make decisions regarding how to best protect its innovations. In Figure 1, HP's process for handling IP protection decisions for individual innovations is presented. When a new product or process has been developed at HP, a decision-making process is used to determine whether to patent it, keep it as a company trade secret or publish it. The decision is made in a committee where different departments give their input, such as the R&D and legal departments. Those innovations that are seen to be of strategic value should be patented as soon as possible. If the innovation could be used by an imitator, and this could not be detected (e.g. a process innovation), then it should be kept as a trade secret (Grindley and Teece, 1997, pp. 25–26). We find this type of process to be a good tool for deciding what type of value and protection mechanism to use for innovations. We would like to see if Volvo utilises a similar process when making decisions about its innovations.

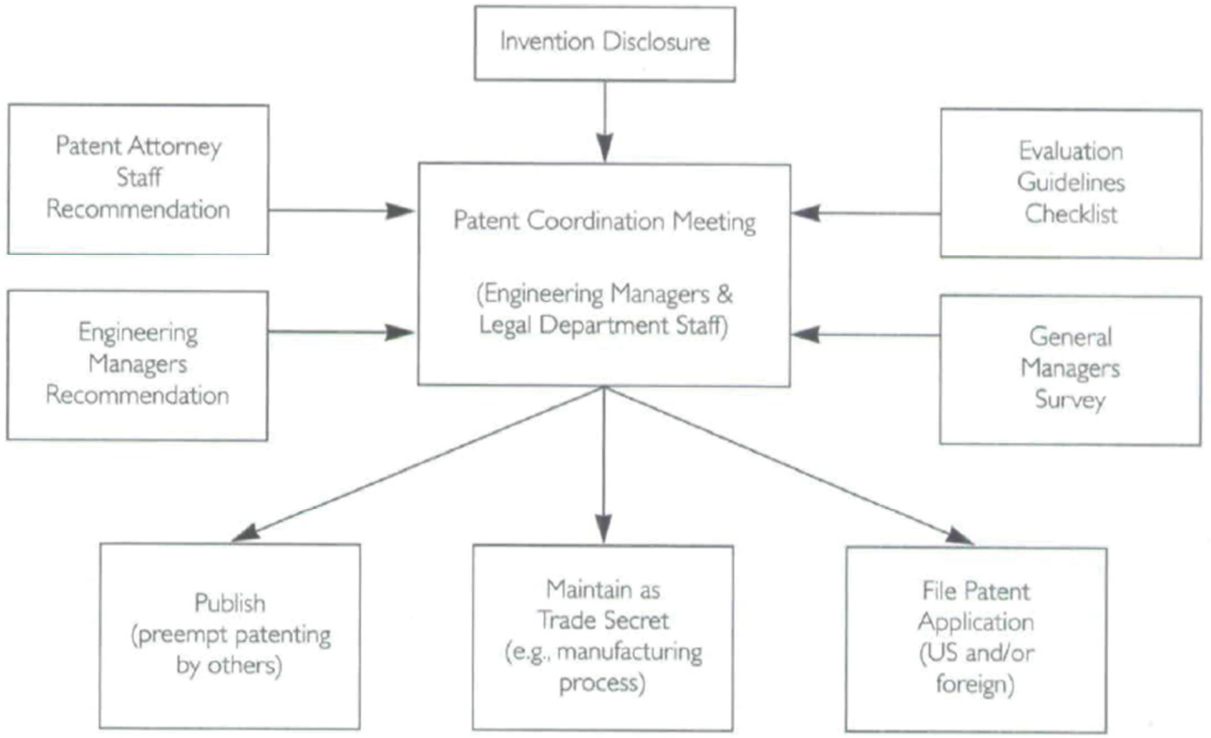

Figure 1 ***IP and Patenting Decision Process at HP*** **(Grindley and Teece, 1997)**

Another aspect companies should consider is the risk of the imitation of their innovations, such as products or processes. According to Mansfield *et al*. (1981), within four years of the launch of a new successfully patented product, 60% are imitated. In the study, the authors also concluded that patent protection generally increases the imitation cost, but that it differs a lot between industries. In the ethical drug industry, patent protection increases imitation cost by 30% compared with only 10% in chemicals and 7% in electronics and machinery. From this study, one can see that patent protection is very important in the drug industry, as it can be quite easy to identify the composition of a new drug and start to manufacture it. However, it can be much harder to implement the innovation in the electronics and machinery industry, and thus patent protection does not increase the imitation cost as much. Levin *et al*. (1987) came up with a similar result on imitation cost except for the electronics industry, where the increase was between 7% and 15%.

The complexity of an innovation is yet another attribute to consider when it comes to patenting. Cohen *et al.* (2000) elaborated on this topic by defining a complex innovation as one with many patentable elements and a simple, or discrete, innovation as one with few patentable elements. From the data collected in this study, the authors concluded that in industries that develop complex products such as the electronics industry, the reason for patenting to be used in negotiations, such as licensing and cross-licensing as well as protecting against lawsuits, is much higher than that for less complex industries such as the drug industry. As mentioned, innovations in the electronics industry are often cumulative (i.e. they build upon each other). This suggests that it is common that innovations include several patentable items from different innovations. To prevent being blocked in the development of innovations,

companies in this type of industry will use negotiations, such as cross-licensing, to be allowed to use the technology behind the patentable items.

Patenting can be a complex process and there are many different aspects and attributes for companies to consider. The prime reason why companies do not want to patent their innovations seems to be that their innovation will be easy to invent and therefore they do not want to disclose any critical information about it (Cohen *et al*., 2000). If we ask the opposite question, namely what are the main reasons for companies patenting their new technology, we conclude the following from the literature: 1) to protect their innovations from imitation (the value of patent protection between industries is notable, but it is still the main reason to patent.); 2) to able to gain revenue from licensing the patented technology; 3) to be able to gain access to competitors' patented technology through cross-licensing; 4) to able to have 'freedom of design' when it comes to developing new innovations, without risking litigation costs and infringements; 5) to block patents (i.e. prevent other companies from patenting a related invention); 6) to protect against infringement suits; and 7) to increase the company's reputation.

We would like to test the main reason for patenting, namely protecting companies' innovations, and assess how this relates to Volvo's performance.

2.2.2 Secrecy

The innovation protection mechanism 'secrecy' involves keeping information regarding innovations secret from competitors and, in some cases, other organisations within the same company. Information flow within the company and with external parties can, for example, be controlled by internal processes and procedures. The value for a company that applies secrecy as a protection mechanism is increased by trade secret laws. Governmental institutions support companies that keep their innovations secret by enforcing trade secret laws as well as contractual agreements (e.g. confidentiality and noncompeting agreements). To get this governmental legal protection against infringement, for instance, it requires that companies have taken reasonable effort and actions to keep the information regarding the innovations a trade secret (James *et al*., 2013; Winter, 2000).

According to Cohen *et al*. (2000), secrecy is the most commonly used protection mechanism within most industries today. This is applicable for both product and process innovations. These authors compared their results with those of other studies and found that there has been a shift over time: patenting was seen as more important historically for protecting innovations, whereas now secrecy has gained more appreciation and this is considered to be more important.

Arundel (2001) concluded that R&D-performing firms of all sizes think that secrecy is a more effective way to retrieve value from innovations than patents. The data from the same study showed that small firms, in comparison with large firms, find patents to be of lower value than secrecy for product innovations. Yet another finding in this study was that firms that find secrecy to be an effective value capture mechanism do not patent their product innovations at the same rate as those that find secrecy to be ineffective. In the figures in Appendix A and Appendix B, we can see that secrecy is the one method that companies find to be the most effective when it comes to capturing value, both for product and for process innovations.

Mansfield (1985) showed that it takes about 12 to 18 months before a competitor of a company knows about the decisions the company has taken to develop a new product or process. He estimated that a normal product or process in the studied industries takes about three years to develop and showed that the probability that a competitor can imitate the product or process and maybe release it before the company itself is quite high. Even though this finding is contradictory to those of the studies mentioned above, which indicate that companies think that secrecy is an effective protection of innovation mechanism, secrecy has grown in importance in recent times, as noted earlier (Mansfield, 1985).

Liebeskind (1997) investigated three different types of secrecy mechanisms for protecting knowledge: rules, compensation schemes and structural isolation. The central conclusion was that keeping control of knowledge and information is difficult for companies. Managers usually struggle to know exactly what type of knowledge is valuable for their company. This results in the over- or under-protection of knowledge. Liebeskind (1997) believed that firms are pressured to scope their protection efforts, from a cost and budget perspective. In the figure in Appendix C, a comparison between castles and firms when it comes to protection is shown. The illustration shows the secrecy mechanisms used to control and protect the information flow within a firm. Certain types of information are kept in the keep (the inner part of the castle), protected from outsiders and shared only by a few employees. There is a balance between using knowledge protection mechanisms and bureaucracy. The higher the security levels/barriers a company has, the more bureaucracy and the higher the cost there is. This is a trade-off between knowledge protection and flexibility.

Kultti *et al*. (2007) compared patenting with secrecy and suggested that secrecy is only more profitable than patenting if an innovator knows that he or she is the only innovator. Further, even the best patent policy does not necessarily give more protection than secrecy. When it comes to patent disputes between innovators, the authors explained that in countries such as the United States, where the first-to-invent principle applies and not the first-to-file patent application principle, secrecy is more attractive than patenting.

From the above explanation of the protection of innovation mechanism secrecy, we can see that it has moved from not being much utilised to one of the most important factors for protecting innovations. This is valid both for product and for process innovations. Secrecy, as other methods, comes at a price: the greater the confidentiality and control over the knowledge information flow, the higher is the cost. In our research, we examine how secrecy is utilised and if it is as popular in Volvo as in many other companies that have been previously studied. To measure how secrecy is used, we incorporate it into our theoretical model, which is based upon the measurements presented in Appendix I, to see if there is a relationship between protection of innovation and success of strategic alliances as well as protection of innovation and performance.

Hypothesis 3: There is a relationship between protection of innovations and firm performance.

Hypothesis 4: There is a relationship between protection of innovation and success of strategic alliances.

2.3 Market Efficiency

In this subchapter, we describe the two mechanisms 'lead time advantages' and 'complementary assets' in relation to market efficiency. Our idea is to examine how Volvo utilises these mechanisms to release their innovations successfully on the market.

2.3.3 Lead time advantages

Lead time advantages are something companies should consider as a mechanism to put new innovations out on the market. They should investigate and weigh up the costs and benefits of trying to push to be first on the market, or take a more waiting position and come later in the market with the new product or process. Being first can have pre-emptive competitive advantages, but it will not have the same flexibility when considering future investments (James *et al*., 2013).

Companies entering the market with an identical product already available (i.e. late entrants into the market) will gain a smaller market share. A smaller market share will result in a disadvantage for the innovator, because the higher the market share, the better are the cost advantages due to process innovation. This means that early entrants into the market will benefit from long-lasting advantages versus late and new entrants (Ethiraj and Zhu, 2008). The early entry advantages and disadvantages are different depending on product categories. Bohlmann *et al.* (2002) argued that early entrants are not as successful as later entrants are where product quality is more important than variety.

Lieberman and Montgomery (1988) found a number of mechanisms that encourage or discourage being a first-mover of a product or process innovation. First-mover advantages included *"…proprietary learning effects, patents, preemption of input factors and locations, and development of buyer switching costs"*. When it came to disadvantages, they found *"…free rider problems, delayed resolution of uncertainty, shifts in technology or customer needs, and various types of organizational inertia"*. The authors argued that if managers get a first-mover opportunity, they should consider if the company should pursue it or not, and if they choose to do so, the way to create the most value.

The optimal timing for when to enter a market with an innovation is usually based on a company's strengths and weaknesses. Being the first in a new market can be a good strategy for companies whose strengths lay in R&D, whereas companies whose strengths are in marketing and manufacturing often benefit from entering later, after the first phase of the market has passed and technological uncertainties have been resolved (Lieberman and Montgomery, 1998).

Golder and Tellis (1993) investigated the relationship between market leaders and market pioneers. They defined market pioneers as *"…the first firm to sell in a new product category"*. According to their findings, 47% of the companies they studied that were classified as markets pioneers fail. Only 11% of market pioneers are market leaders after the market has matured. Market pioneers are only market leaders for about 5–10 years after they have introduced their product on the market. An interesting finding from the study was that 'early market leaders' have a higher market share and success rate than market pioneers and that they enter the market around 13 years after market pioneers. Golder and Tellis highlighted some interesting disadvantages of being first with a product on a new market. They concluded that being first on a new market does not automatically guarantee long-term rewards. They

suggested that companies might find it worthwhile to use a strategy where they let other companies explore new markets and only enter when they have more knowledge about the mature market.

As mentioned, some studies find support for 'late-mover' advantages (Berndt *et al*., 1995; Zhang and Markman, 1998). Shankar *et al*. (1998) argued that innovative companies that enter a market late may be more profitable than companies that enter early. Some research has also examined the psychological understanding of companies that are first on a market with a new product and consumer choice and consumer cognitive processes (Lieberman and Montgomery, 1998). In the product category 'consumer packaged goods', customers learn more about products that are first on a market than those that enter later, and this advantage increases over time. This advantage is also increased if customers are exposed to commercial advertising that describes and reminds customers of the product's features (Kardes and Kalyanaram, 1992).

Kardes *et al*. (1993) found that the first brands released on a market are also those brands that consumers retrieve from memory during the buying decision as well as those actually chosen. When consumers are exposed to a decision between choosing a product from a brand they already use and a new superior competitor brand, they usually choose products from the brand that they already use (Muthukrishnan, 1995). These findings highlight that there are several first-mover advantages when it comes to customers' cognitive processes and decision-making.

When thinking about innovations and lead time advantages, it can be tempting to draw a quick conclusion that the faster a product is put on the market, or a process is implemented, the higher the competitive advantage and rewards that are achieved. However, as discussed above, there are different advantages as well as disadvantages to being a 'first-mover' and 'late-mover'. To create the maximum value of an innovation, companies should consider the lead time and order of entry as a crucial part of their strategy. To measure how lead time advantages are used at Volvo, we assess the relationship between market efficiency and firm performance.

2.3.4 Complementary assets

Complementary assets are mechanisms that companies should utilise to successfully and efficiently put innovations out on the market. Teece (1986) argued that successfully commercialising an innovation requires innovation know-how to be utilised in conjunction with other company capabilities or assets. Most often, services such as marketing, competitive manufacturing and sales support are needed. Such services usually come from specialised complementary assets. Teece makes a distinction between generic and specialised assets. Generic assets are those that do not need to be tailor-made for a specific innovation (e.g. a manufacturing facility that produces running shoes). Specialised assets, on the other hand, are those that have a dependency between the innovation and the asset.

Larger companies usually have the right specialised complementary assets when a new product is to be released on a market. Therefore, they have a greater advantage then smaller firms when it comes to getting the maximum value out of their new products. Teece (1986) concluded that the ownership of complementary assets helps determine who will win or lose from an innovation. Imitators have a good

chance of outperforming the company that first created the innovation if they own critical complementary assets.

Rothaermel and Hill (2005) argued that to increase performance, companies should utilise specialised complementary assets to commercialise innovations. Teece *et al*. (1997) explained that specialised complementary assets are often built up over long periods. Barney (1991) found that these resources are usually valuable and hard for imitators to copy, which in turn can make these assets a competitive advantage.

Helfat (1994) found intra-industry differences between companies in the oil and gas industry. He found that different complementary assets are used to commercialise products and services that come from R&D. He argued that these firm-specific assets increase the value of R&D efforts and make it harder for competitors to imitate. In a larger study of the typesetter industry, Tripsas (1997) found that a firm that owns specialised complementary assets that are necessary to commercially exploit an innovation has a distinct advantage. The study also highlighted that in firms that operate in countries with weak IPR (i.e. where innovations can easily spill over to competing companies), complementary assets are particularly important to gain value from innovations.

Another interesting finding was that even though specialised complementary assets are valuable, new technological innovations can destroy the value of these assets. As an example, the author mentioned the technological shift from electromechanical to electronic calculators. The author argued that this shift was competence destroying from a technological point of view, and also destroyed the value of the specialised complementary assets that established companies had built up. Before this shift, the salesforce and service networks of electromechanical companies were an important part to be competitive. Tripsas (1997) concluded that the importance of specialised complementary assets in the typesetter industry is paramount.

Teece (1986) defined the concept of 'appropriability regimes' as *"...environmental factors, excluding firm and market structure, that govern an innovator's ability to capture the profits generated by an innovation"*. These regimes consist of two core parts, namely the *"nature of technology"* and the *"legal mechanisms of protection"*. Pisano (2006) argued that in weak appropriability regimes complementary assets, which usually take the form of capabilities, are important. Moreover, capturing value from innovations requires that companies master these different complementary assets, such as manufacturing and distribution. Pisano provided the example of Intel who lost its competitive advantage to Japanese competitors in the 1980s because it did not have good complementary capabilities such as process development, manufacturing ramp-up and manufacturing facilities. However, Intel managed to stay dominant in the market by investing in specialised complementary assets between the mid-1980s and 1990s. Intel invested a large amount of money into building highly competitive process development and manufacturing capabilities. In the mid-1990s, Intel was one of the top companies when it came to ramping up production for new computer chips (Iansiti, 1997).

At the beginning, Intel was not well known for its manufacturing (Pisano, 2006). This weakness resulted in lost market shares to competitors. However, the company recognised the need for this

complementary asset, and thus it invested in it and built it up. Pisano concluded that Intel might create value through the company's designs, but it captures value through specialised complementary assets such as process development and manufacturing.

To summarise this subchapter, the academic literature explains that complementary assets are crucial to effectively put innovations out on the market and capture the most value out of them. They should preferably be specialised and not generic ones. In our research, we examine if complementary assets are used in the commercialisation of innovations at Volvo. To measure the market efficiency of complementary assets, we assess the relationship between market efficiency and success of strategic alliances as well as market efficiency and performance.

Hypothesis 5: There is a relationship between market efficiency and firm performance.

Hypothesis 6: There is a relationship between market efficiency and success of strategic alliances.

2.4 Theoretical model

In this subchapter, we present the structural theoretical model used to test the different hypotheses mentioned in previous chapters (see Figure 2). The theoretical model is based upon the four-factor measure of ACAP created by Flatten *et al.* (2011b). We have also added two first-order factors to this model, namely protection of innovation and market efficiency. Data acquisition, data assimilation, data transformation, data exploitation, firm performance and success of strategic alliances are all variables that relate to the measures and questions presented in Appendix E and Appendix I.

We have grouped the questions together in different independent variable groups, four relating ACAP (data acquisition (AC), data assimilation (AS), data transformation (TD) and data exploitation (EX)), protection of innovation (PI) and market efficiency (ME) and two groups with the dependent variables firm performance (FP) and success of strategic alliances (SA). There is also one hypothesis from Flatten *et al.* (2011a) added to examine the relationship between firm performance and success of strategic alliances.

Hypothesis 7: There is a relationship between firm performance and success of strategic alliances.

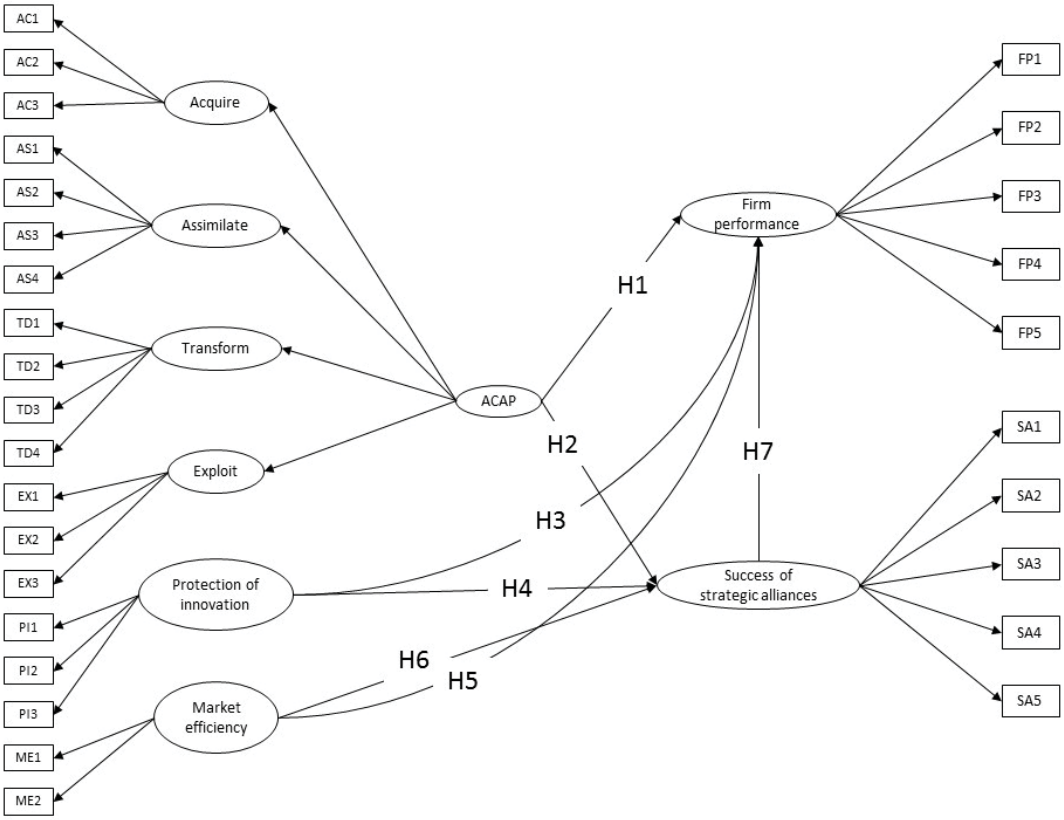

Figure 2 ***Theoretical Model***

3. Research Design

3.1 Methodology

A deductive research approach was chosen for our thesis. This means that we studied different theories around the subjects' innovativeness, protection of innovation and market efficiency in relation to value creation in the form of a literature review. From these theories, six hypotheses were derived, which were presented in chapter 2. An analytical approach was used to gather and analyse data, and from our findings, conclusions are drawn and presented.

For our thesis, we chose both a qualitative and a quantitative method. The quantitative method was applied to our survey, where the focus was on respondents working within R&D and management. The qualitative method was used to conduct semi-structured interviews (Bryman, 2008) with people in management positions in order to validate the results of the survey.

Three different SBUs within the Volvo Group were included in our study: Volvo Bus Corporation (VBC), Volvo Group Telematics (VGT) and Global Onboard Telematics (OBT). The reason for choosing the Volvo Group was that it is a highly R&D-focused company that has created many innovations in different areas (e.g. safety, driving, telematics and electrical hybrid technology). The specific SBUs were chosen because they represent both a traditional manufacturing company (VBC) that has been around for a long time and fairly young companies that work with state-of-the-art telecommunication technologies for vehicles (VGT and OBT). A description of the Volvo Group as well as the different SBUs can be found in Appendix D. All the SBUs work at the global level, which means that they have departments all over the world (e.g. Sweden, France, Japan, the USA, India, etc.).

3.2 Data collection

Here, we describe the different data collection methods used for our research. The primary data for our research were collected from a survey and from interviews. The survey was sent out via Volvo internal e-mail lists to 1497 employees and consultants working in the selected SBUs. The purpose of the survey was to collect data on how Volvo utilises value capture mechanisms and how the company handles information and knowledge according to the theories presented in chapter 2. The survey was created in a structured format and according to the guidelines described by Bryman (2008, pp. 221–224). To ascertain a result that we could quantify, each respondent received the same questions in the same order. All answers were multiple choice with a seven-point Likert scale, where 1 meant that the respondent strongly agreed and 7 indicated that the respondent strongly disagreed.

3.2.1 Measurements

The measurements used to verify our hypotheses were based upon survey questions in prior studies (see Appendix E for a list of all survey questions). In particular, the survey questions were based upon the studies by Flatten *et al.* (2011a) and Cohen *et al.* (2000). The questions from Cohen *et al.* (2000) were slightly modified to be suitable for multiple choice answers with a seven-point Likert scale. The reason for using questions from prior studies was to be able to compare our findings with them.

The questions asked in the survey were around the following topics:

- Data acquisition
- Data assimilation
- Data transformation
- Data exploitation
- Protection of innovation
- Market efficiency

We also asked questions about firm performance and success of strategic alliances to measure how successful the six items were. Apart from the previously mentioned topics, respondents also had to answer questions about their gender, age, organisation and country of work.

We agree with Bryman (2008, pp. 217–218) that using a survey is a low-cost and quick approach to administer. It is also convenient for respondents to answer a questionnaire when they have time. Even though there are a number of disadvantages with self-completion questionnaires (e.g. low response rate, respondents not having anyone to ask if they need an explanation of a specific question), we still thought that this was a good method to use for our data collection.

We created the survey with Google Forms (Google, 2014), which is an easy way to set up a self-completion questionnaire quickly. We stored all data in a spreadsheet that was connected to the questionnaire to analyse and structure the data more simply. We also utilised Google Forms' tools to summarise the data as well as create graphs and diagrams, which can be seen in Appendix F. The survey period was between 14th April and 22nd April 2014. To protect respondents' confidentiality, no questions were asked that could in any way identify the respondent. We also stated in the survey that the data would only be used for this thesis and deleted after three months.

Another primary data source was interviews with employees in management positions in the different SBUs. The interviews were created in what Bryman (2008, pp. 436–440) defined as a semi-structured format. This means that we had an interview guide with a number of questions (see Appendix G). The purpose of these interviews was to ascertain a deeper understanding of how the organisations use different methods to capture value, as presented in chapter 2.

3.3 Analysis method

We used two different software programs for our data analysis, namely Amos version 22.0 and SPSS 20.0. Amos is used to specify, assess and present research models to be able to show hypothesised relationships between variables (Amos, 2014). SPSS, which stands for 'Statistical Package for the Social Sciences', is a software package used for statistical analysis. SPSS is a tool that is widely used within social science research (SPSS, 2014). These programs were used to create statistical structural models and to verify the correlation between the hypotheses presented in chapter 2.

3.4 Validity and reliability

A survey is reliable when a number of questions measure the same thing (i.e. when internal reliability is high). A Cronbach's alpha test was used to measure internal reliability. The ideal internal reliability is

when the alpha value is 1 and the opposite is true when the alpha value is close to 0 (Hair *et al*., 2010). To validate our results, we took the approach stated by Nunnally (1978), which says that values higher than 0.7 are acceptable for the conclusion to be valid.

4. Results

In this chapter, the results from the data collection are described. The chapter is divided into six subchapters: Survey statistics, Analysis of variance (ANOVA), Confirmatory Factor Analysis by Amos, Exploratory Factor Analysis, Reliability and Survey results related to hypotheses.

4.1 Survey statistics

The survey was sent out to 1497 respondents: 860 to VBC, 597 to VGT and 40 to OBT. In total, 165 respondents answered the survey, which is a response rate of 11%. According to Fink *et al.* (2003) and Klassen and Jacobs (2001), there is a difference between online and offline surveys when it comes to response rates, with online surveys most often having a lower response rate. Online surveys usually have a response rate between 9% and 19%, which is in line with the response rate for our survey.

Of those respondents that answered the survey, 39 (24%) were women and 126 (76%) men. The age distribution of respondents was as follows: 8 (5%) were under 25 years old, 40 (24%) between 25 and 34, 50 (30%) between 35 and 44, 48 (29%) between 45 and 54 and 19 (12%) older than 55.

The distribution between the different SBUs was as follows: 97 (59%) VBC, 57 (35%) VGT, eight (5%) OBT and three (2%) other organisations within the Volvo Group. The majority of respondents worked in Sweden (73%) followed by India (8%), Mexico (6%) and Brazil (6%). For more information on the survey statistics data, see Appendix F.

4.2 Analysis of variance (ANOVA)

We have done ANOVAs for gender, age, organisation and country to assess the differences between the groups involved.

4.2.1 Gender

						Interval for Mean					
		N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum	F	Sig.
PI=(PI1+PI2+PI3)/3	Male	123	3,0081	1,41064	,12719	2,7563	3,2599	1,00	7,00	,745	,389
	Female	38	2,7807	1,44836	,23496	2,3046	3,2568	1,00	6,67		
	Total	161	2,9545	1,41838	,11178	2,7337	3,1752	1,00	7,00		
AC=(AC1+AC2+AC3)/3	Male	121	3,5702	1,26083	,11462	3,3433	3,7972	1,00	7,00	,140	,709
	Female	38	3,4825	1,27272	,20646	3,0641	3,9008	1,00	6,00		
	Total	159	3,5493	1,26020	,09994	3,3519	3,7467	1,00	7,00		
AS=(AS1+AS2+AS3+AS4)/4	Male	123	4,0732	1,32741	,11969	3,8362	4,3101	1,00	7,00	,911	,341
	Female	39	3,8397	1,34322	,21509	3,4043	4,2752	1,00	6,25		
	Total	162	4,0170	1,33081	,10456	3,8105	4,2235	1,00	7,00		
SA=(SA1+SA2+SA3+SA4+SA5)/5	Male	117	3,9453	,97295	,08995	3,7671	4,1235	1,80	6,40	,466	,496
	Female	33	3,8182	,83720	,14574	3,5213	4,1150	2,00	6,00		
	Total	150	3,9173	,94356	,07704	3,7651	4,0696	1,80	6,40		
TD=(TD1+TD2+TD3+TD4)/4	Male	119	3,4055	1,26222	,11571	3,1763	3,6346	1,00	6,75	,451	,503
	Female	38	3,2500	1,17548	,19069	2,8636	3,6364	1,00	5,50		
	Total	157	3,3678	1,23988	,09895	3,1724	3,5633	1,00	6,75		
FP=(FP1+FP2+FP3+FP4+FP5)/5	Male	114	4,3175	1,14159	,10692	4,1057	4,5294	1,60	7,00	1,466	,228
	Female	32	4,0438	1,08923	,19255	3,6510	4,4365	2,00	6,00		
	Total	146	4,2575	1,13234	,09371	4,0723	4,4428	1,60	7,00		

Table 4 *ANOVA Analysis - Gender*

For gender, there are no significant differences ($p<0.05$) between female and male respondents.

4.2.2 Age

		N	Mean	Std. Deviation	Std. Error	Interval for Mean Lower Bound	Interval for Mean Upper Bound	Minimum	Maximum	F	Sig.
PI=(PI1+PI2+PI3)/3	18-24 years	8	2,8750	1,72689	,61055	1,4313	4,3187	1,00	6,33	,870	,484
	25-34 years	38	2,7982	1,26524	,20525	2,3824	3,2141	1,00	6,00		
	35-44 years	50	3,2133	1,60040	,22633	2,7585	3,6682	1,00	7,00		
	45-54 years	46	2,9710	1,36233	,20086	2,5665	3,3756	1,00	6,00		
	+ 55 years	19	2,5789	1,19589	,27436	2,0025	3,1553	1,00	5,00		
	Total	161	2,9545	1,41838	,11178	2,7337	3,1752	1,00	7,00		
AC=(AC1+AC2+AC3)/3	18-24 years	8	3,2500	1,40011	,49501	2,0795	4,4205	1,67	6,00	,877	,479
	25-34 years	38	3,3596	1,29304	,20976	2,9346	3,7847	1,00	6,00		
	35-44 years	48	3,5347	1,20625	,17411	3,1845	3,8850	1,00	6,33		
	45-54 years	47	3,6028	1,38250	,20166	3,1969	4,0088	1,00	7,00		
	+ 55 years	18	3,9815	,88909	,20956	3,5393	4,4236	2,33	5,67		
	Total	159	3,5493	1,26020	,09994	3,3519	3,7467	1,00	7,00		
AS=(AS1+AS2+AS3+AS4)/4	18-24 years	8	3,0938	,88578	,31317	2,3532	3,8343	2,25	4,50	1,183	,320
	25-34 years	39	4,0833	1,37091	,21952	3,6389	4,5277	1,00	7,00		
	35-44 years	50	3,9500	1,44808	,20479	3,5385	4,3615	1,00	6,75		
	45-54 years	46	4,1685	1,30070	,19178	3,7822	4,5547	1,25	7,00		
	+ 55 years	19	4,0789	1,08029	,24784	3,5583	4,5996	2,50	5,50		
	Total	162	4,0170	1,33081	,10456	3,8105	4,2235	1,00	7,00		
SA=(SA1+SA2+SA3+SA4+SA5)/5	18-24 years	8	3,4500	,96658	,34174	2,6419	4,2581	2,20	5,00	2,806	,028
	25-34 years	35	3,5486	,83362	,14091	3,2622	3,8349	1,80	5,20		
	35-44 years	46	4,0000	,96425	,14217	3,7137	4,2863	2,00	6,20		
	45-54 years	45	4,1333	1,02247	,15242	3,8261	4,4405	1,80	6,40		
	+ 55 years	16	4,1125	,58409	,14602	3,8013	4,4237	3,00	5,60		
	Total	150	3,9173	,94356	,07704	3,7651	4,0696	1,80	6,40		
TD=(TD1+TD2+TD3+TD4)/4	18-24 years	8	3,0000	1,87083	,66144	1,4359	4,5641	1,00	6,50	2,164	,076
	25-34 years	37	3,0405	,90045	,14803	2,7403	3,3408	1,50	5,00		
	35-44 years	48	3,2396	1,20610	,17409	2,8894	3,5898	1,00	6,50		
	45-54 years	47	3,6809	1,40138	,20441	3,2694	4,0923	1,00	6,75		
	+ 55 years	17	3,7500	,95197	,23089	3,2605	4,2395	1,75	5,25		
	Total	157	3,3678	1,23988	,09895	3,1724	3,5633	1,00	6,75		
FP=(FP1+FP2+FP3+FP4+FP5)/5	18-24 years	7	3,5143	1,46450	,55353	2,1598	4,8687	1,80	6,00	,880	,477
	25-34 years	36	4,3500	1,18116	,19686	3,9504	4,7496	2,00	7,00		
	35-44 years	43	4,2419	1,09506	,16700	3,9049	4,5789	1,60	6,40		
	45-54 years	43	4,2605	1,08192	,16499	3,9275	4,5934	1,60	6,80		
	+ 55 years	17	4,4000	1,12250	,27225	3,8229	4,9771	2,00	6,00		
	Total	146	4,2575	1,13234	,09371	4,0723	4,4428	1,60	7,00		

Table 5 *ANOVA Analysis - Age*

When it comes to age, there is a significant difference (p<0.05) for the question about success of strategic alliances. The older the respondent, the more they tended to disagree with the statements in the survey.

4.2.3 Organisation

		N	Mean	Std. Deviation	Std. Error	Interval for Mean		Minimum	Maximum	F	Sig.
						Lower Bound	Upper Bound				
PI=(PI1+PI2+PI3)/3	Volvo Buss	93	2,6344	1,31974	,13685	2,3626	2,9062	1,00	6,67	11,980	,001
	Other	68	3,3922	1,44086	,17473	3,0434	3,7409	1,00	7,00		
	Total	161	2,9545	1,41838	,11178	2,7337	3,1752	1,00	7,00		
AC=(AC1+AC2+AC3)/3	Volvo Buss	94	3,6631	1,13854	,11743	3,4299	3,8963	1,00	7,00	1,887	,171
	Other	65	3,3846	1,41081	,17499	3,0350	3,7342	1,00	6,33		
	Total	159	3,5493	1,26020	,09994	3,3519	3,7467	1,00	7,00		
AS=(AS1+AS2+AS3+AS4)/4	Volvo Buss	95	4,1474	1,25079	,12833	3,8926	4,4022	1,25	7,00	2,222	,138
	Other	67	3,8321	1,42581	,17419	3,4843	4,1799	1,00	6,75		
	Total	162	4,0170	1,33081	,10456	3,8105	4,2235	1,00	7,00		
SA=(SA1+SA2+SA3+SA4+SA5)/5	Volvo Buss	89	4,0337	,98407	,10431	3,8264	4,2410	1,80	6,40	3,382	,068
	Other	61	3,7475	,86093	,11023	3,5270	3,9680	2,00	6,00		
	Total	150	3,9173	,94356	,07704	3,7651	4,0696	1,80	6,40		
TD=(TD1+TD2+TD3+TD4)/4	Volvo Buss	93	3,5538	1,19034	,12343	3,3086	3,7989	1,25	6,75	5,271	,023
	Other	64	3,0977	1,26978	,15872	2,7805	3,4148	1,00	6,50		
	Total	157	3,3678	1,23988	,09895	3,1724	3,5633	1,00	6,75		
FP=(FP1+FP2+FP3+FP4+FP5)/5	Volvo Buss	89	4,5483	1,13198	,11999	4,3099	4,7868	1,60	7,00	16,656	,000
	Other	57	3,8035	,98088	,12992	3,5432	4,0638	1,60	6,40		
	Total	146	4,2575	1,13234	,09371	4,0723	4,4428	1,60	7,00		

Table 6 ***ANOVA Analysis - Division***

There is a significant difference (p<0.001) between VBC and the other companies regarding protection of innovations where VBC respondents tended to agree more with the statements in the survey. Regarding statements about firm performance, VBC respondents tended to disagree more than others (p<0.001). Regarding transformation, VBC respondents tended to disagree more than others (p<0.05).

4.2.4 Country

		N	Mean	Std. Deviation	Std. Error	Interval for Mean Lower Bound	Interval for Mean Upper Bound	Minimum	Maximum	F	Sig.
PI=(PI1+PI2+PI3)/3	Sweden	117	3,1425	1,48641	,13742	2,8703	3,4146	1,00	7,00	7,843	,006
	Other	44	2,4545	1,08333	,16332	2,1252	2,7839	1,00	6,00		
	Total	161	2,9545	1,41838	,11178	2,7337	3,1752	1,00	7,00		
AC=(AC1+AC2+AC3)/3	Sweden	114	3,7251	1,24662	,11676	3,4938	3,9565	1,00	7,00	8,204	,005
	Other	45	3,1037	1,19515	,17816	2,7446	3,4628	1,00	6,00		
	Total	159	3,5493	1,26020	,09994	3,3519	3,7467	1,00	7,00		
AS=(AS1+AS2+AS3+AS4)/4	Sweden	118	4,2373	1,30820	,12043	3,9988	4,4758	1,00	7,00	12,778	,000
	Other	44	3,4261	1,21830	,18366	3,0557	3,7965	1,25	6,00		
	Total	162	4,0170	1,33081	,10456	3,8105	4,2235	1,00	7,00		
SA=(SA1+SA2+SA3+SA4+SA5)/5	Sweden	105	4,1181	,87429	,08532	3,9489	4,2873	2,00	6,40	17,612	,000
	Other	45	3,4489	,94210	,14044	3,1659	3,7319	1,80	6,00		
	Total	150	3,9173	,94356	,07704	3,7651	4,0696	1,80	6,40		
TD=(TD1+TD2+TD3+TD4)/4	Sweden	112	3,5781	1,25742	,11882	3,3427	3,8136	1,00	6,75	12,036	,001
	Other	45	2,8444	1,03393	,15413	2,5338	3,1551	1,00	5,75		
	Total	157	3,3678	1,23988	,09895	3,1724	3,5633	1,00	6,75		
FP=(FP1+FP2+FP3+FP4+FP5)/5	Sweden	101	4,4396	1,01824	,10132	4,2386	4,6406	1,60	7,00	8,936	,003
	Other	45	3,8489	1,27362	,18986	3,4663	4,2315	1,80	6,40		
	Total	146	4,2575	1,13234	,09371	4,0723	4,4428	1,60	7,00		

Table 7 *ANOVA Analysis - Country*

For every statement, Swedish respondents tended to disagree more with the statements than respondents working in other countries (for AS and SA $p<0.001$ and the others $p<0.01$).

4.3 Confirmatory Factor Analysis by Amos

To describe how several constructs can be explained by one second-order construct, factor analysis was used. If several constructs have high correlation, they can be grouped and described by one second-order construct. Amos was used to measure the factor loading. According to Hair *et al.* (2010, p. 17), to be significant, the value should be higher than 0.5 and preferably higher than 0.6.

Denomination	Construct (item)	Factor loading
Data acquisition	Acquire (second order)	0.63
AC1	The search for relevant information concerning our industry is everyday business in our company.	0.57
AC2	Our management motivates the employees to use information sources within our industry.	0.70
AC3	Our management expects that the employees deal with information beyond our industry.	0.77
Data assimilation	Assimilate (second order)	0,78

AS1	In our company ideas and concepts are communicated cross-departmental.	0.75
AS2	Our management emphasizes cross-departmental support to solve problems.	0.68
AS3	In our company there is a quick information flow. (E.g. if a business unit obtains important information it communicates this information promptly to all other business units or departments.)	0.75
AS4	Our management demands periodical cross-departmental meetings to interchange new developments, problems and achievements.	0,74
Data transformation	Transformation (second order)	0,68
TD1	Our employees have the ability to structure and to use collected knowledge.	0,73
TD2	Our employees are used to absorb new knowledge as well as to prepare it for further purposes and to make it available.	0,86
TD3	Our employees successfully link existing knowledge with new insights.	0,93
TD4	Our employees are able to apply new knowledge in their practical work.	0,84
Data exploitation	Exploitation (second order)	0,92
EX1	Our management supports the development of prototypes.	0,73
EX2	Our company regularly reconsiders technologies and adapts them accordant to new knowledge.	0,83
EX3	Our company has the ability to work more effective by adopting new technologies.	0,58
SA1	Overall, our program of using alliances for new product	0,81

	development has been a success.	
SA2	Most of our alliances for innovation development have met our objectives.	0,81
SA3	Company sales and profits have benefited from using alliances for new product development.	0,74
SA4	Our alliance development efforts have been more successful than competitors.	0,80
SA5	Innovations developed by alliances have achieved good market penetration.	0,73
FP1	Growth in sales	0,86
FP2	Return on investment	0,89
FP3	Operating profit margin	0,79
FP4	Return on equity	0,79
FP5	Customer retention	0,52
PI1	Patents to prevent that competitors imitate our products.	0,80
PI2	Patents to secure royalty income.	0,87
PI3	Secrecy (Keeping development of new innovations secret from competitors.)	0,58
ME1	Lead time (Knowing when it is the right time to commercialize and release the innovation to the market.)	0,70
ME2	Complementary assets (Specialized assets in areas such as marketing, manufacturing or sales support.)	0,86

Table 8 *Confirmatory Factor Analysis results*

4.4 Exploratory Factor Analysis

Another type of method, known as the rotation method, which is called *"Varimax with Kaiser Normalisation",* was used to identify if the second-order constructs could be grouped into first-order constructs according to our theory. The software package SPSS was used to perform this analysis.

		1	2	3	4	5	6	7	8	Cronbach's alpha
1	AC1						0,75			CA = 0.72
	AC2						0,692			
	AC3						0,793			
2	AS1				0,799					CA = 0.82
	AS2				0,669					
	AS3				0,72					
	AS4				0,761					
3	TD1			0,717						CA = 0.90
	TD2			0,851						
	TD3			0,864						
	TD4			0,801						
4	EX1								0,512	CA = 0.94
	EX2	0,425		0,358					0,53	
	EX3								0,671	
5	PI1					0,877				CA = 0.79
	PI2					0,876				
	PI3					0,601		0,387		
6	ME1							0,831		*r* = 0.55
	ME2							0,84		
7	SA1	0,723								CA = 0.89
	SA2	0,796								
	SA3	0,76								
	SA4	0,845								
	SA5	0,778								
8	FP1		0,868							CA = 0.89
	FP2		0,877							
	FP3		0,895							
	FP4		0,861							
	FP5		0,549						0,407	

Table 9 *Exploratory Factor Analysis results*

As noted earlier, factors should be higher than 0.5 and preferably higher than 0.6, according to Hair *et al.* (2010). Eigenvalues should be higher than 1 and factors should explain more than 60% of the variance.

In our factor analysis, the eigenvalue is 1.34 and the six factors explain 72.5% of the variance, which means that the model is significant. As stated in chapter 3.4, Cronbach's alpha is a measure of internal reliability: 1 is perfect reliability and 0 is no internal reliability. Values higher than 0.7 are acceptable for the conclusion to be valid, according to Nunnally (1978). In our Exploratory Factor Analysis results, the Cronbach's alphas for the different variables are between 0.79 and 0.94, indicating high internal reliability. EX2, PI3 and FP5 show some overlap, although the values are small. This could indicate that these questions have some overlap.

4.5 Reliability

4.5.1 Cronbach's Alpha Test

To be reliable, the questions in every second-order construct have to measure the same thing. To verify this, a Cronbach's alpha test was performed.

			Cronbach's alpha Test	Cronbach's alpha
1	PI	PI 1	Patents to prevent that competitors imitate our products.	CA=0.79
		PI 2	Patents to secure royalty income.	
		PI 3	Secrecy	
2	AC	AC 1	The search for relevant information concerning our industry is every-day business in our company.	CA=0.72
		AC 2	Our management motivates the employees to use information sources within our industry.	
		AC 3	Our management expects that the employees deal with information beyond our industry.	
3	AS	AS 1	In our company ideas and concepts are communicated cross-departmental.	CA=0.82
		AS 2	Our management emphasizes cross-departmental support to solve problems.	
		AS 3	In our company there is a quick information flow.	
		AS 4	Our management demands periodical cross-departmental meetings to interchange new developments, problems, and achievements.	
4	FP	FP 1	Growth in sales	CA=0.89
		FP 2	Return on investment	
		FP 3	Operating profit margin	
		FP 4	Return on equity	
		FP 5	Customer retention	
5	SA	SA 1	Overall, our program of using alliances for new product development has been a success.	CA=0.89
		SA 2	Most of our alliances for innovation development have met our objectives.	
		SA 3	Company sales and profits have benefited from using alliances for new product development.	
		SA 4	Our alliance development efforts have been more successful than competitors.	
		SA 5	Innovations developed by alliances have achieved good market penetration.	
6	TD	TD 1	Our employees have the ability to structure and to use collected knowledge.	CA=0.90
		TD 2	Our employees are used to absorb new knowledge as well as to prepare it for further purposes and to make it available.	
		TD 3	Our employees successfully link existing knowledge with new insights.	
		TD 4	Our employees are able to apply new knowledge in their practical work.	
7	EX	EX 1	Our management supports the development of prototypes.	CA=0.74
		EX 2	Our company regularly reconsiders technologies and adapts them accordant to new knowledge.	
		EX 3	Our company has the ability to work more effective by adopting new technologies.	
7	ME	ME 1	Lead time - Knowing when it is the right time to commcercialize and release the innovation to the market.	r = 0.55
		ME 2	Complementary assets - Specialized assets in areas such as marketing, manufacturing or sales.	

Table 10 *Cronbach's Alpha Test*

4.5.2 Correlation Matrix

A Pearson correlation coefficient test was performed in Amos (Table 11). The purpose of conducting this test was to see if the variables that measure the same thing have high internal correlation. Values close to 1 indicate a perfect match between two series of answers and a good correlation of values. A value close to 0 would show a weak correlation.

Values marked in bold in Table 11 have high internal correlation. If the values from different groups showed higher correlation than within the group, it could indicate that they are not separated from each other. The table shows that the values have high internal correlation and low correlation between groups of variables.

	Question	Mean	Std. Deviation	N	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19	X20	X21	X22	X23	X24	X25	X26	X27	X28	X29
AQ1	X1	3,2857	1,58678	161	1,000																												
AQ2	X2	3,5280	1,55749	161	**,396****	1,000																											
AQ3	X3	3,8491	1,59584	159	**,455****	**,514****	1,000																										
AS1	X4	4,0366	1,64257	164	,159*	,264**	,229**	1,000																									
AS2	X5	3,4479	1,66353	163	,114	,244**	,192*	**,548****	1,000																								
AS3	X6	4,3049	1,59515	164	,141	,230**	,226**	**,577****	**,406****	1,000																							
AS4	X7	4,2945	1,69579	163	,231**	,269**	,256**	**,502****	**,510****	**,547****	1,000																						
TD1	X8	3,5094	1,39106	159	,227**	,313**	,363**	,426**	,240**	,313**	,395**	1,000																					
TD2	X9	3,4472	1,40045	161	,234**	,267**	,304**	,326**	,282**	,358**	,337**	**,681****	1,000																				
TD3	X10	3,3625	1,38948	160	,105	,227**	,340**	,332**	,285**	,342**	,327**	**,649****	**,775****	1,000																			
TD4	X11	3,1472	1,43687	163	,169*	,206**	,279**	,357**	,368**	,289**	,244**	**,545****	**,692****	**,789****	1,000																		
EX1	X12	3,3742	1,53894	163	,229**	,283**	,383**	,404**	,351**	,458**	,366**	,306**	,318**	,363**	,409**	1,000																	
EX2	X13	3,5741	1,41775	162	,213**	,297**	,341**	,374**	,455**	,485**	,351**	,326**	,379**	,457**	,444**	**,606****	1,000																
EX3	X14	3,2037	1,42793	162	,180*	,153	,200*	,354**	,334**	,399**	,359**	,270**	,281**	,341**	,356**	**,396****	**,452****	1,000															
PI1	X15	2,9632	1,75231	163	,219**	,123	,040	,146	,039	,121	,063	,081	,027	-,004	,075	,104	,045	,170*	1,000														
PI2	X16	3,1304	1,68126	161	,222**	,154	,081	,125	,026	,084	,095	,134	,088	,061	,136	,152	,097	,090	**,706****	1,000												
PI3	X17	2,7914	1,65348	163	,164*	,121	,142	,059	,130	,009	,059	,083	,102	,118	,204**	,160*	,101	,074	**,461****	**,524****	1,000											
ME1	X18	2,4969	1,57371	161	,232**	,093	,088	,037	,139	,129	,108	,004	,012	,033	,077	,193*	,100	,236**	,277**	,257**	,382**	1,000										
ME2	X19	2,7975	1,27574	158	,267**	,126	,222**	,206**	,239**	,213**	,184*	,154	,120	,147	,150	,243**	,161*	,222**	,335**	,396**	,462**	**,547****	1,000									
SA1	X20	3,9177	1,22586	158	,254**	,335**	,282**	,392**	,359**	,343**	,398**	,464**	,344**	,377**	,335**	,396**	,554**	,389**	,252**	,262**	,195*	,127	,158*	1,000								
SA2	X21	4,0065	1,11728	154	,140	,338**	,302**	,320**	,340**	,328**	,389**	,338**	,283**	,384**	,240**	,419**	,578**	,348**	,166*	,135	,211**	,098	,109	**,718****	1,000							
SA3	X22	3,8497	1,09887	153	,117	,300**	,332**	,319**	,253**	,287**	,371**	,362**	,243**	,334**	,252**	,358**	,414**	,269**	,223**	,151	,064	-,014	,098	**,587****	**,619****	1,000						
SA4	X23	4,0523	1,09239	153	,063	,344**	,275**	,255**	,275**	,274**	,284**	,372**	,247**	,380**	,272**	,306**	,460**	,344**	,201*	,228**	,163*	,152	,164*	**,612****	**,628****	**,662****	1,000					
SA5	X24	3,7550	1,11933	151	,164*	,251**	,211**	,316**	,315**	,312**	,407**	,331**	,277**	,352**	,314**	,280**	,385**	,241**	,164*	,234**	,209*	,073	,177*	**,603****	**,574****	**,613****	**,682****	1,000				
FP1	X25	4,2994	1,49557	157	,207**	,243**	,263**	,172*	,108	,211**	,223**	,269**	,246**	,255**	,233**	,302**	,327**	,247**	,073	-,007	,000	,068	,113	,244**	,206*	,281**	,326**	,129	1,000				
FP2	X26	4,4481	1,28867	154	,193*	,237**	,346**	,115	,115	,230**	,194*	,240**	,177*	,213**	,168*	,312**	,344**	,207*	,201*	,062	,016	,111	,049	,282**	,246**	,358**	,390**	,120	**,786****	1,000			
FP3	X27	4,5256	1,42534	156	,131	,174*	,220**	,120	,166*	,247**	,250**	,239**	,222**	,209**	,187*	,222**	,264**	,204*	,097	-,024	-,025	,028	-,020	,229**	,200*	,324**	,338**	,199*	**,682****	**,749****	1,000		
FP4	X28	4,2697	1,27622	152	,151	,140	,253**	,209**	,201*	,301**	,290**	,290**	,233**	,232**	,204*	,259**	,313**	,191*	,180*	,042	-,022	,124	,055	,241**	,210*	,270**	,293**	,102	**,682****	**,721****	**,748****	1,000	
FP5	X29	3,8212	1,29659	151	,190*	,199*	,111	,180*	,210**	,149	,319**	,213**	,249**	,206*	,282**	,246**	,253**	,305**	,116	,102	,084	,049	,033	,335**	,184*	,177*	,286**	,222**	**,482****	**,436****	**,436****	**,520****	1,000
	**p<0.01; *p<0.05																																

Table 11 ***Pearson's Correlation Matrix***

4.6 Survey results related to hypotheses

A regression analysis was conducted to test our hypotheses.

	Regression analysis	Std. Beta	t-value	p-value	Result
H1	Firm performance vs. ACAP	0.561	2.717	0.007	Supported
H2	Strategic alliances vs. ACAP	0.762	4.572	***	Supported
H3	Firm performance vs. Protection of innovations	0.067	0.587	0.558	No support
H4	Strategic alliances vs. Protection of innovations	0.211	2.294	0.022	Supported
H5	Firm performance vs. Market efficiency	-0.148	-1.177	0.239	No support
H6	Strategic alliances vs. Market efficiency	-0.167	-1.641	0.101	No support
H7	Strategic alliances vs. Firm performance	-0.091	-0.545	0.586	No support

Table 12 *Regression Analysis*

As shown in Table 12, the survey results show a significant positive relationship between firm performance and ACAP (beta = 0.561, $p<0.001$) and between success of strategic alliances and ACAP (beta=0.762, $p<0.001$). There is also a significantly positive relationship between our added measurement of protection of innovations and strategic alliances (beta=0.211, $p<0.05$). We find no relationship between market efficiency and firm performance ($p>0.1$) as well as no relationship between market efficiency and success of strategic alliances ($p>0.1$). No support was found between firm performance and success of strategic alliances ($p>0.1$). We have added the resulting data into our theoretical model, which leads to the conceptual picture in Figure 3.

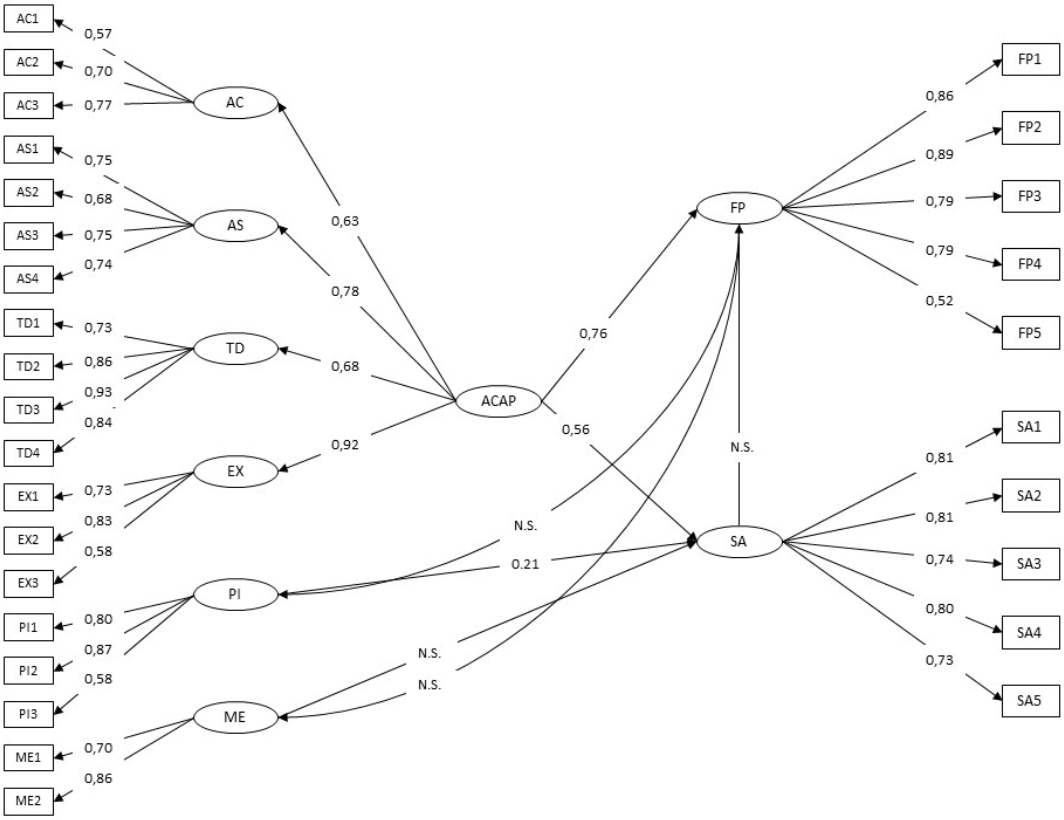

Figure 3 ***Test Results of the Theoretical Model***

5. Analysis and Discussion

In this chapter, the analysis of the results is presented. For the analysis and testing of our hypotheses, through our theoretical model, we worked with proven and accepted measurements. We based our measurements on a four-dimensional measure created by Flatten *et al*. (2011b). Their measure was created to compare different studies that research ACAP. Based upon our interviews, we added two other first-order measurements, namely Protection of Innovation and Market Efficiency. As shown by the results in chapter 4 and in Figure 3 above, the measurements and our theoretical model worked very well.

Flatten *et al*. (2011a) studied small and medium-sized companies in Germany. We studied a large manufacturing company in Sweden with global operations. We verified successfully that ACAP and our own measurements work well for the manufacturing industry.

5.1 Analysis of survey results

As shown in Table 12 in chapter 4.6, the survey results show a significant positive relationship between firm performance and ACAP and between success of strategic alliances and ACAP, which is in line with the study by Flatten et al. (2011a). There is also a significantly positive relationship between our added measurement of protection of innovations and success of strategic alliances. We find no relationship between market efficiency and firm performance as well as no relationship between market efficiency and success of strategic alliances. In the study by Flatten et al. (2011a), there was a relationship between firm performance and success of strategic alliances, but in our survey, this relation was not significant.

5.2 Post-hoc analysis

To explain our survey results further, we conducted interviews with employees in management positions in the different SBUs. The only exception was OBT, where no manager could attend an interview in the requested timeframe. In this subchapter, we present our findings and describe how they relate to the different hypotheses and survey results.

5.2.1 Innovativeness

The two hypotheses that relate to innovativeness are measured by examining the relationship between ACAP and firm performance and between ACAP and strategic alliances. The survey answers related to these hypotheses can be found in Appendixes F.3.–F.8.

Hypothesis 1: There is a relationship between ACAP and firm performance.

In general, survey respondents agreed with the statements and questions asked about ACAP. There were a few exceptions. When asked about if ideas and concepts are communicated cross-departmentally, respondents leaned to the disagreeing side. When it comes to if companies have a quick information flow, they strongly disagreed. Respondents leaned to the disagreeing side when it came to the question about operating profit margin and return on investment related to firm performance.

The interview respondents described that the most important source of new ideas is other Volvo Group companies and customers. They also explained that to share information, they use internal Volvo Group communities. They see a need to share information and seek ways of doing this by using Wikis and similar tools.

Respondent 1 highlighted that within the Volvo Group so-called 'technical meetings' are held to spread ideas and innovations. Different representatives from the SBUs within the Volvo Group attend these technical meetings. Respondent 1 also mentioned that 'engineering reports' are released almost every week (which are available to the whole Volvo Group), which is a way to spread information about new technical achievements and knowledge. We find that these two initiatives are good ways of spreading knowledge and are in line with increasing ACAP.

Respondent 2 explained that VBC works with knowledge management surveys that measure how good the company is at handling and spreading knowledge. Management set goals and measures if the company comes closer or further away from reaching these goals. They take actions accordingly to try to change its way of working to be able to reach the goals if necessary.

Respondents 3 and 4 described that VGT works with a concept called 'Happy Friday' to spread knowledge. Happy Friday means that employees get to spend one day per month studying a subject and/or work with a project of their choice. We see this as an excellent opportunity for knowledge spreading and collaboration as well as increasing ACAP.

Hypothesis 2: There is a relationship between ACAP and success of strategic alliances.

The survey respondents agreed with most of the statements related to success of strategic alliances. This is in line with the statements of the interview respondents. The SBUs use many suppliers, especially VBC. They are not involved in many open innovation initiatives apart from government-sponsored activities such as the 'NASA challenge' (NASA, 2014) and 'Lindholmen Science Park' (Lindholmen, 2014) activities. We see this as an area of improvement for the SBUs.

5.2.2 Protection of Innovation

Hypothesis 3: There is a relationship between protection of innovations and firm performance.

The majority of the survey respondents agreed that patenting is a useful method to protect innovations from imitation as well as to gain royalty incomes (see the figures of Appendix F.2). However, patents are still the method that comes in last place of all the value capture methods according to respondents. This is in line with the findings of Cohen *et al*. (2000), as shown in the figures of Appendix A and Appendix B.

The interview respondents indicated that none of the SBUs works actively with patents to protect their innovations, even though they admitted that it could play a more important role in the future. Here, we think that the SBUs can improve in order to create more value from their innovations.

Hypothesis 4: There is a relationship between protection of innovation and success of strategic alliances.

As with patents, the majority of the survey respondents answered that they think secrecy is a good method for capturing value (Appendix F.2). Secrecy ranks third among the value capture methods. This result is slightly different from that of Cohen *et al.* (2000), where secrecy was second for product innovations and first for process innovations, as seen in Appendix A and Appendix B.

Interview respondents 2–4 described that their company practice secrecy in the form of non-disclosure agreements within employment and consultant contracts as well as with agreements with suppliers.

Respondent 1 explained that at VBC, information is sometimes made public in the early phase of the project when signing a contract with a customer. The reason for this is to get financing from customers so that the project can continue.

One interview question was about if the SBU utilises different security classes to access different types of information. Respondent 2 described that at VBC there are documents that have different types of security classes (e.g. strategies, product plans and technical plans). Respondent 4 explained that VGT has a specific security setup, but could not go into more detail regarding this.

Secrecy is a factor that is always present but it is not something respondents see as a particularly important, which differentiate them from other companies. We can see that secrecy is a matter of balance for companies such as VBC, where they have to disclose information to make agreements with strategic partners.

5.2.3 Market Efficiency

Hypothesis 5: There is a relationship between market efficiency and firm performance.

This hypothesis relates to lead time advantages, as described in chapter 2.3.3. Of the four value capture mechanisms described and presented in this study, this was the most popular among survey respondents. This is aligned with the results from Cohen *et al*. (2000) when it comes to product innovations, as seen in the figure of Appendix A.

All interview respondents emphasised that lead time is very important for their companies. Respondent 1 explained that it is more important to have short lead times than to keep information on new projects secret. The respondent continued by saying that it is important to reach customers quickly, which in turn results in that information leaking out. This is related to Hypothesis 4.

Respondent 2 explained that it is very important to release new breakthrough technology fast on the market. An example of this from VBC is buses with hybrid technology. On the same topic, respondent 3 highlighted that VGT develops telematics software platforms and it is very important to stay ahead by developing new functions and new applications, and most importantly, releasing them quickly to remain competitive on the market. All respondents answered in the same way, namely that they see time to market as the most important way of protecting innovations and making the most value out of them.

Hypothesis 6: There is a relationship between market efficiency and success of strategic alliances.

Complementary assets were the second most popular value capture mechanisms according to survey respondents. This is similar to what Cohen *et al*. (2000) found, as shown in Appendix A and Appendix B. All respondents agreed that complementary assets are very important to create value and to successfully release new products. According to respondents 1 and 2, VBC controls the whole chain of complementary assets such as financing, development, sales and manufacturing. To VGT, marketing and sales are the most important complementary assets according to respondents 3 and 4.

5.2.4 Test of Protection of Innovation and Market Efficiency hypotheses

Hypotheses 3–6 were measured and tested by examining the relationships between protection of innovation and firm performance and between protection of innovation and strategic alliances as well as the relationships between market efficiency and firm performance and between market efficiency and strategic alliances. We also analysed the relationship between strategic alliances and firm performance, as had been done by Flatten *et al*. (2011a). As shown in chapter 4.6 no support for these relationships were found except between protection of innovation and strategic alliances.

5.2.5 Summary of interviews

Here we present a summary from the interviews conducted during our research. A list of respondents including their managing role and SBU is presented in Table 13 in Appendix H. From the interview data, we can draw the following conclusions:

- VBC, VGT and OBT are not using patents as a way of protecting their innovations.
- There is a rising consciousness that patents could be more valuable in the future not only as innovation protection but also as an income via licensing and cross-licensing to gain access to other companies' patents.
- Time to market is the most used method to get value from innovations. It is important to present and deliver new products to the market and be able to gain market share via innovations, especially around *"green"* innovations for VBC, where they act as a display window for the Volvo Group.
- VBC, VGT and OBT do not take part in open innovation communities to any great extent. When they participate, it is more by chance than as a part of a company strategy.
- VBC, VGT and OBT seek input from several sources outside their own organisation, mainly from customers, other parts of the Volvo Group and companies in the same industry.
  To spread information within the Volvo Group, there is no standardised form but they employ user groups and publish reports.

6. Conclusions

To remind our readers about our research questions, we repeat them here. The primary research question is, **How can value be captured from innovations?** The complementary research question is **How is value created from innovations in a large manufacturing company?** In order to answer the questions, we set up seven hypotheses. Of these hypotheses, we found support for three of them.

6.1 Conclusions related to the research questions

We set up a model to describe the relationship between ACAP, protection of innovation, market efficiency and firm performance and strategic alliances mainly based on the research done by Flatten *et al*. (2011a). Of these relationships, we managed to show a significant positive relationship between ACAP and firm performance, ACAP and success of strategic alliances and protection of innovation and success of strategic alliances. We also showed that all the factors of ACAP - acquisition, assimilation, transformation and exploitation - can be described by one factor - ACAP. The factors of firm performance and success of strategic alliances can also be described by two factors - FP and SA. This study has shown it is possible to use established measurements of ACAP for large manufacturing companies. The importance of ACAP has been highlighted for creating value out of innovations. This means that to succeed in the market, Volvo should continue to support its efforts in ACAP, start to work more with patents within the companies SBUs and continue to use the secrecy model that is currently being applied.

6.2 Limitations and further research

To explore the benefits of ACAP and protection of innovation further we suggest that all the SBUs within the Volvo Group, or another large manufacturing company, shall be included in a new survey. This study only focused on one company, in one type of industry. We believe that more firm- and industry-specific studies could be conducted to gather more empirical data from a wider variety of sources. Thanks to Flatten *et al*. (2011a), it is possible to compare studies that measure ACAP. By utilising this measurement framework, empirical data can be gathered in a consistent way and compared accordingly, which will increase the collective knowledge on ACAP.

Even though the Volvo Group is a global company and data was collected from several daughter companies around the globe, we believe that more research should be conducted on companies in other parts of the world. We believe that Volvo is a typical Swedish company and that the cultural aspects of other companies in other countries would be interesting for further research.

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Appendix A: Effectiveness of Appropriability Mechanisms for Product Innovations

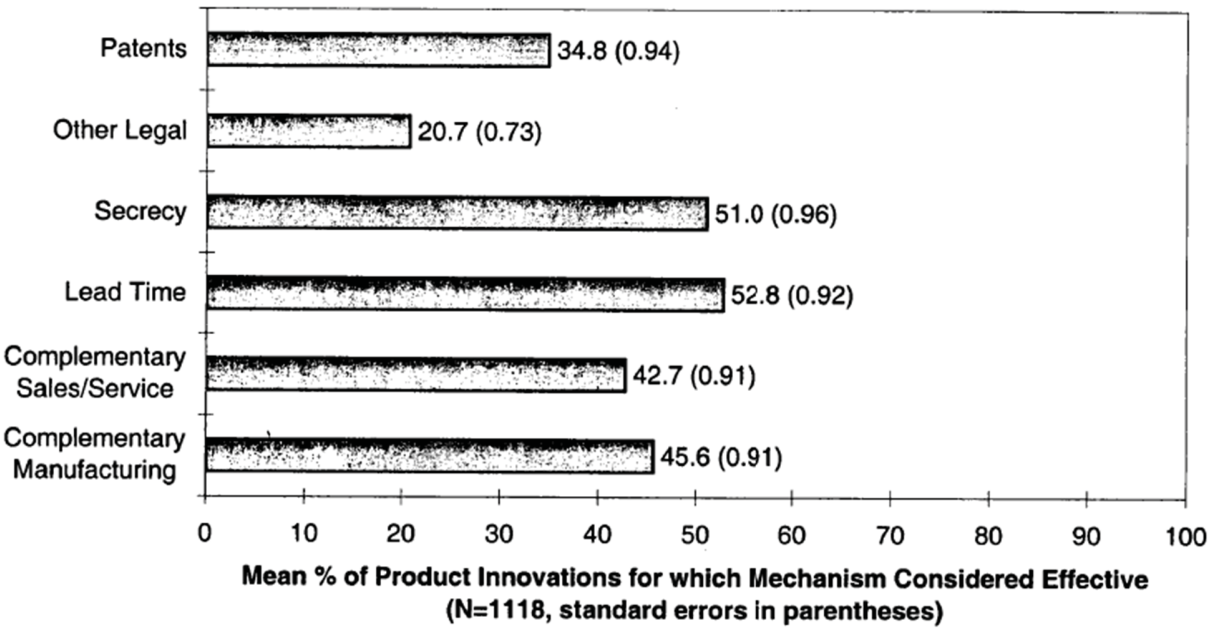


Figure 4 *Effectiveness of Appropriability Mechanisms for Product Innovations* (Cohen *et al.*, 2000)

Appendix B: Effectiveness of Appropriability Mechanisms for Process Innovations

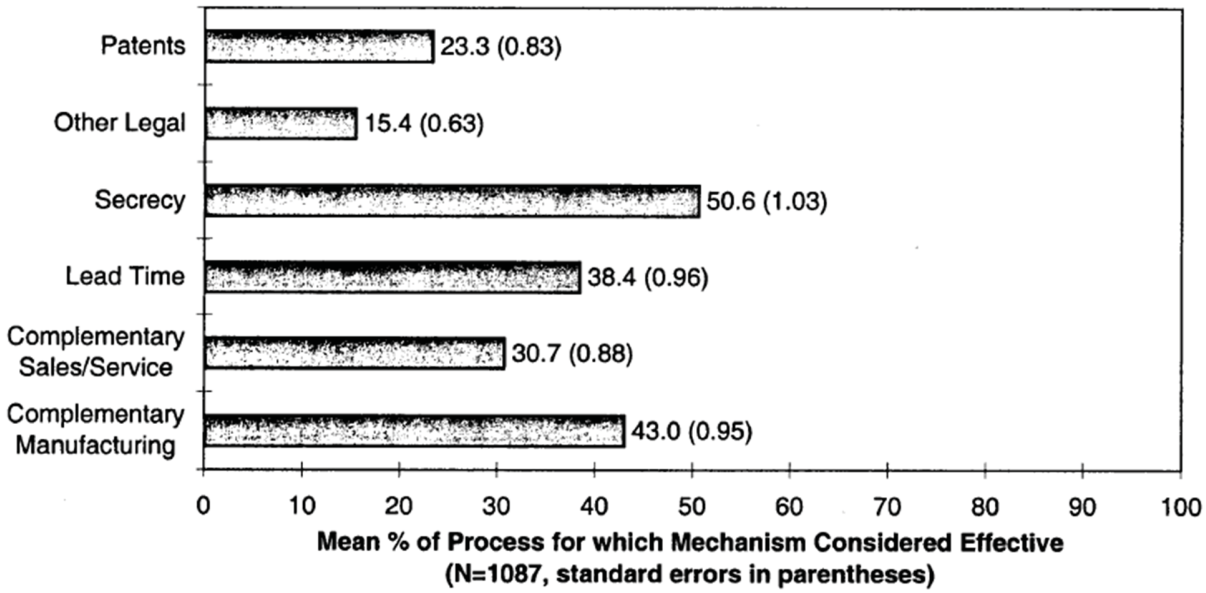


Figure 5 *Effectiveness of Appropriability Mechanisms for Process Innovations* (Cohen *et al.*, 2000)

Appendix C: Protective Mechanisms in Castles and Firms

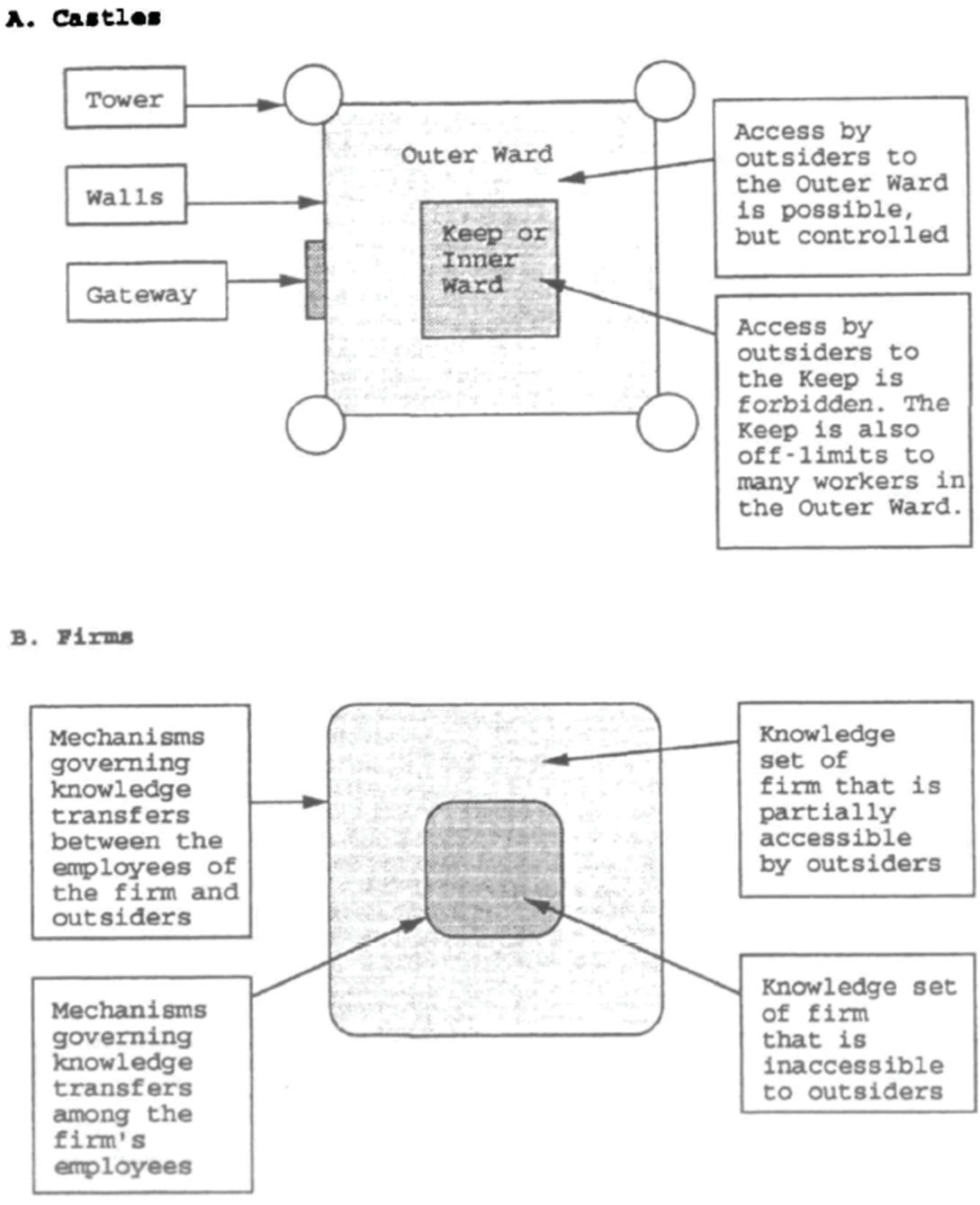


Figure 6 *Protective Mechanisms in Castles and Firms* (Liebeskind, 1997)

Appendix D: Description of the Volvo Group and different SBUs

D.1. Volvo Group

The Volvo Group is a public traded company listed on the NASDAQ OMX Stockholm Stock Exchange. Volvo was founded in 1927 by Gustaf Larson and Assar Gabrielsson (Volvo, 2013a). The company is one of the world's leading manufacturers of trucks, buses and construction equipment. The Volvo Group employs about 95,000 people, has production facilities in 18 countries and sells its products to more than 190 markets. The company's vision is "To become the world leader in sustainable transport solutions". The Volvo Group's corporate values are "Safety, Quality and Environmental Care".

Within the Volvo Group, there is a guideline for leaders and team members called 'The Volvo Way'. One of the things this guideline describes is how the employees of the company should "...work with energy, passion and respect for the individual". In 2013, the revenue of the Volvo Group was 272 billion SEK and it delivered 200,000 trucks (Volvo, 2013b). Further, within the Volvo Group it is not only the brand 'Volvo' that is included but also Renault Trucks, UD Trucks, Mack Trucks, Eicher, SDLG, Prevost and Nova Bus.

D.2. VGT

VGT supports the Volvo Group with telematics services and external customers in the Automotive Car OEM segment through the WirelessCar brand. VGT is a global organisation within the Volvo Group, providing telematics off-board services. The organisation enables and accelerates the development and delivery of customer-oriented off-board telematics services. Off-board telematics consist of everything that is not located in the vehicle; typically, this involves the telematics portal, databases, telecom solution and infrastructure.

On-board Telematics consist of the physical parts that are located in the vehicle; typically, this means a telematics control unit, a display unit that can show information for the driver in the vehicle, connectors and wiring harnesses and antennas. The on-board part of telematics within the Volvo Group is developed by OBT.

D.3. OBT

OBT was established to secure connected vehicles and support the increasing demand for soft products. OBT is part of Group Trucks Technology, which is the largest R&D organisation within the Volvo Group. Connectivity is a key enabler for fleet management, uptime services and advanced vehicle services such as driver assistance and fuel reduction, targeting reduced costs as well as increased revenues. The organisation consists of local brand solution units and a global platform unit. The brand solution units enable clear focus and responsibility for each brand-specific solution, while the global platform unit secures the leverage of common architecture and shared technology.

D.4. VBC

VBC is the world's second-largest manufacturer of buses and bus chasses. The product programme comprises city buses, intercity buses and tourist coaches as well as supplementary services in the areas of financing, servicing, vehicle diagnostics and traffic information systems. VBC has approximately 8000 employees worldwide, with production activities in Europe, North and South America, Asia and Africa. The head office is in Sweden, where product planning and product development are primarily concentrated. VBC also has product development and manufacturing in Brazil, Mexico, the USA, Canada, Poland and India.

Appendix E: Survey questions

What is your gender?

What is your age?

For which organisation do you work?

In which country do you work?

Please rate if you agree or disagree that these methods are effective to protect your company's competitive advantage when it comes to new or improved processes and products.

- Patents to prevent competitors from imitating our products.
- Patents to secure royalty income.
- Secrecy (keeping the development of new innovations secret from competitors).
- Lead time (knowing when it is the right time to commercialise and release the innovation to the market).
- Complementary assets (specialised assets in areas such as marketing, manufacturing and sales support).

Please specify to what extent your company uses external resources to obtain information, such as personal networks, consultants, seminars, the Internet, databases, professional journals, academic publications, market research, and regulations and laws concerning environment/technique/health/security.

- The search for relevant information concerning our industry is everyday business in our company.
- Our management motivates employees to use information sources within our industry.
- Our management expects employees to deal with information beyond our industry.

Please rate to what extent the following statements fit the communication structure in your company:

- In our company, ideas and concepts are communicated cross-departmentally.
- Our management emphasises cross-departmental support to solve problems.
- In our company, there is a quick information flow. (E.g. if a business unit obtains important information, it communicates it promptly to all other business units or departments.)
- Our management demands periodic cross-departmental meetings to exchange new developments, problems and achievements.

Please specify to what extent your strategic alliances match the following statements:

- Overall, our programme of using alliances for new product development has been a success.

- Most of our alliances for innovation development have met our objectives.
- Company sales and profits have benefited from using alliances for new product development.
- Our alliance development efforts have been more successful than those of our competitors.
- Innovations developed by alliances have achieved good market penetration.

Please specify to what extent the following statements fit the knowledge processing in your company:

- Our employees have the ability to structure and to use collected knowledge.
- Our employees are used to absorbing new knowledge as well as to preparing it for further purposes and making it available.
- Our employees successfully link existing knowledge with new insights.
- Our employees are able to apply new knowledge in their practical work.

Please specify to what extent the following statements fit the commercial exploitation of new knowledge in your company (please think about all company divisions such as R&D, production, marketing, and accounting).

- Our management supports the development of prototypes.
- Our company regularly reconsiders technologies and adapts them according to new knowledge.
- Our company has the ability to work more effectively by adopting new technologies.

Firm performance - How satisfied are you with the last year's key data compared with your most important competitor?

- Growth in sales
- Return on investment
- Operating profit margin
- Return on equity
- Customer retention

Appendix F: Summary of survey responses

F.1. General questions

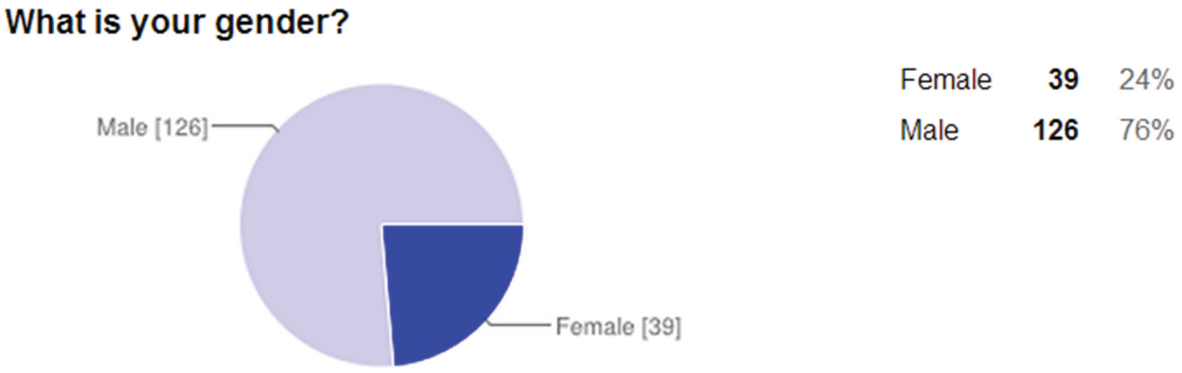


Figure 7 *What is your gender?*

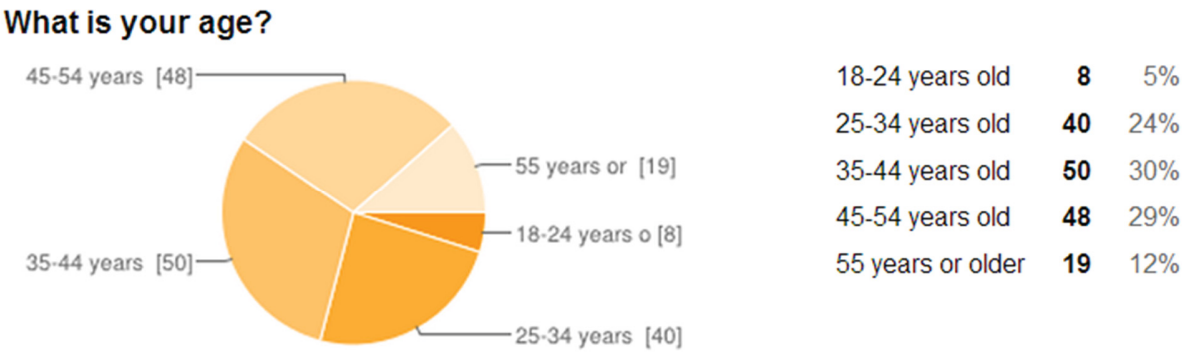


Figure 8 *What is your age?*

Figure 9 *For which organisation do you work?*

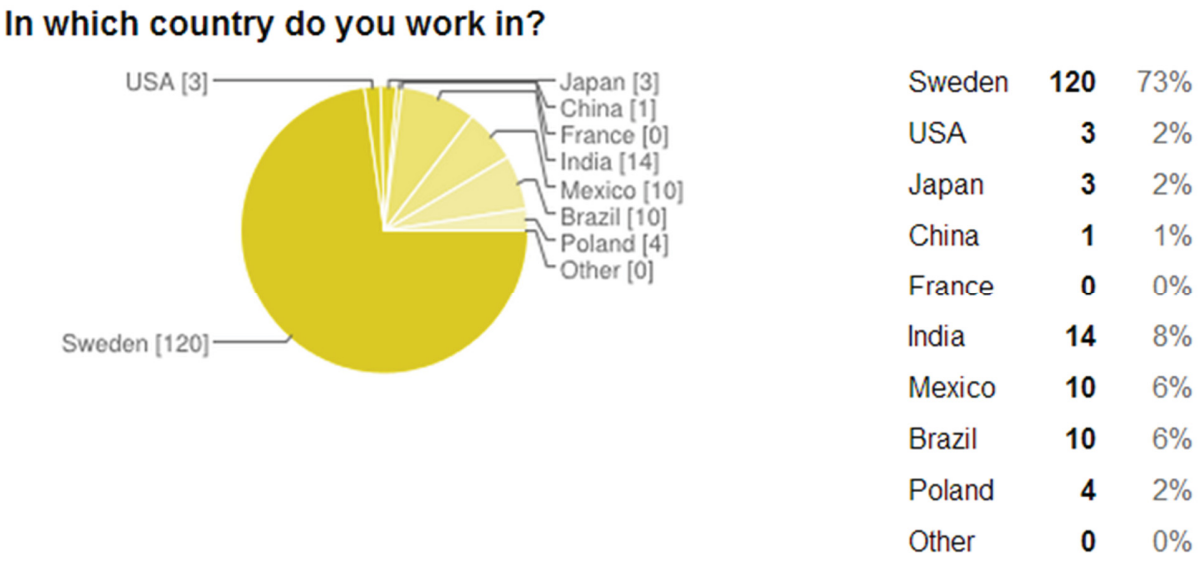


Figure 10 *In which country do you work?*

F.2. Please rate if you agree or disagree that these methods are effective to protect your company's competitive advantage when it comes to new or improved processes and products.

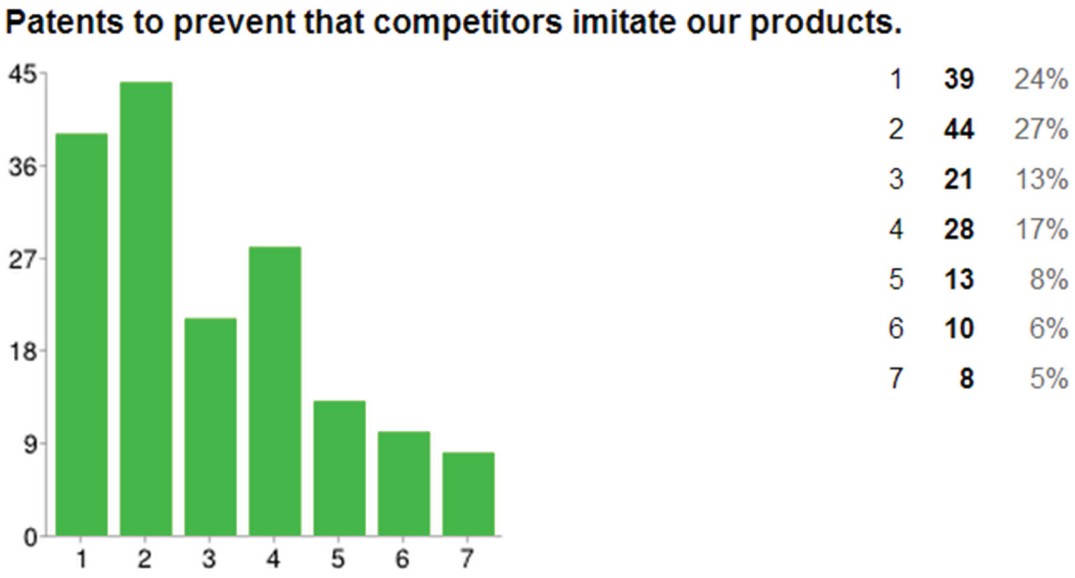


Figure 11 *Patents to prevent competitors from imitating our products.*

Figure 12 *Patents to secure royalty income.*

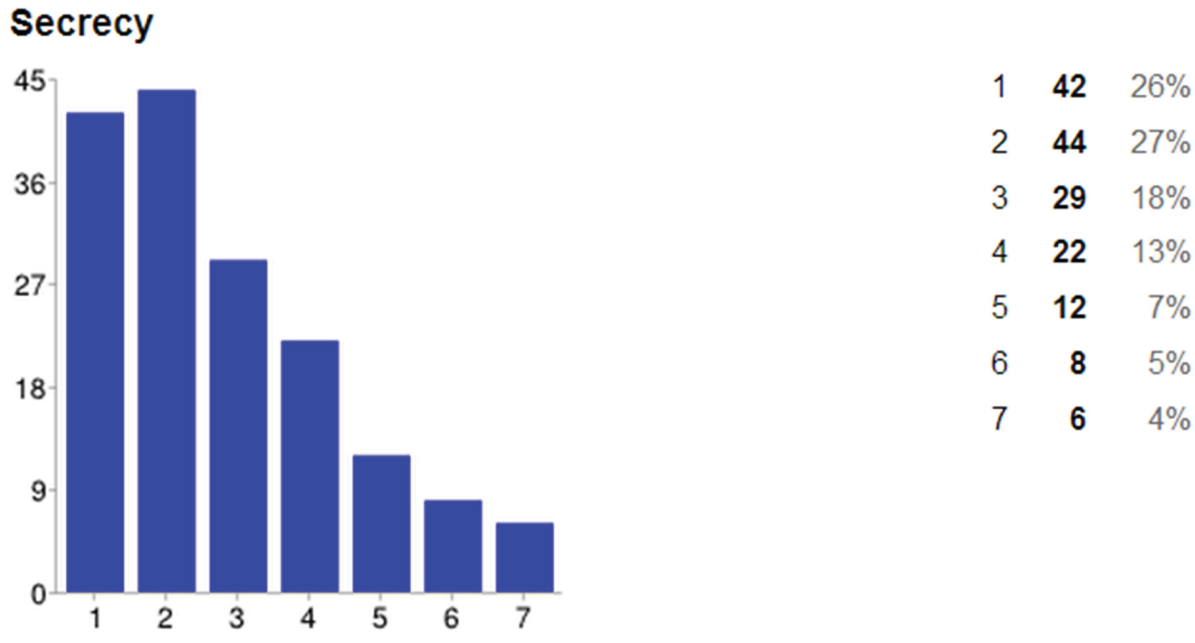
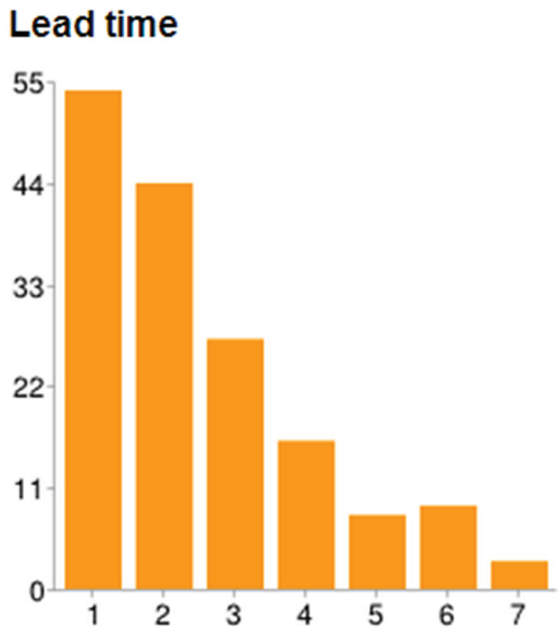
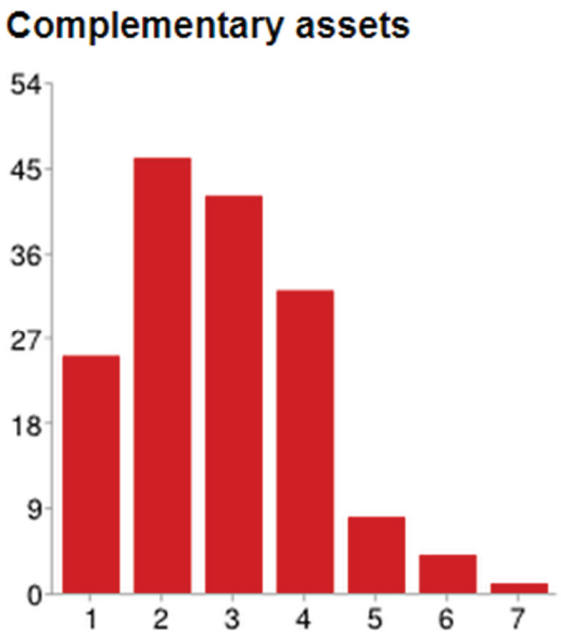


Figure 13 *Secrecy.*



1	**54**	34%
2	**44**	27%
3	**27**	17%
4	**16**	10%
5	**8**	5%
6	**9**	6%
7	**3**	2%

Figure 14 *Lead time.*



1	**25**	16%
2	**46**	29%
3	**42**	27%
4	**32**	20%
5	**8**	5%
6	**4**	3%
7	**1**	1%

Figure 15 *Complementary assets.*

F.3. Please specify to what extent your company uses external resources to obtain information.

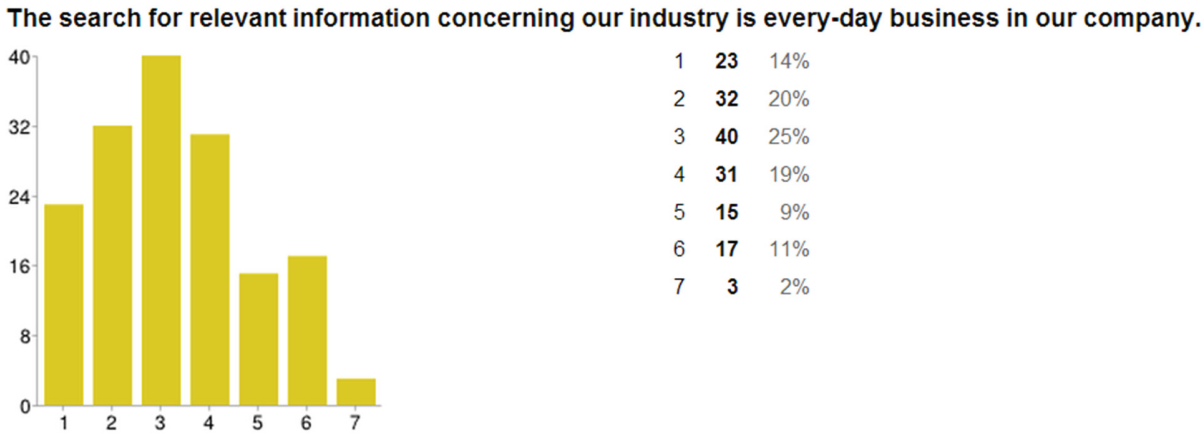


Figure 16 *The search for relevant information concerning our industry is everyday business in our company.*

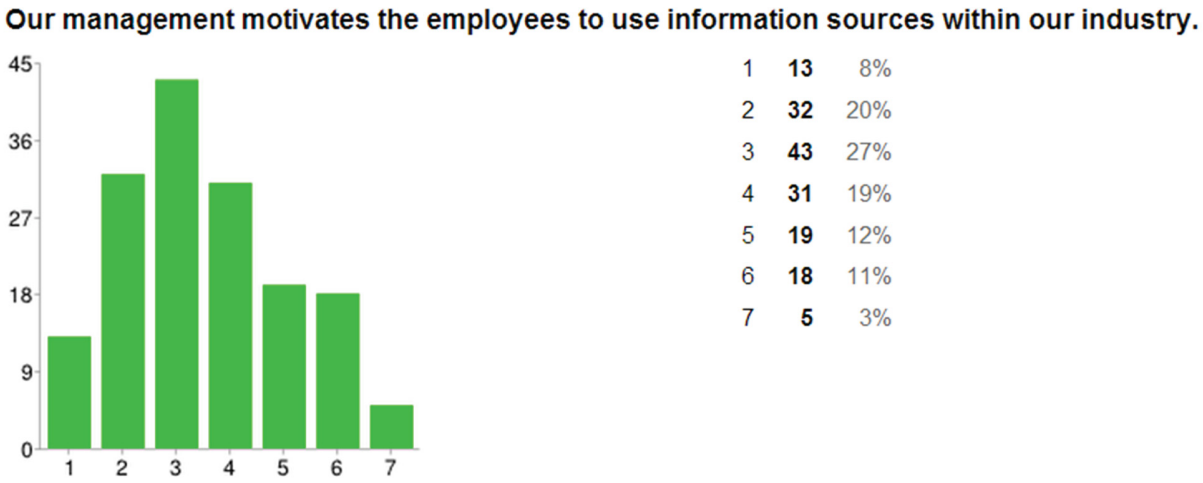


Figure 17 *Our management motivates employees to use information sources within our industry.*

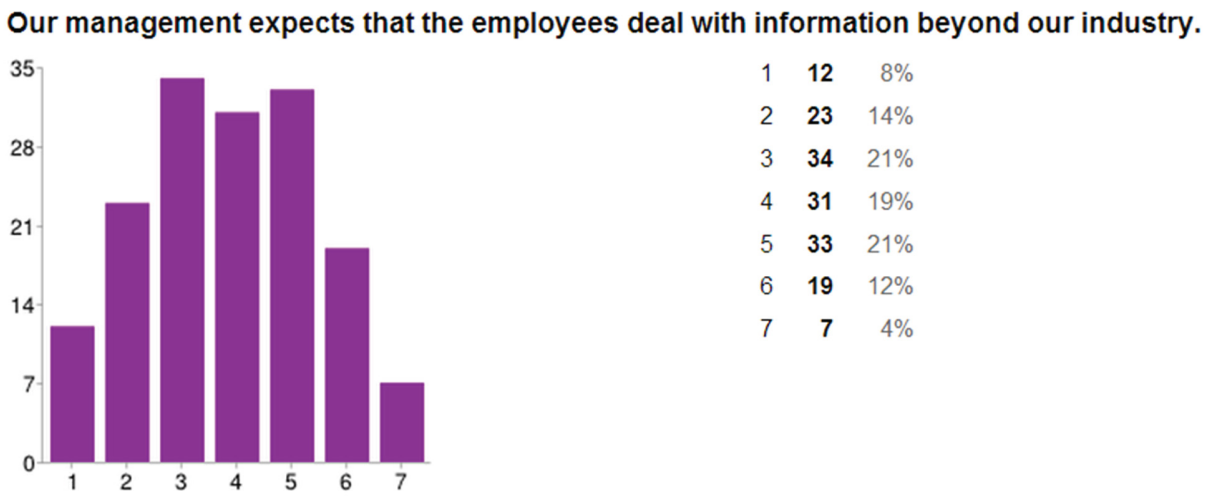


Figure 18 *Our management expects employees to deal with information beyond our industry.*

F.4. Please rate to what extent the following statements fit the communication structure in your company:

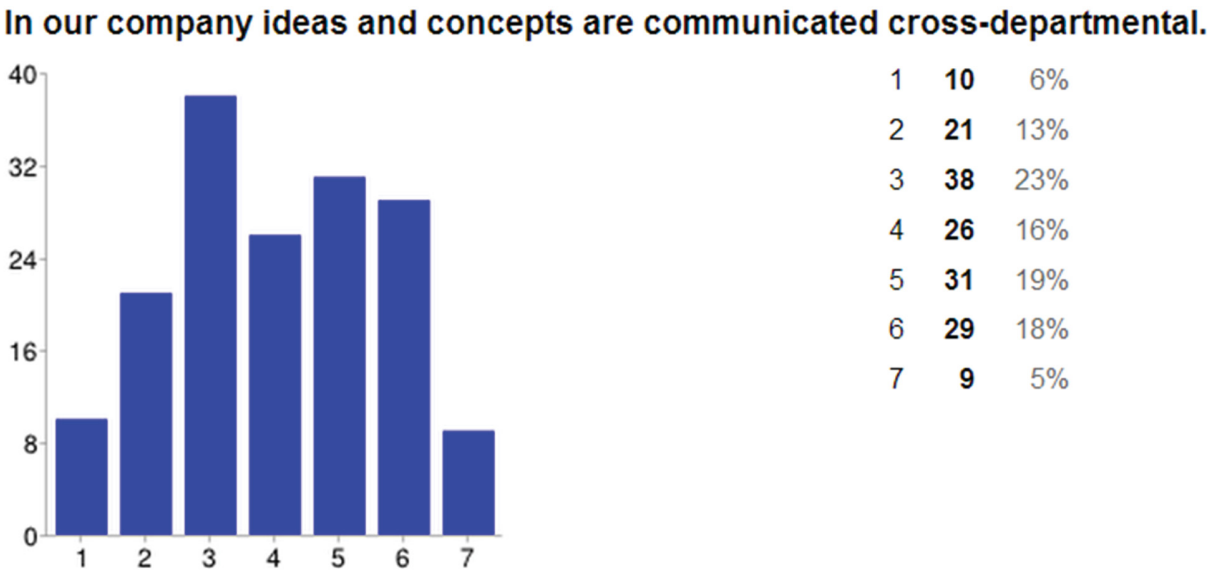


Figure 19 *In our company, ideas and concepts are communicated cross-departmentally.*

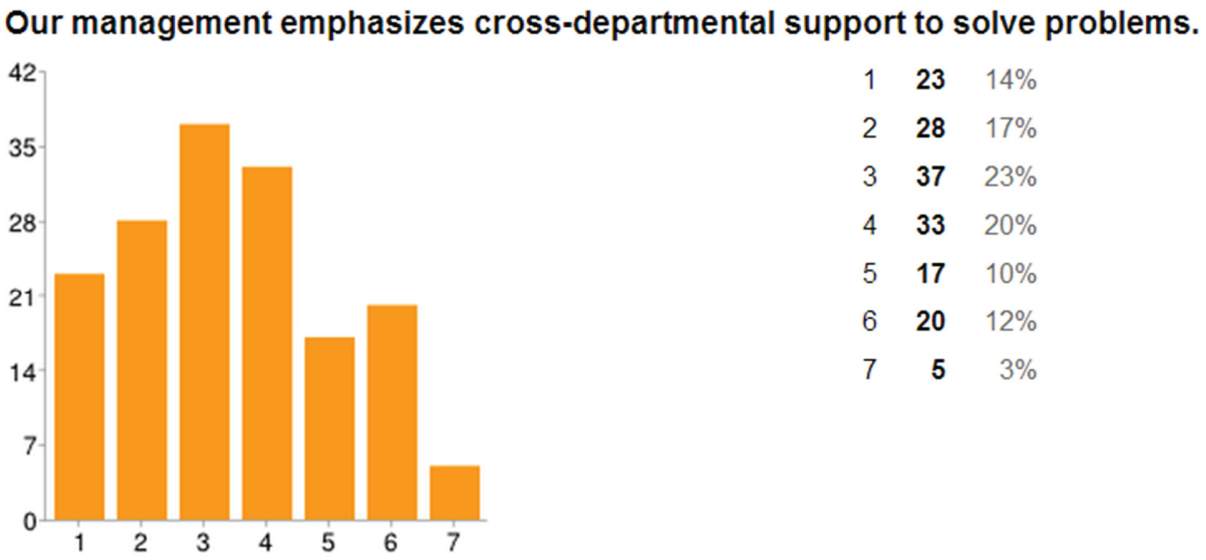


Figure 20 *Our management emphasises cross-departmental support to solve problems.*

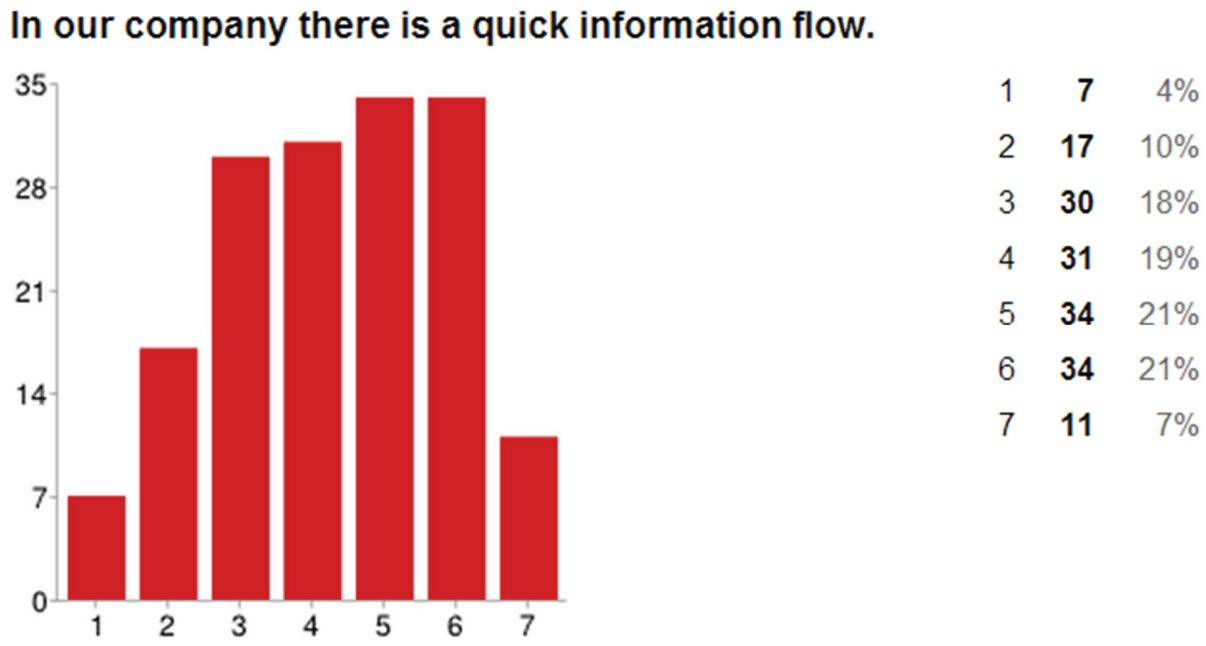


Figure 21 *In our company, there is a quick information flow.*

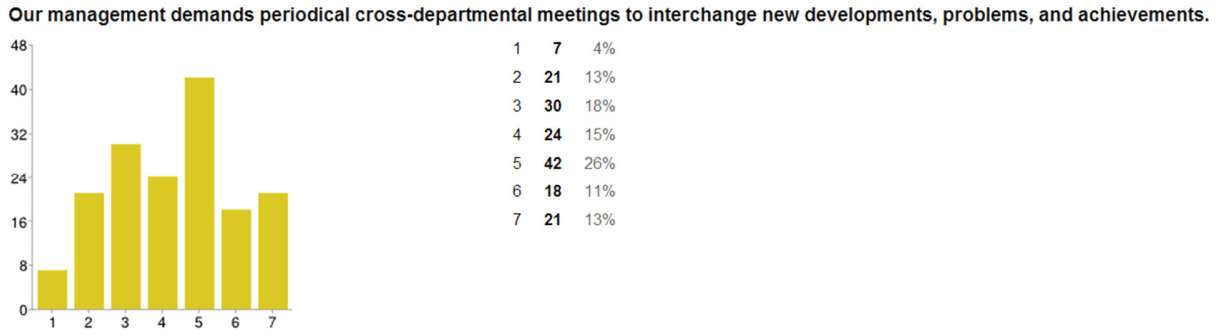


Figure 22 *Our management demands periodic cross-departmental meetings to exchange new developments, problems and achievements.*

F.5. Success of strategic alliances

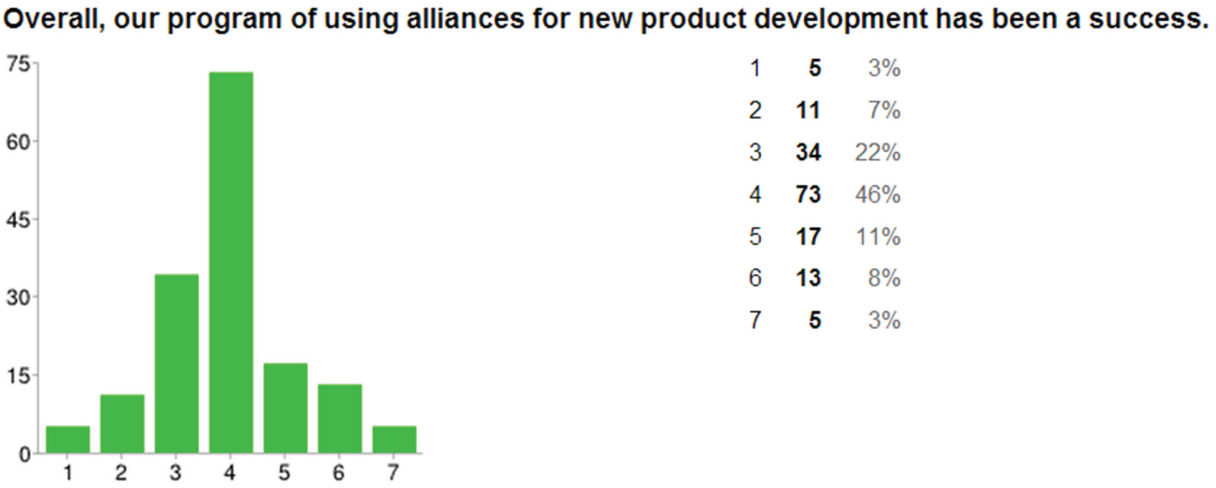
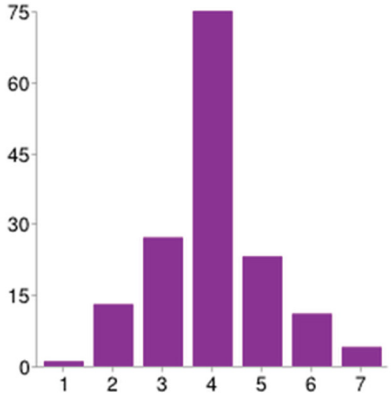


Figure 23 *Overall, our programme of using alliances for new product development has been a success.*

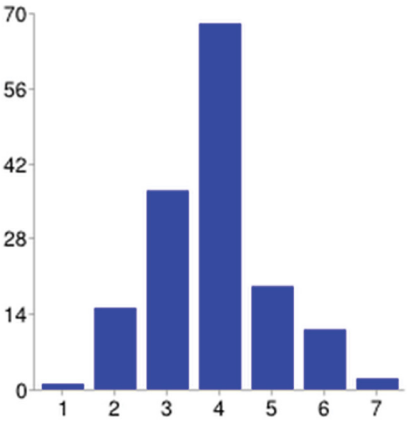
Most of our alliances for innovation development have met our objectives.



1	**1**	1%
2	**13**	8%
3	**27**	18%
4	**75**	49%
5	**23**	15%
6	**11**	7%
7	**4**	3%

Figure 24 *Most of our alliances for innovation development have met our objectives.*

Company sales and profits have benefited from using alliances for new product development.



1	**1**	1%
2	**15**	10%
3	**37**	24%
4	**68**	44%
5	**19**	12%
6	**11**	7%
7	**2**	1%

Figure 25 *Company sales and profits have benefited from using alliances for new product development.*

Figure 26 *Our alliance development efforts have been more successful than those of our competitors.*

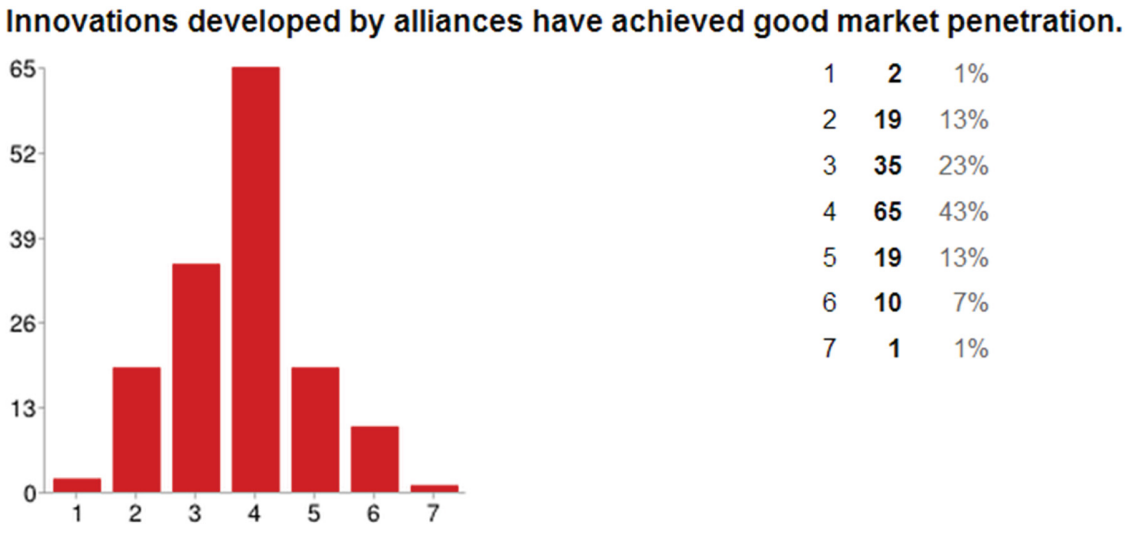


Figure 27 *Innovations developed by alliances have achieved good market penetration.*

F.6. Please specify to what extent the following statements fit the knowledge processing in your company:

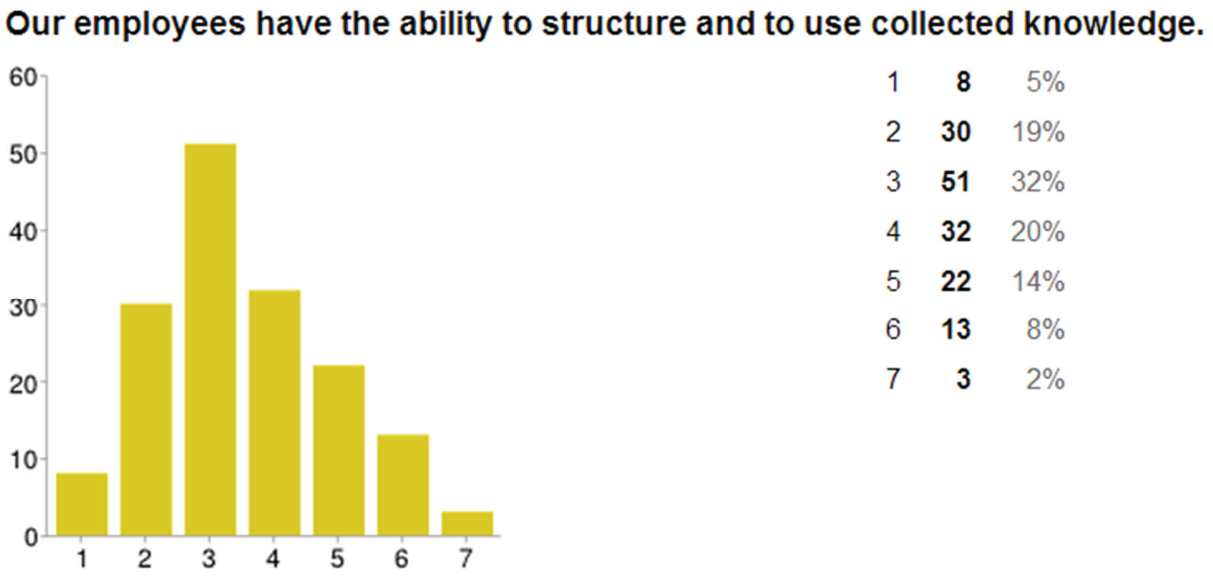


Figure 28 *Our employees have the ability to structure and use collected knowledge.*

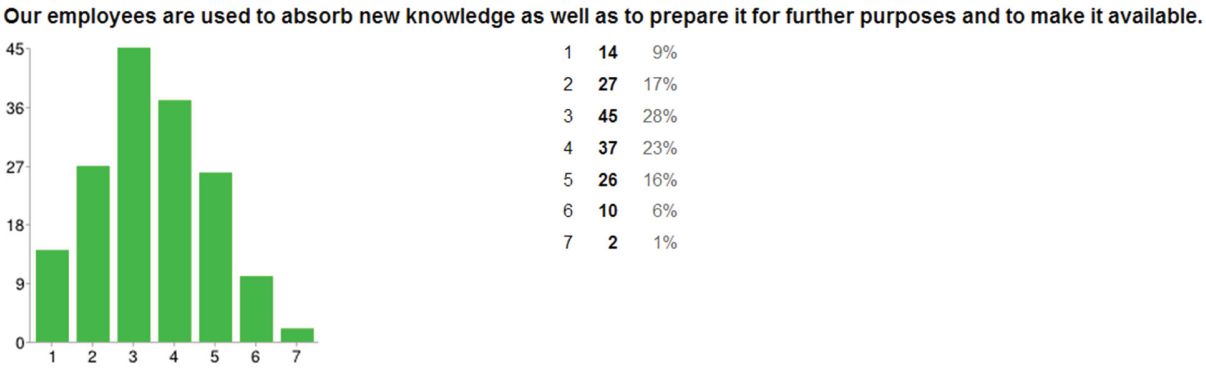


Figure 29 *Our employees are used to absorbing new knowledge as well as to preparing it for further purposes and making it available.*

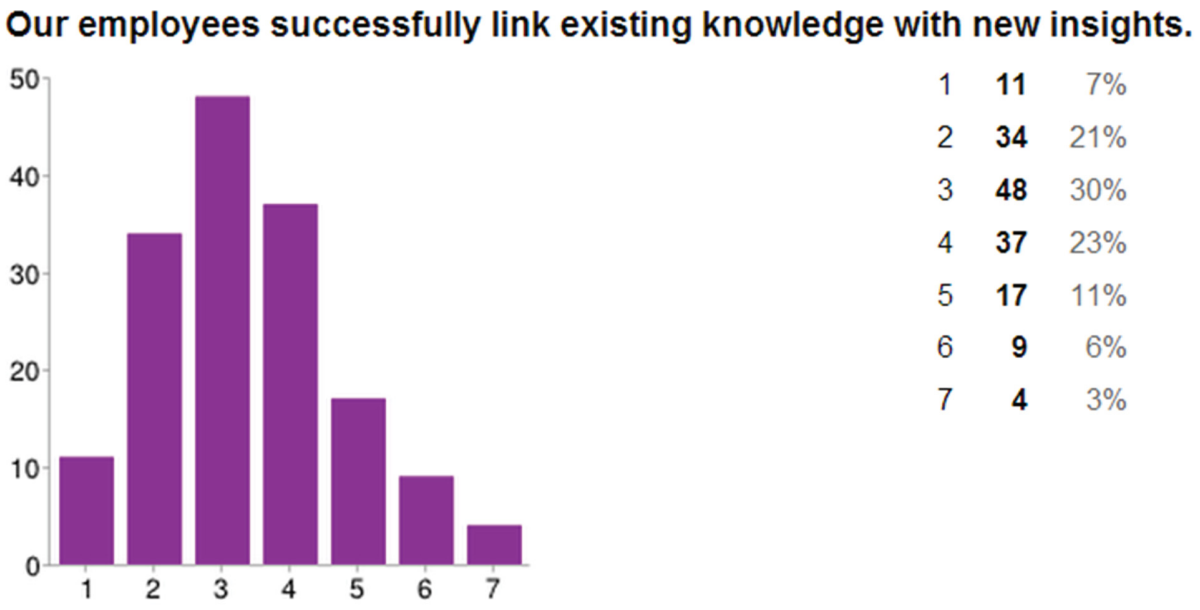


Figure 30 *Our employees successfully link existing knowledge with new insights.*

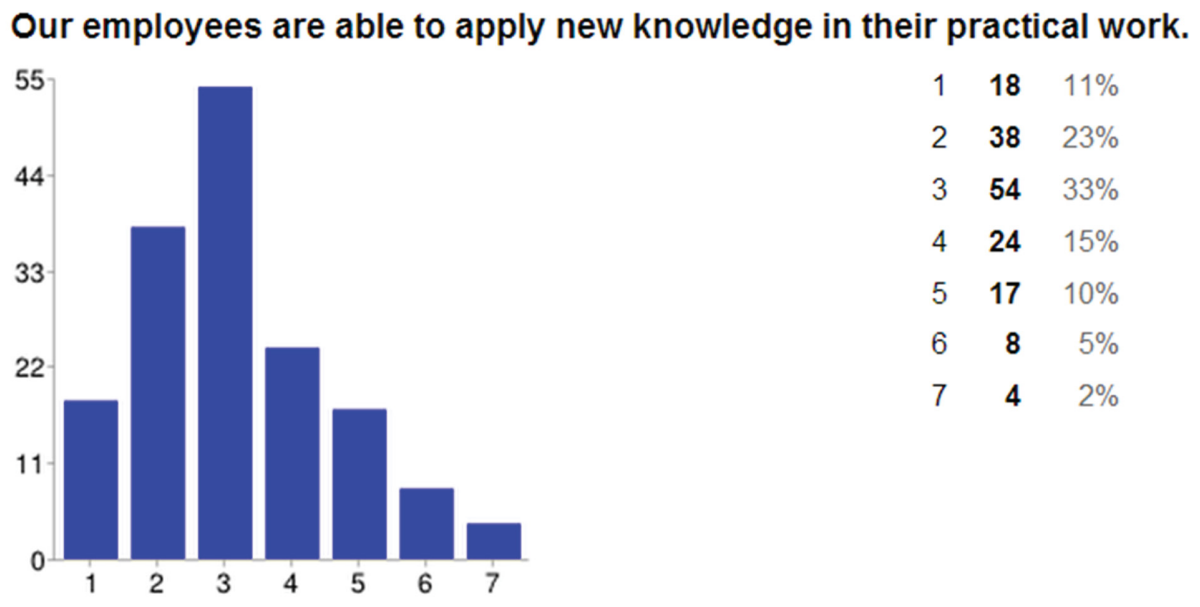


Figure 31 *Our employees are able to apply new knowledge in their practical work.*

F.7. Please specify to what extent the following statements fit the commercial exploitation of new knowledge in your company

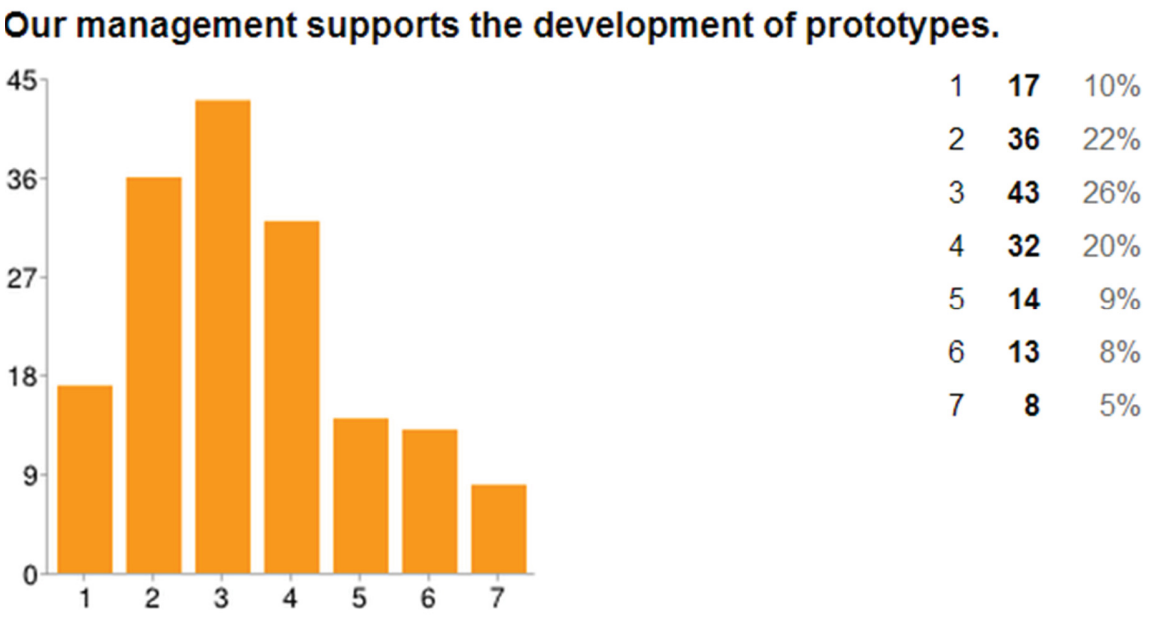


Figure 32 *Our management support the development of prototypes.*

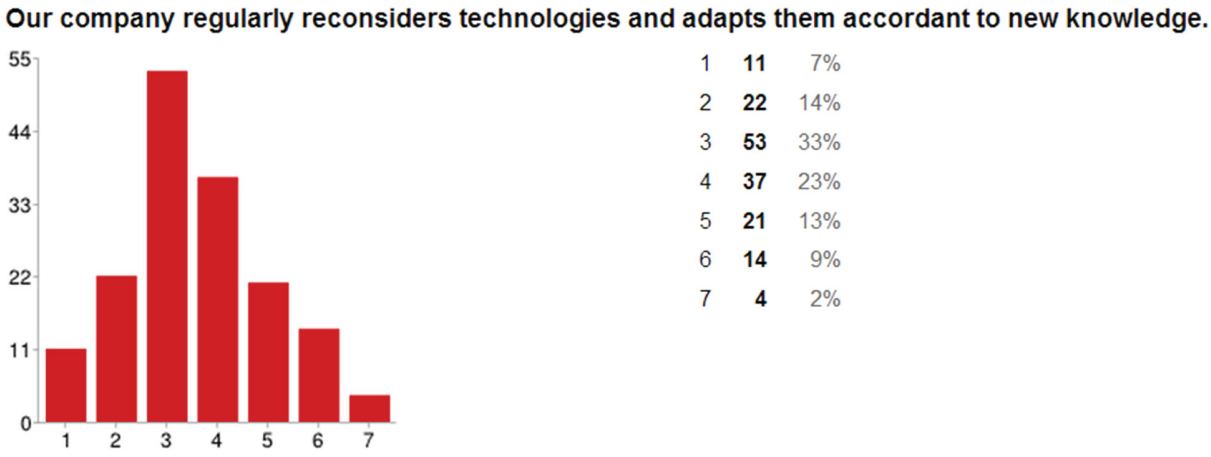


Figure 33 *Our company regularly reconsiders technologies and adapts them according to new knowledge.*

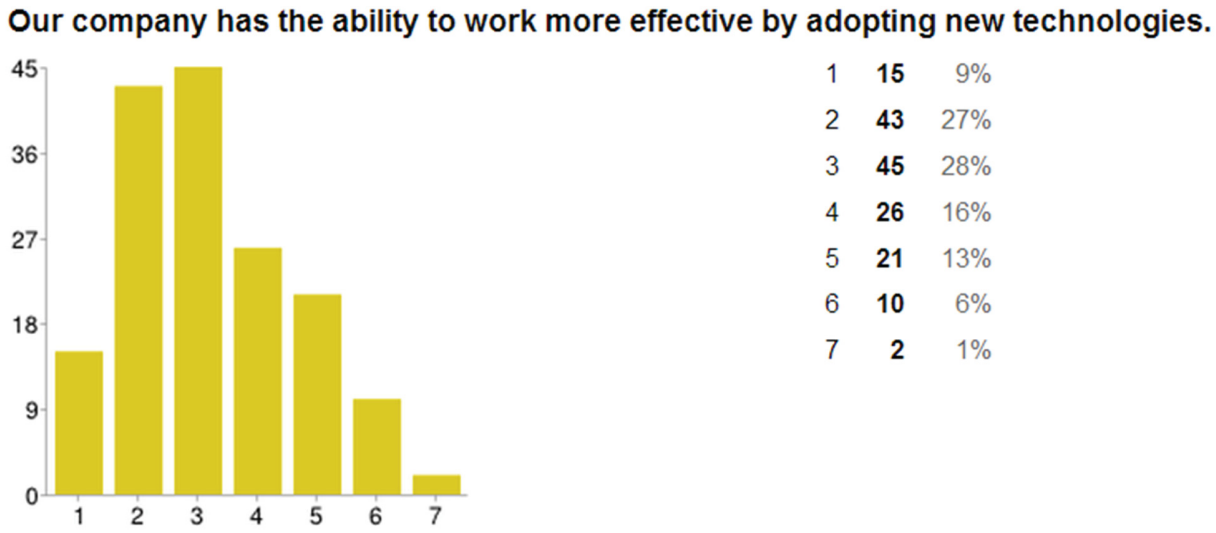
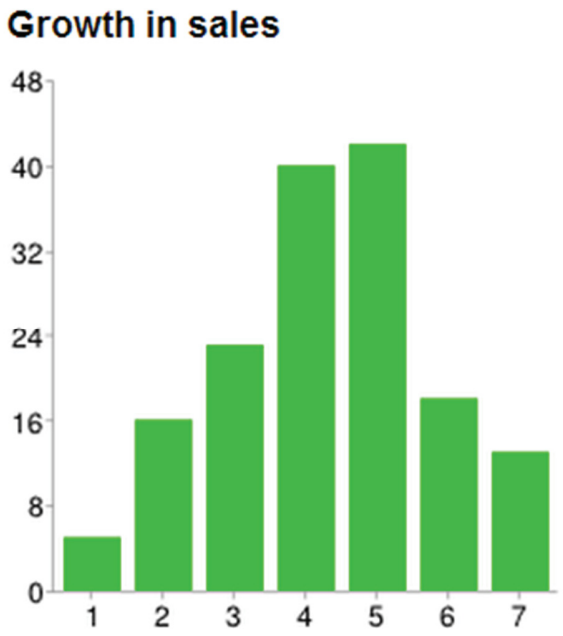


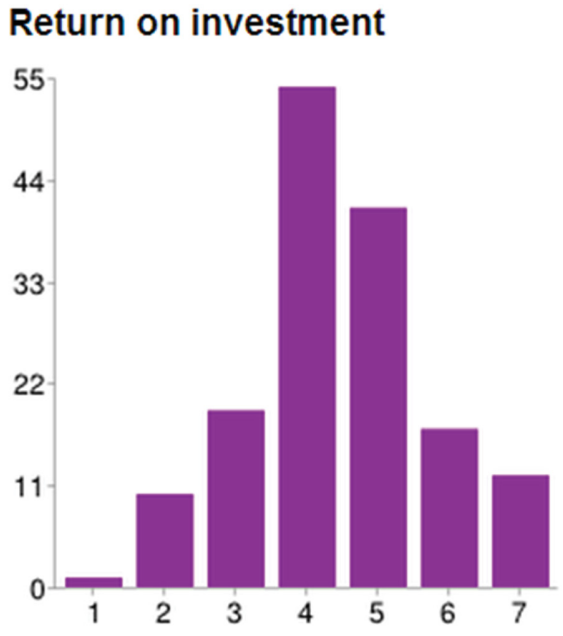
Figure 34 *Our company has the ability to work more effectively by adopting new technologies.*

F.8. Firm performance



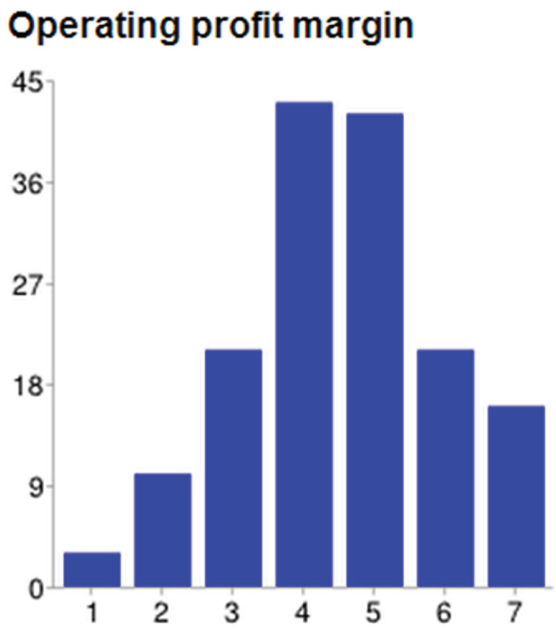
1	**5**	3%
2	**16**	10%
3	**23**	15%
4	**40**	25%
5	**42**	27%
6	**18**	11%
7	**13**	8%

Figure 35 *Growth in sales*



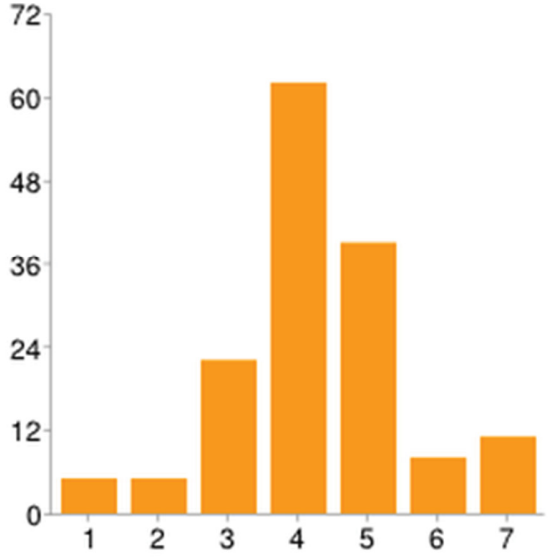
1	**1**	1%
2	**10**	6%
3	**19**	12%
4	**54**	35%
5	**41**	27%
6	**17**	11%
7	**12**	8%

Figure 36 *Return on investment*



1	**3**	2%
2	**10**	6%
3	**21**	13%
4	**43**	28%
5	**42**	27%
6	**21**	13%
7	**16**	10%

Figure 37 *Operating profit margin*



1	**5**	3%
2	**5**	3%
3	**22**	14%
4	**62**	41%
5	**39**	26%
6	**8**	5%
7	**11**	7%

Figure 38 *Return on equity*

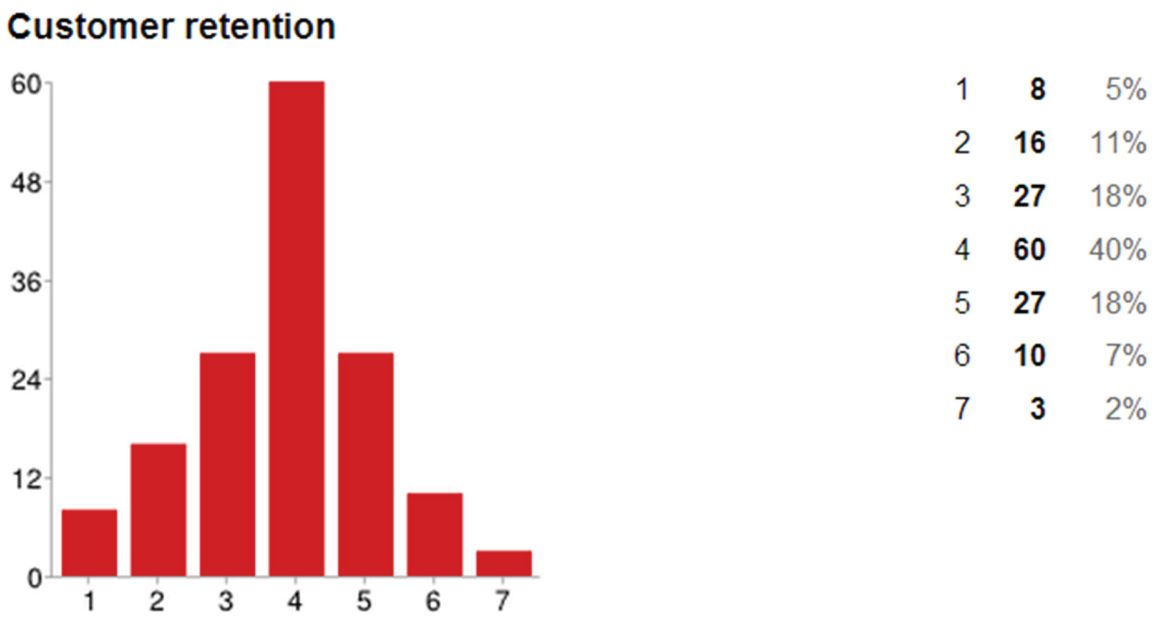


Figure 39 *Customer retention*

Appendix G: Interview questions

G.1. Swedish version (Original)

Patents

1. Hur jobbar er organsation med patent när det kommer till utveckling utav nya innovationer?
2. Vad anser du är det bästa sättet att utnyttja ett patent?
3. Licenserar ni era produkter eller teknik till andra företag?
4. Tror du att själva patent-processen fördröjer eran time-to-market när det gäller nya innovationer?
5. Har er organisation en process för att besluta ifall man skall göra en patentansökan eller ej för nya innovationer?

Secrecy

6. Hur hanterar ni sekretess utav information relaterade till utveckling av nya produkter?
7. Använder ni er utav olika säkerhetsnivåer för att få tillgång till en viss typ utav information?

Lead time

8. Finns 'lead time' med som en del i era strategier för produktutveckling, alltså när ni ska lansera nya produkter eller implementera nya processer?
9. Hur viktigt anser du att det är att erat företag är först på marknaden med nya produkter?

Complementary assets

10. Hur viktigt anser du att funktioner som säljstöd, tillverkning, marknadsföring är för att lyckas lansera era nya produkter?

Patents, Secrecy, Lead time, Complementary Assets

11. Vilken utav följade metoder tycker du är viktigtast när det kommer till att skapa eller fånga värde ifrån innovationer:
    - Patent för att få royalty-inkomster och skydd mot kopiering
    - Hålla information hemlig
    - Veta när en produkt skall lanseras eller när en process skall implementeras
    - Specialfunktioner som säljstöd, tillverkning, marknadsföring.

Inhämtning av kunskap eller erfarenheter

12. Vilka är de viktigaste sätten att hämta in nya eller fördjupade kunskaper?
    - Från den egna affärsenheten
    - Från andra bolag inom Volvo
    - Från andra företag i samma bransch
    - Från andra företag i andra branscher
    - Från skolor och forskningsinstitut
    - Från kunder
    - Från leverantörer
    - Från konkurrenter

13. Hur sprider ni kunskap inom företaget?

Open innovation

14. Deltar ni i några “Open innovation communities”?
15. Delar ni med er av kunskap i några “Open innovation communities”?
16. Hur utnyttjar ni kunskap som inte passar inom den egna affärsmodellen?
17. Hur påverkar detta er förmåga att utveckla nya produkter?
    - Leadtime?
    - Nya produkter?
    - Vinstmarginal?

G.2. English version

Patents

1. How does your organisation work with patents when it comes to the development of innovations?
2. What do you think is the best way to utilise a patent?
3. Do you license your products or technology to other companies?
4. Do you believe that the patent application process delays your time to market when it comes to innovations?
5. Does your organisation have a process to decide if a patent application should be created or not for innovations?

Secrecy

6. How do you handle the secrecy of information related to the development of new products?

7. Do you use different security levels to access different types of information?

Lead time

8. Is lead time a part of your strategy for product development i.e. when you release new products or implement new processes?
9. How important do you believe it is for your company to be the first on the market with new products?

Complementary assets

10. How important do think functions such as sales support, manufacturing and marketing are for successfully releasing your new products?

Patents, Secrecy, Lead time, Complementary Assets

11. Which of the following methods do you believe is most important when it comes to creating or capturing value from innovations:
    - Patents to gain royalty income and protect against imitation
    - Keeping information secret
    - Knowing when to release a product or when to implement a process
    - Complementary assets such as sales support, manufacturing and marketing

Gathering of knowledge or experiences

12. Which are the most important ways to gather new or deeper knowledge?
    - From our own SBU
    - From other companies within Volvo
    - From other companies within the same industry
    - From other companies in other industries
    - From universities and research institutes
    - From customers
    - From suppliers
    - From competitors

13. How do you spread knowledge within the company?

Open innovation

14. Do you take part in any open innovation communities?
15. Do you share your knowledge in any open innovation communities?

16. How do you utilise knowledge that does not fit into your business model?
17. How does this affect your performance to develop new products?
    - Lead time?
    - New products?
    - Profit margins?

Appendix H: List of interview respondents

Respondent	Type of role	SBU	Date
Respondent 1	Line manager	VBC	2014-04-23
Respondent 2	Line manager	VBC	2014-04-23
Respondent 3	Line manager	VGT	2014-04-25
Respondent 4	Line manager	VGT	2014-04-30

Table 13 *Interview Respondents*

Appendix I: Measures - ACAP, firm performance and strategic alliances

Acquisition	
Please specify to what extent your company uses external resources to obtain information (e.g., personal networks, consultants, seminars, internet, database, professional journals, academic publications, market research, regulations, and laws concerning environment/technique/health/security):	
Acquire 1	The search for relevant information concerning our industry is every-day business in our company.
Acquire 2	Our management motivates the employees to use information sources within our industry.
Acquire 3	Our management expects that the employees deal with information beyond our industry.
Assimilation	
Please rate to what extent the following statements fit the communication structure in your company:	
Assimilate 1	In our company ideas and concepts are communicated cross-departmental.
Assimilate 2	Our management emphasizes cross-departmental support to solve problems.
Assimilate 3	In our company there is a quick information flow, e.g., if a business unit obtains important information it communicates this information promptly to all other business units or departments.
Assimilate 4	Our management demands periodical cross-departmental meetings to interchange new developments, problems, and achievements.
Transformation	
Please specify to what extent the following statements fit the knowledge processing in your company:	
Transform 1	Our employees have the ability to structure and to use collected knowledge.
Transform 2	Our employees are used to absorb new knowledge as well as to prepare it for further purposes and to make it available.
Transform 3	Our employees successfully link existing knowledge with new insights.
Transform 4	Our employees are able to apply new knowledge in their practical work.
Exploitation	
Please specify to what extent the following statements fit the commercial exploitation of new knowledge in your company (Please think about all company divisions such as R&D, production, marketing, and accounting):	
Exploit 1	Our management supports the development of prototypes.
Exploit 2	Our company regularly reconsiders technologies and adapts them accordant to new knowledge.
Exploit 3	Our company has the ability to work more effective by adopting new technologies.

Figure 40 *ACAP Scale* (Flatten *et al.*, 2011a)

Items with 7-point Likert scale	
Firm performance	
How satisfied are you with the last years key data compared to your most important competitor:	
FP 1	Growth in sales
FP 2	Return on investment
FP 3	Operating profit margin
FP 4	Return on equity
FP 5	Customer retention
Success of strategic alliances	
Please specify to what extent your strategic alliances match the following statements:	
SA 1	Overall, our program of using alliances for new product development has been a success.
SA 2	Most of our alliances for innovation development have met our objectives.
SA 3	Company sales and profits have benefited from using alliances for new product development.
SA 4	Our alliance development efforts have been more successful than competitors.
SA 5	Innovations developed by alliances have achieved good market penetration.

Figure 41 *Indicators of Firm Performance and success of strategic alliances* (Flatten *et al.*, 2011a)