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SaaS adoption in Swedish manufacturing markets

Master's Thesis in
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TABLE OF CONTENTS

FIGURES

TABLES

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ABSTRACT:

The purpose of this research is to understand factors that affect to cloud computing adoption and deployment in Swedish manufacturing markets. Cloud computing is a method to provide IT services through the Internet. The research is done by studying largest manufacturing companies in Sweden that have over 300 m. € revenue.

A semi-structured survey was sent to 186 top managers in SCM related positions by web survey and telephone calls. The questions are focusing on success factors in cloud computing adoption and deployment. This thesis used mixed research design. The core of this mixed research is quantitative research. Mean, standard deviation and confidence intervals were calculated. The core was supplemented with qualitative analysis. Themes that arose from open questions were categorized and summed and mixed with quantitative research.

Total 6 valid responses were gathered. Even as the results are not generalizable due small sample size, indications can be made. For the core part, statistically the most significant findings were trust between the cloud provider and client organization and client communicating cloud benefits to employees have both positive affect on cloud deployment. Qualitative analysis revealed that sharing and communication, flexibility, reduced costs, convenience, improved performance, references, client need comprehension and big data usages were themes that benefit cloud computing adoption and deployment. The findings are useful for the managers who are working in SaaS related companies and are aiming to offer SaaS services to the manufacturing industry.

KEYWORDS: XaaS, Supply Chain Collaboration, success factors in cloud computing

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TIIVISTELMÄ:

Tämän tutkielman tavoitteena on ymmärtää niitä tekijöitä jotka vaikuttavat Ruotsin valmistavan teollisuuden haluun hankkia ja ottaa käyttöön pilvipalveluita. Pilvilaskenta on tapa, jolla IT palveluita tuotetaan Internetin välityksellä. Tässä tutkielmassa tutkittiin isoimpia valmistavan teollisuuden yrityksiä Ruotsissa joiden liikevaihto ylittää 300 m. euroa.

Puolistrukturoitu kysely lähetettiin 186 SCM tehtäviin liittyville johtajille. Haastattelut toteutettiin verkkolomakkeella ja puheluhaastatteluilla. Kysymykset keskittyvät menestystekijöihin pilvipalveluiden hankinnassa ja käyttöönotossa. Sekoitettua tutkimussuunnitelmaa käytettiin tässä tutkielmassa. Sen ytimenä toimii kvantitatiivinen tutkimus, jolla selvitettiin vastausten keskiarvoja, keskihajontaa sekä luottamusväliä. Ydintutkimusta tuki kvalitatiivinen analyysi. Teemat jotka nousivat johtajien avoimista vastauksista laskettiin yhteen ja yhdistetiin kvantitatiiviseen tutkimukseen.

Hyväksyttäviä vastauksia kerättiin 6 kappaletta. Vaikka tulokset eivät ole yleistettävissä isompaan populaatioon johtuen pienestä otoskoosta, siitä voidaan tehdä johtopäätöksiä. Aineiston tilastollisesti merkittävimmät löydöt olivat, että pilvipalvelun tarjoajan ja asiakkaan välinen luottamuksella sekä pilvipalveluiden hyötyjen esittämisellä työntekijöille on molemmilla positiivinen vaikutus pilvipalveluiden käyttöönottoon. Kvalitatiivisessa analyysissa jakaminen ja kommunikaatio, joustavuus, pienentyneet kustannukset, helppokäyttöisyys, kohentunut tehokkuus, referenssit, asiakastarpeiden ymmärrys sekä Big datan käyttö olivat teemoja, jotka vaikuttavat positiivisesti tekijöihin joilla hankitaan ja otetaan käyttöön pilvipalveluita. Tulokset ovat hyödyllisiä johtajille ja yrityksille jotka toimivat pilviyrityksissä ja tarjoavat SaaS-palveluita valmistavalle teollisuudelle.

KEYWORDS: XaaS, Toimitusketjun yhteistoiminta, menestystekijät pilvilaskennassa

COMMON TERMS

Big Data: Term for datasets that are huge and complex

Business Intelligence: Business information management that provides systematic way for companies to acquire, save and analyse data

Cloud computing: IT service that is provided through internet

ECM: Enterprise content management

IaaS: Infrastructure as a Service

PaaS: Platform as a Service

SaaS: Software as a Service

SCM: Supply chain management

SCC: Supply Chain Collaboration

Virtual machine: Virtualized computing resources such as processors, storage and memory

VMS: Vendor Management System.

XaaS: Everything as a Service, refers to IaaS, PaaS and SaaS as a upper category

1 INTRODUCTION

Cloud computing technology has been one of the hottest topics during the 2010s. Its ability to scale its computing power depending on the usage has enabled new business areas and given smaller companies access to such technology that had been previously beyond their reach. Per IT research company Gartner, cloud computing has gained top positions in their top 10 strategic technology list from 2009 to 2015 (Gartner 2009-2016). In 2010 and 2011 cloud computing was the most promising strategic technology (Figure 1).

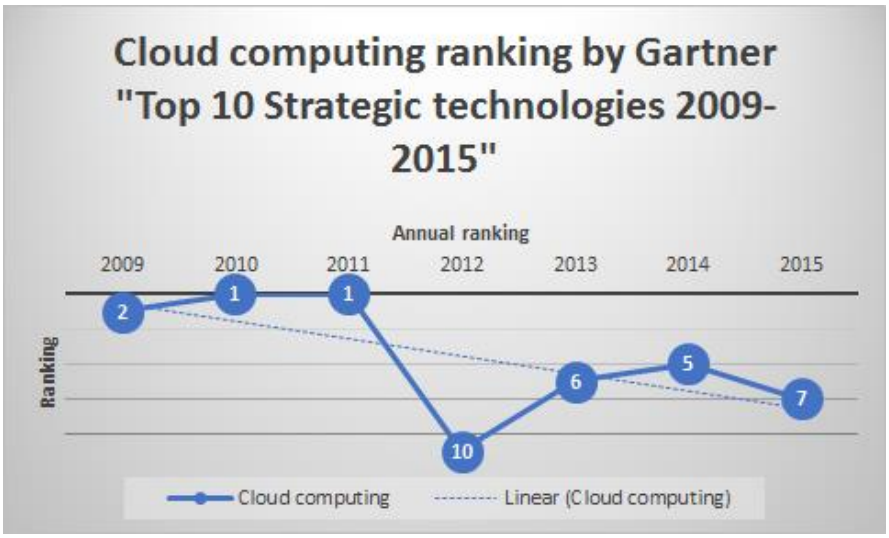


Figure 1: Top 10 Strategic technology rankings 2009-2016 (Gartner)

1.1 Background and objective of the study

The aim of this study is to get more insight in Swedish markets and understand the needs and challenges that companies are facing related to SaaS computing and supply chain collaboration. Supply chain collaboration company Alpha (company name here anonymized) proposed to make cloud market research in Swedish manufacturing markets.

1.2 Research problem and research questions of the study

There have been previous studies in cloud adoption and deployment for example in Portugal (Oliveira, Thomas, & Espadanal 2014), United Kingdom (Alshamaila, Papagiannidis. & Li 2013), US (Wu, Cegielski, Hazen & Hall 2013), Taiwan (Low, Chen, & Wu 2011). Similar research papers lack in Sweden but for an example Statistics Sweden has conducted a statistical survey in 2016 on how Swedish companies perceive cloud computing. The survey conducted by Statistic Sweden didn't go very deep so I decided to formulate research questions based on prior research to get more insight about adoption and deployment of Swedish cloud computing markets. Broader review on Statistics Sweden findings has been presented in chapter 3.

The research questions are:

1. What **factors** affect to **cloud computing adoption** in Swedish manufacturing **companies**, and what **plans** these companies have for the future related to cloud computing **services**?
2. Which are the **success factors** when deploying cloud computing in Swedish manufacturing companies?

The first research question aims to discover which elements affect to intention to adopt cloud services now and in the future. These elements are called as factors, which are studied in both research question 1 and 2. Their intention is to determine if given input has a positive or negative effect on cloud computing adoption in research question 1 or on successful cloud deployment in research question 2. It is also noteworthy to mention that in both research question 1 and 2 the perspective is on the client side. Cloud computing adoption is perceived as the *intention* to acquire cloud computing technology or services. By understanding what factors are motivating or demotivating to acquire cloud computing technology or services, cloud computing provider could focus their resources developing their cloud computing services or giving the idea where to focus when selling these services.

The viewpoint is also vital. In this thesis, unlike one could think, IT managers are not interviewed. Instead, the aim is to understand research questions from SCM point of view. This is done by asking the questions from managers who are working with supply chains, logistics, procurement, business development and so on. In chapter 3 is shown that cloud computing has become common in Sweden. It's also interesting to get feedback from the actual users. IT managers acquire and run cloud related services but in this case, SCM related managers are the users.

1.3 Research strategy

To find answers to these research questions, there should be a research strategy. There are three types of traditional research strategies. Experimental research studies how one factor affects to another factor. Survey research is a structured research where information is gathered from a certain group of people. A case study is a specific research on one or small groups that studies relationship with each other. (Hirsjärvi, Remes, & Sajavaara 2012:134). Out of these three research strategies, survey research would help most to find answers to research questions, as the managers have the knowledge from their experience which helps to understand the current situation in SaaS markets in Sweden. Survey as a study compared to the case study is also more viable as even though this research has business motivation behind, the research results can be used in other circumstances. The results from the survey are useful for companies that are providing cloud services to companies, especially through SaaS cloud delivery model.

The research strategy will be conducted by as follow: first, the hypotheses are being constructed based on previous studies in cloud deployment and adoption. Then, LinkedIn and company websites are used as tools to gather the names of the informants. Then these informants are contacted with email and if possible in some cases also with cold calls to ensure necessary answering rates. When enough responses have been gathered, an analysis will be

conducted based on the results in chapter 5. In the fifth chapter, both quantitative and qualitative research is conducted, depending on if the questions are in closed or open form. In quantitative analysis, mean, standard deviation and confidence interval will be calculated. In open questions, presentation of answers and comparing those to the previous studies will be done. In the last chapter, findings are presented and comparison to previous studies is done.

1.4 Research limitations

This research is limited in Swedish markets and more precisely, on SaaS services in Procurement, SCM, Logistics and Business Development department in manufacturing companies. This study focuses on success factors in cloud adoption and deployment. As the questions are pointed to SCM related managers, there's also one SCC SaaS question.

The research is limited to companies that have more than 300 M€ turnovers. There are four factors for that. The first one is that studies show that large companies have more resources and capable of taking more risks regarding innovation adaption compared to SMEs (Zhu, K, K L. Kraemer, and Sean Xu. et al. 2006: 1557). The second reason is that larger companies have more complex and bigger business units which need cross knowledge in IT and SC processes compared to smaller companies. The third is the Alpha business model supports an approach where large client base is acquired by contacting and acquiring large sized clients as they tend to have lots of subcontractors. Subcontractors can join Alpha and then they can share information easily with their key clients. Last reason is to keep this Master's Thesis manageable by reducing the number of contacts reasonable.

1.5 The structure of thesis

In chapter 2 most common and universal concepts of cloud computing and supply chain collaboration are discussed. Literature review focuses on cloud computing success factors as this will give good theory background compared to the field which the managers are facing. The third chapter discusses Swedish cloud and manufacturing markets, cloud use globally and case company Alpha. The fourth chapter defines the research methods and constructs of the hypotheses. In the fifth chapter the results are discussed. The sixth chapter concludes this thesis with discussion and conclusion.

2 PREVIOUS STUDIES IN CLOUD COMPUTING AND SUPPLY CHAIN COLLABORATION

In this chapter, the most common phenomena's around cloud computing are discussed. Supply chain management and collaboration are also briefly discussed as they link to the research questions. This helps to understand research area and the motives. Sources are mostly from articles in Information management and Supply Chain collaboration. TOE framework and previous studies in Swedish cloud computing markets are also discussed.

2.1 Cloud computing and Supply Chain collaboration

U.S. based National Institute of Standards and Technology (NIST 2011) names five categories that define cloud computing. These are

- On-demand self-service
- Broad network access
- Resource pooling
- Rapid elasticity
- Measured service.

On-demand self-service gives the client opportunity to acquire and use cloud-based technologies on demand without requiring human interaction with the service providers. Broad network access refers to cloud computing characteristic that the services are available over the internet which can be accessed by different devices such as laptops, workstations, mobile phones, tablets etc. Resource pooling is gathering enough resources and distributing those to

the clients based on their usage. Usually, the client doesn't know how much one is using cloud services from the total service provider capacity. The client also doesn't know where the data is located physically. Rapid elasticity is the technological capability which provision and release resources based on their use. To the client's side, it seems that the service provider has an unlimited amount of resources. The last characteristic defined by NIST is that measured services which informs to both client and cloud service provider how much resources are currently used. (NIST 2011)

Armbrust, Fox, Griffith, Joseph, Katz, Konwinski, Lee, Patterson, Rabkin, Stoica, Zaharia, (2010) defined three aspects that are new in cloud computing compared to previous IT technologies. 'Infinitive' appearance of cloud computing which refers to a utility that cloud computing has 'unlimited' computing power. This is extremely useful in situations where there are demand spikes for cloud services. Cloud computing services can scale up with demand which removes the need for over-provisioning computing capacity. Amazon EC2, Google Cloud Platform or Microsoft Azure are cloud computing services that exploit this type of technology.

The second aspect that Armbrust et al. (2010) defined was the elimination of costly computing services. Computing services that were previously available only for big companies have now come accessible also to SME companies because SMEs can start with a low budget and increase computing capacity as their computing capacity need becomes larger. The last aspect was the ability to pay for short periods. Previously computing services like servers and software were leased or bought, but depending on cloud services, the billing might be charged monthly, daily, hourly or even in seconds. This is a great utility for companies because they can buy computing power for only short periods of time.

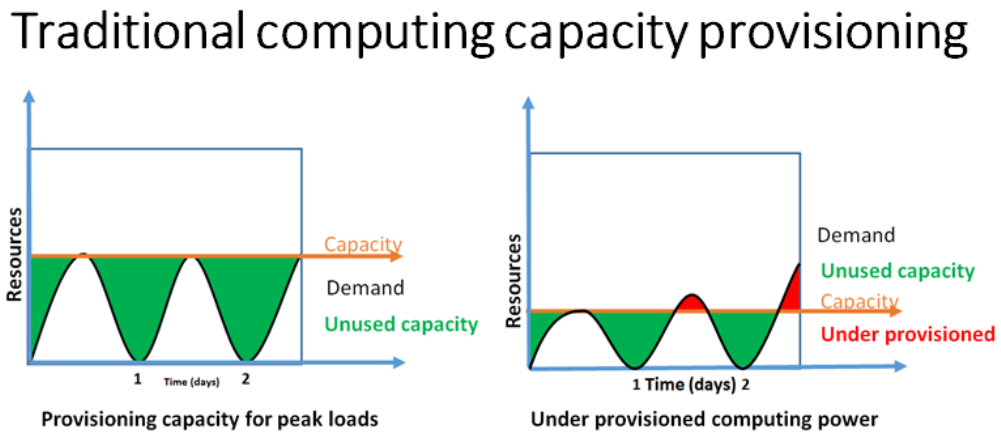


Figure 2: Traditional computing capacity provisioning (Armbrust et al 2009)

To further stress the benefits of cloud computing Armbrust et al. (2009:10) illustrated this in Figure 2 with two simple drawings that show how traditional computing capacity provisioning has either unused or under provisioned computing capacity. As one can see below in Figure 3, when cloud services work efficiently, they don't under or overprovision computing resources. Instead, they scale up and down based on the usage and runs at exact capacity.

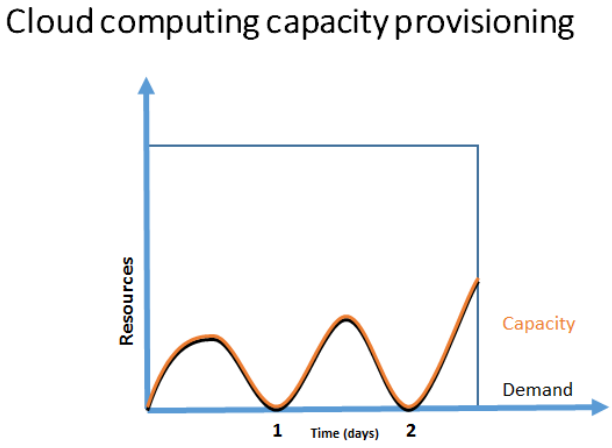


Figure 3: Cloud computing provisions capacity based on usage

2.1.1 Cloud computing architecture

The cloud computing architecture is divided into four different layers: application layer, platform layer, infrastructure layer, and hardware layer. These layers were defined by Zhang, Cheng & Boutaba (2010). The *hardware layer* handles the physical resources such as processors, memory and storage. To gain IT economies of scale, the physical resources are usually located in data centres. The infrastructure layer, which is also known as the virtualization layer, makes certain pools out of hardware layer. The virtualization refers to the ability to make certain partitions out of hardware layer based on the client's computations needs. One could say that the hardware layer is the core of the four layers as it enables what makes cloud successful. The third layer is the *platform layer* which allocates the resources which are operating at the infrastructure layer. For example, in the Google cloud platform, one can use their *containers* (Google 2017). This removes the need from the user to deploy and integrate needed web services to run the application. The fourth and the last layer is the *application layer.* Application layer runs the actual cloud applications. The distinct feature compared to traditional layers is that the cloud application can scale based on usage (Figure 4).

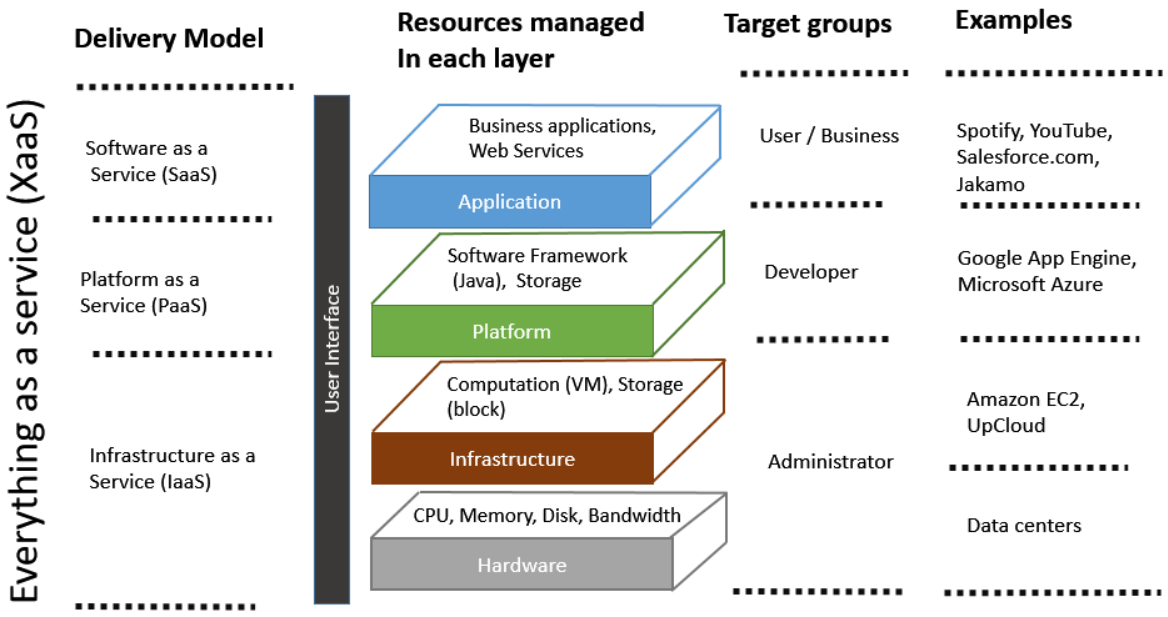


Figure 4: Combining cloud layers and XaaS model (Zhang et al 2011 and Pallis 2010)

2.1.2 Cloud business models

Cloud services are categorized in different ways. In numerous publications cloud computing service models are divided into 3 distinct categories: Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Service as a Service (SaaS) (Armbrust et al 2010, Garrison, Kim & Wakefield 2012). These business models are based on layers which were presented previously in cloud computing architecture. Pallis, G presented that Everything as a Service (XaaS) can be used as the upper concept to understand that everything as a service refers to combined layers of Software-as-a-Service (SaaS), Platform-as-a-Service (PaaS) and Infrastructure-as-a-Service (IaaS). (Pallis 2010).

In the IaaS vs. PaaS vs. SaaS- YouTube-video, the ownership of cloud delivery was simply presented (Figure 5). In the packaged software, which the vendor provides, the client has access from networking to up to applications. The ownership moves towards vendor when going to cloud services. In the IaaS model cloud vendor takes control over from Networking,

Storage, Servers and virtualization. In the PaaS business model, cloud vendor provides operating systems, middleware and runtime. In the SaaS model vendor controls, also the data and applications. (IntegrantSoftware 2013)

Cloud can be delivered in three different types public, private and hybrid clouds. Public cloud refers to cloud offered to general public. Private cloud is usually enterprise focused that is provided in a closed environment. Hybrid cloud is something between these two. Hybrid cloud can use the computing performance from the public cloud while still working under private cloud. Armbrust, et al 2010).

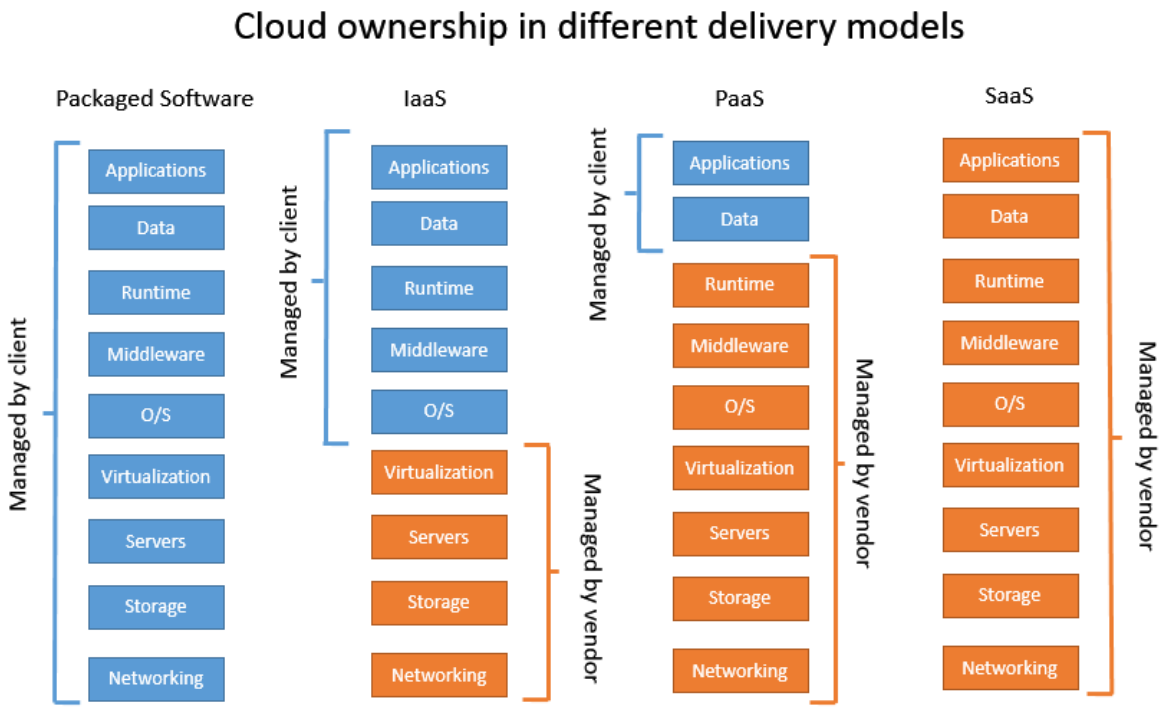


Figure 5: Cloud ownership in different delivery models (IntegrantSoftware 2013)

2.2 Critical success factors for adopting and deploying cloud computing

To understand what factors, affect cloud computing adoption, it's important to understand the environment where the companies are. There are positive and negative factors that affect cloud computing adoption. Previous research in the field of critical success factors for deploying cloud computing is crucial for this study as it gives answers from the cloud computing providers perspective to questions where to focus when contacting new possible clients.

Oliveira et al (2014:506) conducted a research where they compared cloud adoption in both service and manufacturing sectors in Portugal. They found that relative advantage, complexity, technological readiness, top management support and firm size affect positively on cloud computing adoption. Per their study, relative advantage consists both on economic and environmental responsibility benefits. Economic benefits are lowered capital investments (this notion is supported by Armbrust et al. 2009 study), lower negotiation costs and reduced maintenance and energy costs. Environmental responsibility refers to the fact that cloud computing uses energy as much as it is needed. Otherwise, the firm would buy or lease data and thus use only fraction of available capacity, which would lead to excessive provisioning computing capacity for peak loads.

In another article, Garrison et al. (2012) decided to find success factors for deploying cloud computing. They represented three hypotheses and tested these by conducting research on different industries. The first hypothesis was that trust leads to successful cloud computing. They also stressed that company must have technological readiness and top management support to implement successfully cloud computing.

Trust is a common concept in the literature; both cloud computing and supply chain collaboration literature that defines success between the cloud provider and client. It also boosts performance in the supply chain. (Garrison et al. 2012) explained that trust is one of the key elements when determining if the company will be successful when deploying cloud. They

defined trust as a relational capability which refers to positive association between IT manager and cloud provider. To build positive association the cloud provider should know how their cloud services can benefit the client company. It's also necessary that the cloud provider is motivated to successfully deliver cloud service for the client. Client organization needs to trust that the cloud provider can boost client's IT resources. Trust can be build up during the contract negotiations and boosted through communication, procurement and transactional activities.

Johnston, McCutcheon, Stuart, and Kenwood, H. (2004) conducted a research to find factors that boost trust between client and the supplier. The most explaining reason for better performance was the development of flexible arrangements which is each party's willingness to make changes when unanticipated situations happen. Development of flexible arrangements means also that both parties are sharing their strategic plans and scheduling information. They also found that supplier performance was a key factor for client satisfaction and degree of flexibility doesn't improve client - supplier performance but it helps to improve client satisfaction.

2.3 Supply Chain Collaboration

Here's supply chain management briefly discussed and then moved to supply chain collaboration (SCC). The emphasis is on SCC as cloud computing can be used as a tool operate supply chain collaboration.

2.3.1 Supply chain management

Supply chain management is a chain that links each member of the manufacturing and supplier side, ranging raw materials all the way to the end user, going through multiple different organizations and making them work as a one big business entity. Scott and Westbrook (1991)

2.3.2 Supply chain collaboration

Supply chain collaboration is a process of decision making among interdependent parties. It involves joint ownership of decisions and collective responsibility for outcomes. Major dimensions in supply chain collaboration are commitment to work together, cross-organization and common goal. Stank, Keller & Daugherty (2001: 40) presented in their study that companies that focus both internal and external communication have the best practices. Stank et al. study suggests that external communicating is not enough. Successful companies focus on both. In the external communication, companies can gather useful information including order status, claims etc. It's vital for external collaboration that the right person's reach the right information. Internal collaboration helps to focus on the right topics. In companies' tasks are done in cross-functional teams. As they work as customer driven and information from external companies help in this.

Collaboration with external partners has positive for internal collaboration which increases logistical performance. This works also vice versa. When an organization uses external collaboration it also improves logistical performance. Collaboration with external suppliers' effects on internal collaboration because firm gets valuable information outside its company which it can use to improve it their operations. They also found that if company wants to improve collaboration with suppliers and customers, it needs to focus on how to improve their internal collaboration

They stressed that both internal and external collaboration could be used in organizations for organizational change. When organizations apply internal and external collaboration, organization start freely exchange information and improve cooperation. The results indicate that supply chain collaboration improves collaborative advantage and indeed has a bottom-line influence on firm performance, and a collaborative advantage is an intermediate variable that enables supply chain partners to achieve synergies and create superior performance. A further analysis of the moderation effect of firm size reveals that collaborative advantage completely mediates the relationship between supply chain collaboration and firm performance for small firms while it partially mediates the relationship for medium and large firms."

In the article Cao & Zhang (2011) studied SCC impact on collaborative advantage and firm performance. They found in their study that effective supply chain collaboration leads to collaborative advantage and better firm performance. To gain this situation, companies should create win-win situations where all participants could collaborate in order to achieve business synergy. This collaborative link could be used to compete with other supply chains. Mei Cao et al argued that managers in all companies should align goals and benefits with supply chain partners to create collaborative advantage. They found that supply chain collaboration has strong link with firm performance when small company is performing it whereas medium and large companies the link was smaller.

2.4 Technology-Organization-Environmental (TOE) framework

Technology-Organization-Environmental (TOE) framework is of the main frameworks that has been constantly used in cloud success related studies **(**Alshamaila, Y. et al in 2013, Oliveira, T., Thomas, et al. (2014:503), some of them build their research solely on it. TOE framework is also used as a tool to construct factors in the research question 1. For these reasons, it had to be taken into this literature review. The framework was developed by DePietro Wiarda & Fleischer (1990). Their intention was to develop a framework that would explain the intentions of companies to invest in innovations. It includes three different aspects in the enterprise context: technology, organization and environment. The technology aspect explains external and internal technologies that the company is using. It also shows the possible technologies that the companies could adopt. The organizational aspect includes the resources and characteristics the company has. These are for an example human resources, firm and managerial size, centralized or decentralized structure and the way of communicating among employees. The last aspect, environmental, explains the current situation of the company and how it is positioned against it competitors, industry, etc. All these three aspects have opportunities and threats for technology adoption.

2.5 Previous Masters' thesis studies in Swedish cloud computing markets

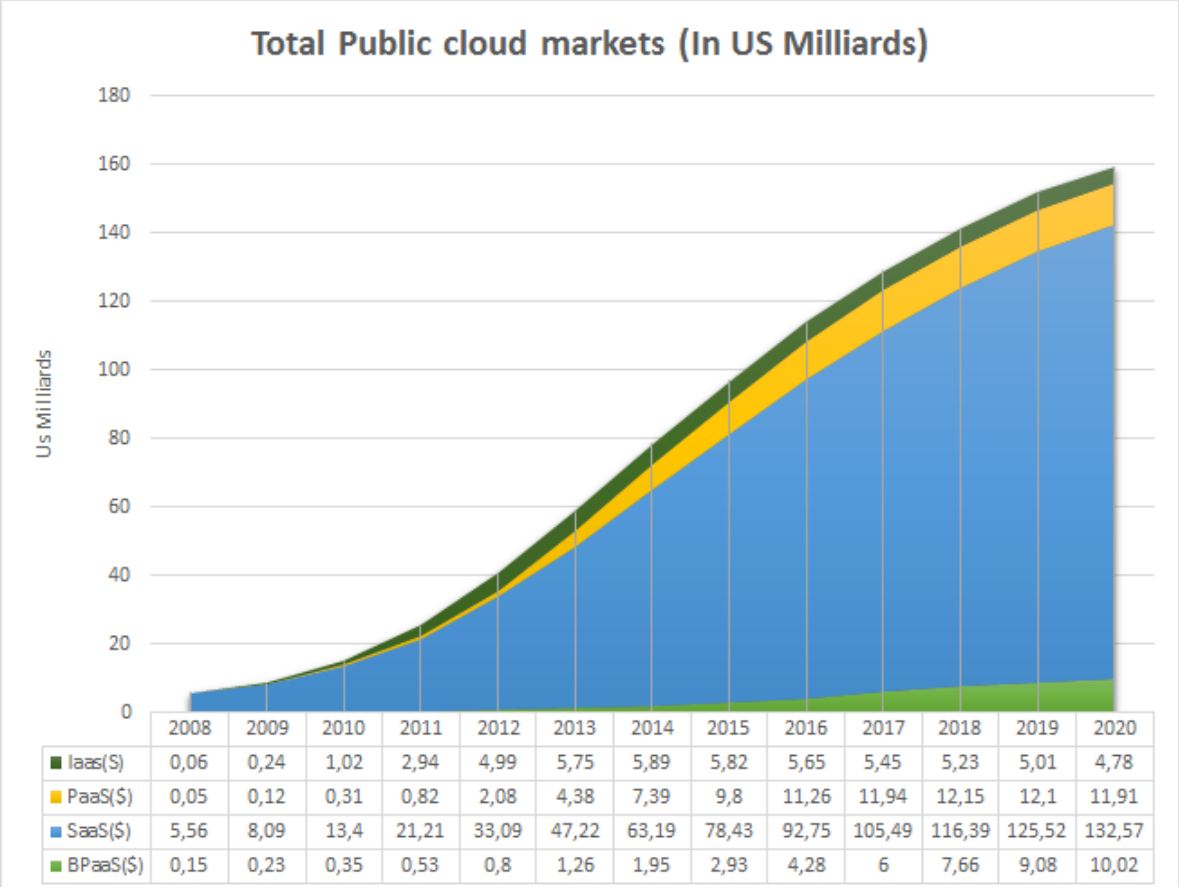
As said previously, there were no scientific articles published related to Swedish SaaS adoption markets. However, some Master's theses were found. Chapter 3.1 presents also Swedish cloud market statistics that broadens the markets.

The first one was in by Hoseini written in 2013. The focus in this thesis, as the same suggests is what factors are the advantages and disadvantages of acquiring ERP as in SaaS model. The study found 19 advantageous factors and 12 disadvantageous factors. These factors were grouped in 3 groups: financial, technical and strategic. 90 responses were collected from various businesses and firm sizes. They respondent found that they didn't confirm the disadvantages and found 5 factors that affected positively. These were that a) ERP as SaaS helps the companies to run their business globally b) mobile use will be more convenient c) reduced high capital investments of users d) saves in technology costs and e) eases the work of users in managing and maintaining ERP services. P.78. However, in the study was found that the companies were not planning to invest in ERP in SaaS model in the future.

The second Master's thesis by Lundberg and Åkesson (2015). In this thesis, the couple tried to find factors that affect cloud adoption in Swedish bank. Just like in this thesis, they used TOE framework to reveal affecting factors. In their study, they found that Integration, Lack of competence, Sensitive information, Heritage, Employee resistance, Miscommunication, Size and structure, Common heritage, Standard agreements, New actors and Regulations. When comparing the results from Lundberg and Åkesson thesis and the factors presented in this, following factors can be identified to be identical or almost identical: size and structure (Hypothesis 2), sensitive information (Hypothesis 9), lack of competence (Hypothesis 11), Employee resistance (Hypothesis 15), Miscommunicating (Hypothesis 14). All factors except new actors in thesis made by Lundberg and Åkesson were found to hindrance adopting cloud computing technologies.

3 CLOUD COMPUTING MARKETS

In this chapter, the cloud computing markets are discussed briefly in global and Swedish context. Cloud computing based business has become a huge globally. Per Forrester research, public cloud global market size had exponential growth from 2008-2014. When looking at Figure 6, each year from 2009 to 2014 had bigger increase to market size than the previous year. By the end of 2020 public cloud market has reached nearly 160 US$ milliards, when in 2008 the size was less than 6 milliards US$. That's over 27 times increase in just 13 years. (Forrester blog 2011)



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Iaas($)	0,06	0,24	1,02	2,94	4,99	5,75	5,89	5,82	5,65	5,45	5,23	5,01	4,78
PaaS($)	0,05	0,12	0,31	0,82	2,08	4,38	7,39	9,8	11,26	11,94	12,15	12,1	11,91
SaaS($)	5,56	8,09	13,4	21,21	33,09	47,22	63,19	78,43	92,75	105,49	116,39	125,52	132,57
BPaaS($)	0,15	0,23	0,35	0,53	0,8	1,26	1,95	2,93	4,28	6	7,66	9,08	10,02

Figure 6: Total Public cloud markets in US$ Milliards (Forrester Blog)

3.1 Swedish cloud markets

Based on Statistics Sweden in Figure 7, all business sectors have increased their usage of cloud resources from 40% to 50% between 2014 and 2016. In the first time in history, Statistics Sweden published in 2016 figures about cloud services. In Table 1 the most relevant information has been gathered. The data has been collected based on the firm size, industry branch and the locations of the companies. Based on the statistics, it seems that companies that are larger tend to acquire cloud services. The only exception is case "Buy accounting applications as a cloud service" where companies sized between 50 - 249 buy more these services that companies that have over 250 employees. This result confirms Zhu et al. (2006: 1557) findings that were previously mentioned.

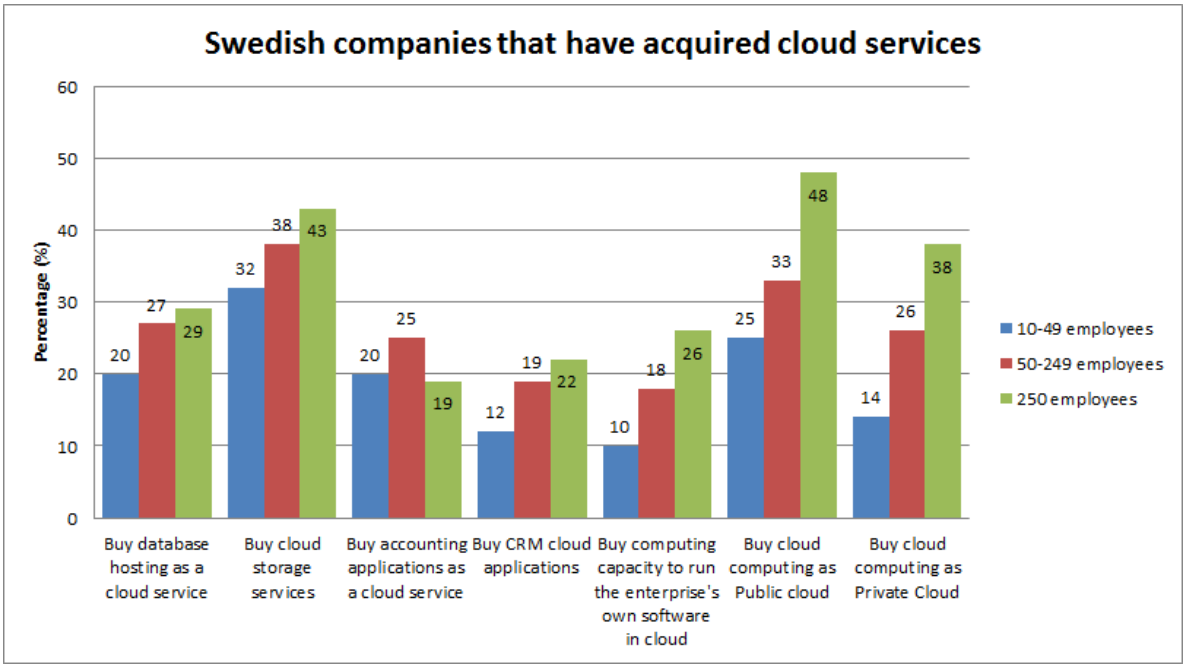
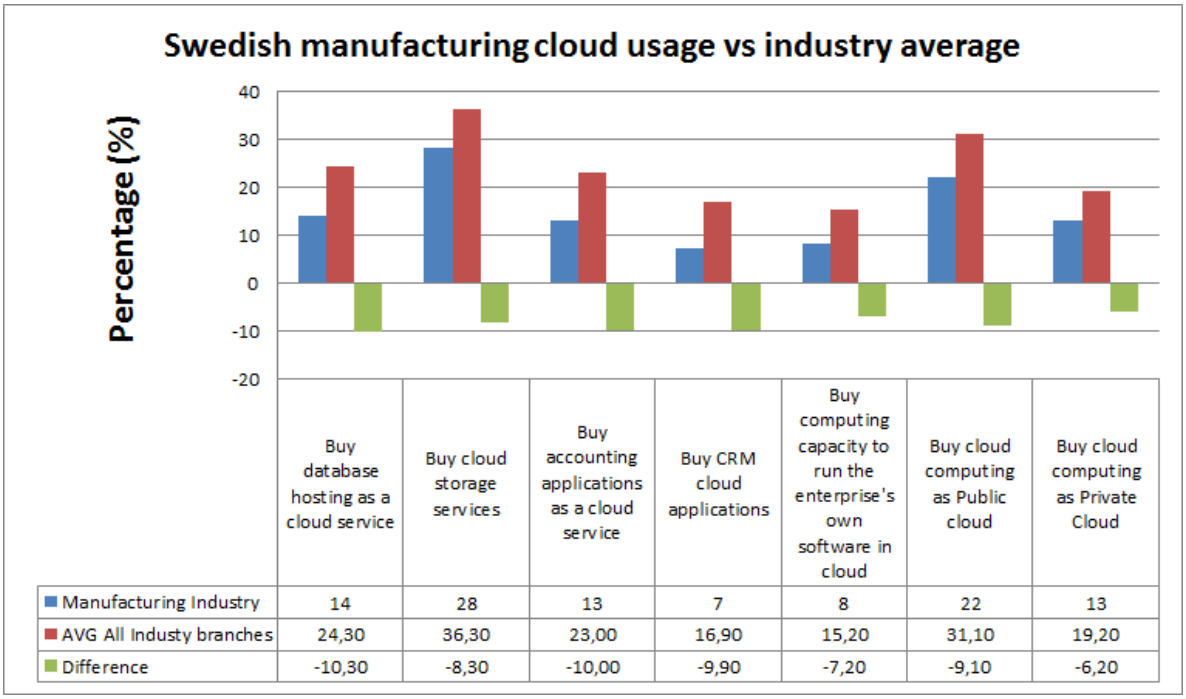


Figure 7: Swedish companies that have acquired cloud services

When comparing, industry branches it is noteworthy that manufacturing sector, which is target sector in this thesis, is lacking in every cloud case usage when compared to the average of the industry branches (Figure 8). The biggest gap with -10,3% lack from the average is the

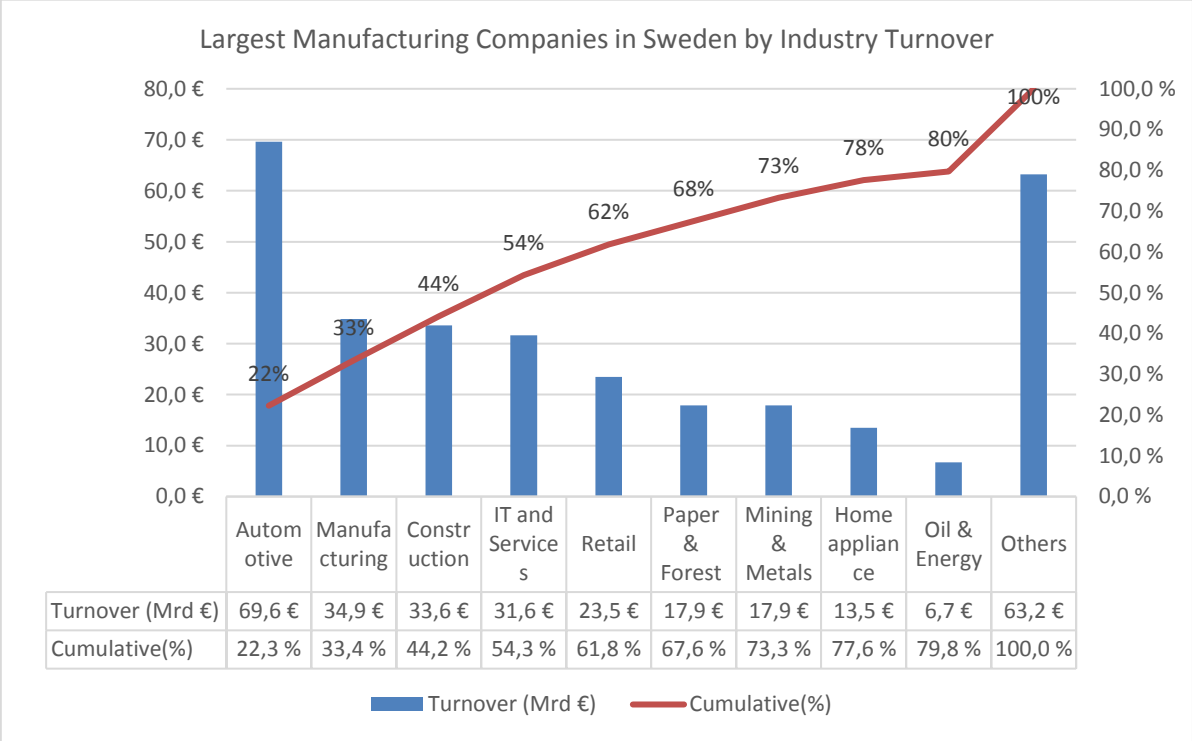
case where the company has acquired database hosting as a cloud service. This might probably be because firms operating in manufacturing branch either don't need such services or have already database hosting. The smallest gap with -6,2% gap from industry branch average is the case when the company is buying cloud computing as a private cloud. Apparently, this is because if the manufacturing companies are acquiring cloud services, they want it to be secured to prevent data losses or data breaches. (Statistiska centralbyrån)



	Buy database hosting as a cloud service	Buy cloud storage services	Buy accounting applications as a cloud service	Buy CRM cloud applications	Buy computing capacity to run the enterprise's own software in cloud	Buy cloud computing as Public cloud	Buy cloud computing as Private Cloud
Manufacturing Industry	14	28	13	7	8	22	13
AVG All Industy branches	24,30	36,30	23,00	16,90	15,20	31,10	19,20
Difference	-10,30	-8,30	-10,00	-9,90	-7,20	-9,10	-6,20

Figure 8: Comparison between manufacturing and all industries in cloud adoption

3.2 Swedish manufacturing markets



	Automotive	Manufacturing	Construction	IT and Services	Retail	Paper & Forest	Mining & Metals	Home appliance	Oil & Energy	Others
Turnover (Mrd €)	69,6 €	34,9 €	33,6 €	31,6 €	23,5 €	17,9 €	17,9 €	13,5 €	6,7 €	63,2 €
Cumulative(%)	22,3 %	33,4 %	44,2 %	54,3 %	61,8 %	67,6 %	73,3 %	77,6 %	79,8 %	100,0 %

Figure 9: Largest manufacturing companies in Sweden by industry turnover

In the above Figure 9 is the total sum of all collected all companies by their industry that have supply chains or working in the manufacturing industries with turnover more than 300M euros in Sweden in 2016. The complete list of contacted companies is in Appendix 1. Some companies were in grey area as they were not manufacturing companies but were still accepted. This was due to their likeness to operate with supply chains, and as the research questions are pointed to SCM related managers, these companies were included. These companies were operating in construction, retail, oil & energy and airline industries.

4 THE RESEARCH DESING

In this chapter, the research design is discussed more closely. Mixed research design, population, and sample aspects are covered. Also, the hypotheses are constructed based on prior research for the core component and open question from supplementary component are presented.

4.1 Background

The aim of this study is to get more insight in Swedish markets and understand the needs and challenges that companies are facing related to SaaS computing and supply chain collaboration. The inspiration for this thesis came from supply chain collaboration company Alpha (name anonymized). Alpha is used briefly as case company to show one example how cloud computing and supply chain collaboration can be unified.

4.1.1 Alpha

Alpha is a startup that has created a supply chain collaboration platform to increase performance in supply chain by providing platform where clients and suppliers can have secured connection to develop their supply chain. This platform is offered as a Software as a Service (SaaS). As Alpha is based on supply chain collaboration, it needs both clients and suppliers to get its service working properly. In Figure 10 is presented two ways how Alpha is expanding its user base. In most cases, client takes Alpha in pilot testing and invites some of its suppliers to join. After client and supplier have validated Alpha to be useful, they expand it for larger use in their companies. This also works the other way around. The larger the company, the broader is its supply chain network. That was one of the main reason why the largest manufacturing companies in Sweden were contacted in this study.

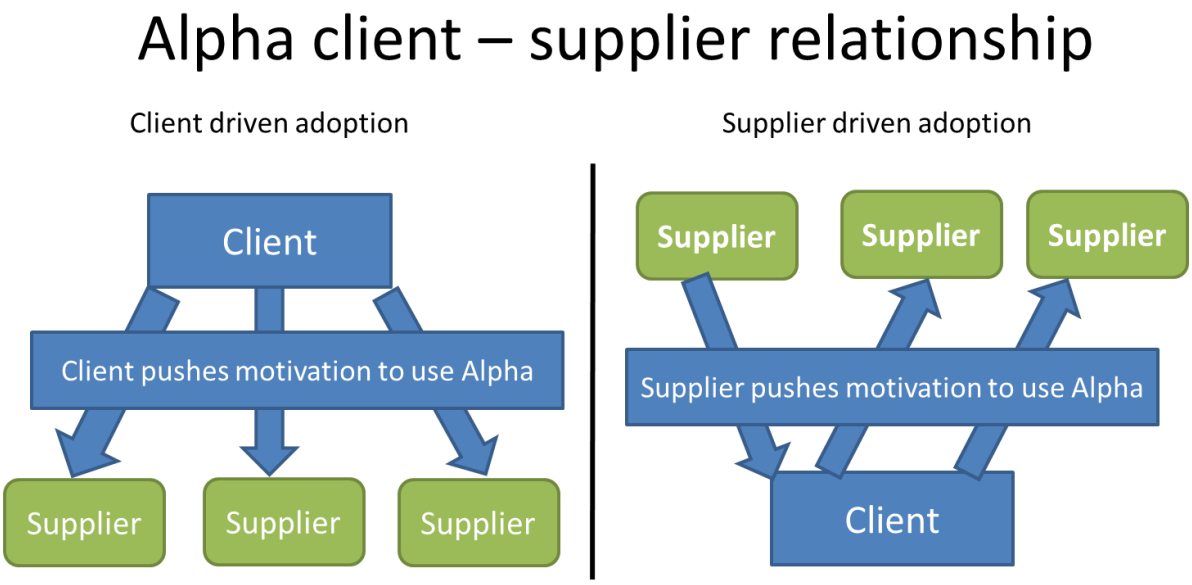


Figure 10: Alpha client- -supplier relationship

4.1.2 Swedish society

Sweden was chosen as a new market because swedes are known to be open-minded and transparent. Sweden was the first country in 1766 to allow freedom of the press, which was revolutionary during that time. (Sweden.se). Alpha's motives are also pushing from Finland to expand to Sweden. Alpha has already gained good saturation in Finland and it's looking for new market opportunities.

4.2 Purpose of the study

The purpose of this study is to find answers to previously mentioned cloud issues. To find the answers, there should be a purpose for the study as the purpose steers the research strategy. In this study, a survey was the most feasible tool of purpose. Other tools of purposes are explanatory, descriptive and predictive (Hirsjärvi et al. 2012:138). Explanatory study focus

is to find causalities. We are not interested in finding causalities from the study's problematic. We are interested more about the current situation. Explanatory research could be used in the future studies to understand the answer's the managers submitted in the survey. The descriptive study fits partially to this study. Purpose of predictive study is to predict events and human actions which are based on phenomena. This purpose doesn't fit to this study problem and it also needs experimental research strategy.

Survey as the purpose of this research fits best to solve the research problems for the following reasons. The survey aims to find new viewpoints and understand new phenomenon. Cloud computing as a phenomenon is so new that there is good chance to find new factors and ideas. Based on the literature, the earliest mentions of cloud computing in its current form and definition are from 2007, which is 10 years ago, (Boss, Malladi, Quan, Legregni & Hall (2007) and Weiss (2007). Surveys also develop hypotheses, which can be tested with quantitative and qualitative tools. In the chapter four hypotheses are constructed based on prior literature.

4.2.1 Research questions

First research questions aim to answer these questions. Answers from procurement managers would be valuable for Alpha, other SaaS and ERP companies that are targeting in Swedish markets. To understand more the aims and problematics in the target area, a comprehensive literature study was conducted in the articles of cloud computing adoption, cloud computing success factors and supply chain collaboration. The following topics and the leading idea was found during this study:

The original purpose was to study what are motivating factors that make adoption of cloud computing more attractive for manufacturing companies. It would have also been intriguing to find which factors increase trust in supply chains, as higher trust leads companies to provide more high-quality information which has a direct influence on firm performance (Wiengarten, Humphreys, Cao, Fynes, & Mckittrick 2010).

After studying more of this topic, it was found that the latter research question wasn't found to be close with the first research question. Also, Alpha expressed that the information studied from this would not be so useful for them. However, supply chain management and supply chain collaboration are covered in literature review as the view in this thesis is still how cloud computing is seen from supply chain management perspective. Instead, by studying also those factors that make cloud computing *deployment* successful, would give more supportive information for research question 1 it would also link it to the scientific framework for cloud computing and give the leading idea for the whole research: Road from intention successful cloud deployment. (Figure 11)

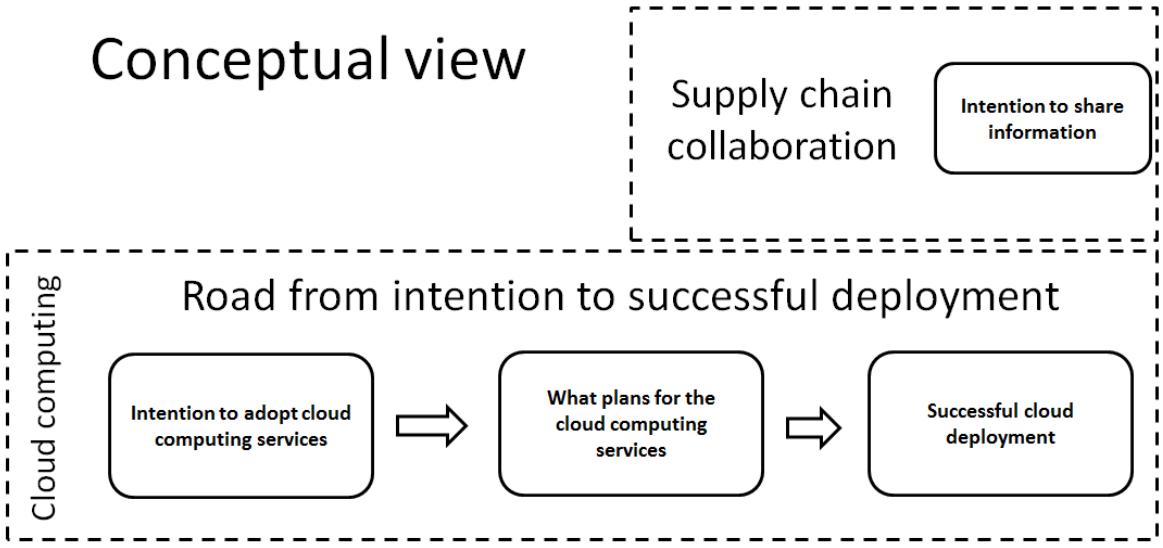


Figure 11: Conceptual view of thesis subject area

4.3 Data collection

To determine what the biggest manufacturing companies in Sweden are, research on web-based services like largestcompanies.com and allabolag was conducted. These websites list Swedish companies based on their turnover. There were some expectations of companies that were included and not included in this study. The distinctive factor was supply chains. If

companies had supply chain activity, they were accepted. For example, airline companies were accepted as they were assumed to have supply chains. Companies in the field of holding, banking, retailing or pharmaceutics were excluded. Also, subsidiaries were excluded e.g. Volvo Parts. Totally there were 102 companies that were accepted to this survey. Out of these companies' population of 186 eligible SCM related managers were identified.

The semi-structured research method was used in this thesis. It fits best for the research purpose as some questions can be based on the literature and be presented with closed questions but to get more in depth in Swedish SaaS adoption interest, open questions provide deeper insight. In other words, both closed and open questions support each other. Closed questions mean, median, standard deviation and Student Confidence were calculated to test whether hypothesis in literature meets Swedish manager opinions. For the open questions, qualitative content analysis was used.

In cloud computing and supply chain collaboration studies, the questions are usually aimed to managers working for procurement, IT or managers in general. (Wiengarten et al 2010, Alshamaila et al. 2013, Wu et al. 2013). This thesis focuses on SCM related managers that have experience using the cloud in their work. The supply chain is a broader target group than focusing solely on managers who are working with IT and as so it includes all kinds of business units. One supply chain might have people working in positions such as in procurement and IT. The other might have people working in SCM and sourcing. The population limitation goes to the companies that are operating mainly on the manufacturing sector in Sweden and have revenue over 300m euros. The population target is going to be SCM related managers that operate in these companies and have some experience using the cloud in in their work. But how one can determine who is working in which operations?

To determine all managers that are working with supply chains, one should have inside knowledge in all large manufacturing companies in Sweden and know which managers are working with supply chains. This is because work and responsibilities are divided in each company differently.

For these reasons the exact population of managers working for large Swedish manufacturing companies in SCM fields is hard to point out. And for these reason, the survey was sent to 186 managers operating in all operations that *might* have be operating in SCM related area. These managers were working in procurement, sourcing, supply chain development, logistics or in business development. There's also another limitation which is the mode of administration, how the data from the sample is gathered.

When comparing answer rates of previous similar researches, the answer rate was usually between 5% to 18.5% which in this case would mean that there would be 9 to 34 companies (5% * 186 respondents = 9 to 18.5%*186 respondents= 34). Oliveira, T et al 2014:503). The number of answers would not be enough for just quantitative research. When considering the given task to interview managers about cloud computing from SCM point of view, a generalizable quantitative research would be difficult to conduct. This is because it's hard to find managers that are both willing to contribute to similar researches and have the knowledge and are working with supply chains and cloud technology. For example, one of the respondents sent me an email that she should consult IT department before she could answer to thesis questions.

4.3.1 Sample gathering

LinkedIn was used as the main gathering tool to collect the sample. LinkedIn was chosen because it seemed to be the most convenient way of contacting managers. The problem with the LinkedIn contact strategy is that one should have broad enough professional network to reach out all the managers. LinkedIn shows the names of the searched persons if the connection is in their first, second or third connection. The first connection is a person that one has already in their network. The second connection is someone who is connected to one's connection. The third connection is someone who knows one's second connection. In below picture, an example query is executed by searching for procurement managers at Volvo. The first result shows that the manager is my third connection which allows me to see his or her name. The second search result shows that there is a person who is working in procurement

at Volvo but LinkedIn doesn't show his or her name because he or she is more than third connection away from my professional network (Figure 12).

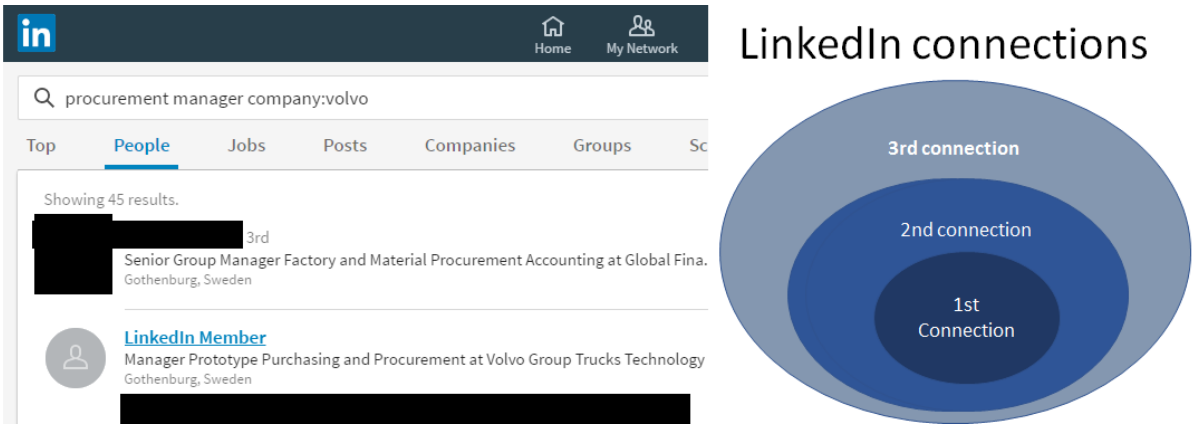


Figure 12: LinkedIn example query and connections

Other contact strategies could have been contacting the human resources in these companies and asking them to contact SCM managers. This contact strategy would have such drawback that only certain companies would have participated because it would have been likely that not all human resources could be contacted or willing to participate due to different reasons.

4.3.2 Sample design

As mentioned before in the population, there's a risk that the population is wrong because it's hard to estimate its size. This also makes it hard to estimate the sample size. In this research, the sample was gathered purely based on all the responses that could be gathered which means that there is no sample selection and the sample gathered is not generalizable to the larger population. The minimum target, however, is to get 5 answers. Anything more than 10 would be very beneficial. The size of the population and the sample size was hard to determine. How to then conduct a research when these problems occur?

A mixed research method was chosen as a tool to supplement these answers. In the mixed research, the core component is the main study of this research project. It works as the back-bone for the project where other components will be attached. Core component must be so self-sufficient that research could be published purely based on it. Supplemented component is used to extend the research. It's relatively independent but joins to the core component at the point of interface.

4.3.3 Theoretical drive

Morse & Niehaus (2009) presented concept "theoretical drive" which should determine which research method, quantitative or qualitative, one should choose when conducting a research (Figure 13). The theoretical drive is the direction of the research project and it is based on the research questions. Recalling the research questions in this thesis, they were

1. What factors affect to cloud computing adoption in Swedish manufacturing companies, and what plans these companies have for the future related to cloud computing services?
2. Which are the success factors when deploying cloud computing in Swedish manufacturing companies?

Both research questions include the concept of factors. Factors are measurable and they can be rather easily described. This makes them rather easy also to formulate. The factors are formulated in this thesis based on the previous studies. This means that this research is deductive, a way of testing hypotheses, making the core of this research quantitatively-driven. Quantitative research is the core component in this research project with deductive theoretical drive and supplemented simultaneously with qualitative supplementary component.

4.3.4 Pacing

In this thesis, both quantitative and qualitative research components are conducted simultaneously. I don’t want to interfere managers more than once because if they are participating, they probably want to keep time used in this research short and do it only once. Quantitative research is the core component in this research project with deductive theoretical drive and supplemented simultaneously with qualitative supplementary component.

4.3.5 Point of interface

The point of interest is the timing when the core and supplement component meet. In POI, the findings of core component are strengthened with the supplementary core. In this research, the POI will happen in research findings (Figure 13).

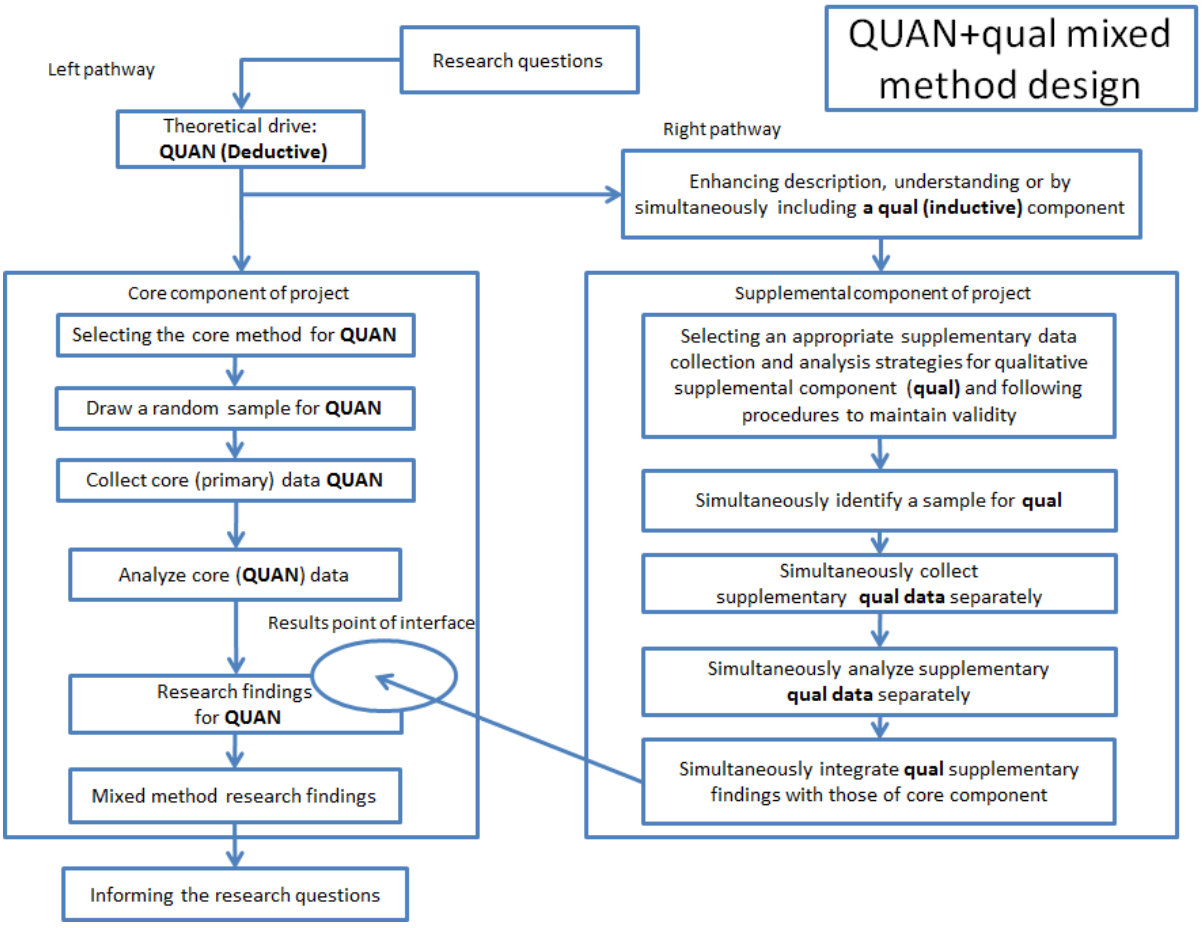


Figure 13:QUAN + qual mixed method design (Morse & Niehaus 2009)

4.4 Core component (Quantitative)

The process of core component (quantitative) is as follow: First, the hypotheses are constructed based on prior literature. Second, the sample is gathered. Scientifically the sample should be constructed based on methods that enable generalization of the sample to the larger population. This is not however done in this research because it's likely that if one had drawn a random sample out of the population, for example, sample size 15, and sent that to the managers it would have been likely that the response rate would have been 2-3 (11% * 15 –

23%*15) valid responses (Garrison, G et al 2015, response rate 11% and Wu, Y. et al 2013, response rate 23%).

I decided to accept all the answers to maximize the sample size. It decreases the quality of the core component (QUAN), but doesn't affect that much to the supplementary component (QUAL). This is because the respondents that are willing to participate are likely to be highly motivated and can provide good qualitative content. In the third phase, the sample is analysed. Mean, confidence interval and standard deviation are calculated. In the fourth phase, the results from the supplementary component (Qualitative) are mixed and analysed together. All hypotheses are quantitative because they have been constructed deductively based on prior research. All other questions are inductive.

The mean is used as a tool to determine if hypotheses can be confirmed or not. Standard deviation is needed to calculate the confidence interval. Confidence interval (CI) is used to study the variation in the results. If the CI is low it means that the managers have similar opinions about the question. If the CI is high it means that there's big variance in the answers and it makes hypotheses confirmation harder.

4.5 Supplementary component (Qualitative)

In this thesis, a qualitative research has been used as a supplementary component. Per Hirsjärvi et al. (2012:164), qualitative research is a useful and scientifically appropriate tool when interviewing people. It supports to comprehensive understand discussed area. The inductive analysis is used and some questions are open ended so that the researcher could reach uncharted areas, which previous studies haven't shown. Qualitative research supports research where studying targets express how they feel about the current subject which in this study is cloud computing adoption and deploying cloud computing in companies. Also, the target group is exactly selected. One can assume that in this study procurement managers are in a good role when discussing intention to procure cloud computing. One could argue that IT managers would be better target group as they understand technological aspects better. During the survey, one respondent contacted me and asked why she should answer to these questions as she was a procurement manager and not IT manager.

For semi-structured interviews in QUAN+qual research Morse & Niehaus (2009:127) suggest to use content analysis or transforming data to numerical values in analysis phase to be able to incorporate them into quantitative research. For the supplementary component (qualitative), content analysis was chosen because the number of valid responses is likely to be low. In the results chapter in general, research question 1 and research question 2 open questions the qualitative results have been presented. A short qualitative analysis for each question is conducted.

4.6 Interpreting data qualitatively from semi-structured review

Bryman and Bell (2007) presented 3 possibilities how the qualitative documents can be analysed. These are qualitative content analysis, semiotics and hermeneutics. The qualitative content analysis aims to find underlying themes in the materials and connect them to prior studies. The qualitative content analysis focuses heavily on coding. Semiotics aims to find certain *signs* from the content. This analysis focuses how the messages are communicated. Semiotics are based on semiotic theory, a culture of symbols is built and interpreted through a system of signs. In business studies, the semiotic analysis is used in studies of marketing and advertising. Hermeneutics bring out of the meanings from a text from perspective of its author. This focuses on the historical and social context where text was produced. Out of these analyses, qualitative content analysis was chosen. It's likely that certain themes will arise from manager's answers. These themes can be compared to the literature. Themes that appear from managers' answers in each qualitative question will be summed up in general, demographic, research question 1 and research question 2 questions. Themes will be ordered by the amount they have received answers and they are presented with categories 1-9.

Schreier, M. (2012) names eight steps that are done in QCA (Qualitative content analysis) which are:

1. Deciding research questions
2. Selecting your material
3. Building a coding frame
4. Diving your material into units of coding

5. Trying out your coding frame
6. Evaluating and modifying your coding frame
7. Main analysis
8. Interpreting and presenting your findings

Coding frame has three strategies: concept-driven, data-driven and combining concept-driven and data-driven strategies (Schreier 2012:94). In this research, a combined coding frame was chosen because in some of the questions are based more on the prior research (deductive) and some question are exploratory (inductive). The coding frame has medium complexity. It comprises of three main categories (General questions, research question 1 and research question 2). Each main category has subcategories that describe main categories. In Figure 14 the thesis coding frame is presented.

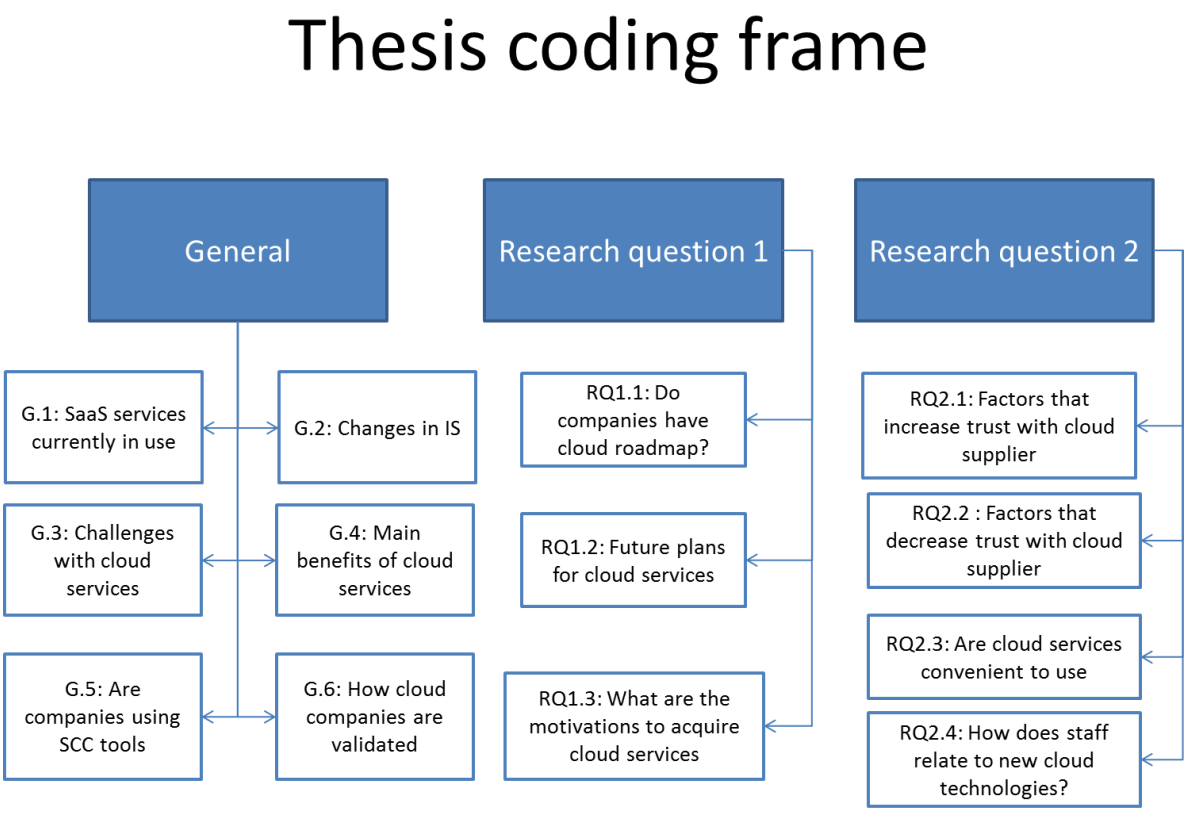


Figure 14: Thesis Coding frame

In the supplementary component, subcategory questions are coded with G.X, RQ1.X or RQ2.X depending on the main category where the subcategory belongs to (G.X = General, RQ1.X research question 1 and RQ2.X = Research question 2).

4.7 General and demographic questions

The managers were first asked to provide demographic information regarding company size they were working for and their gender. First general question G.1 simply asks which cloud services companies are currently using. G.2 asks what information system changes companies have faced in the past 5 years. G.5 ask if the companies are using SCC tools. G.6 aims to find how the cloud companies are validated. G.3 and G.4 ask the up and down sides of the cloud computing.

Table 1: General open questions coding (qual)

Identifier	Question	Concept / data driven
G.1	SaaS services currently in use	Data
G.2	Changes in IS past 5 years	Data
G.3	Challenges with cloud services	Concept
G.4	Main benefits of cloud services?	Concept
G.5	Are companies using SCC tools?	Data
G.6	How cloud companies are validated?	Data

4.8 Constructing factors and hypotheses for research question 1 (QUAN+ qual)

Factors from the literature will play a key role defining the questions for questionnaires. Each factor will get a hypothesis that argues if it has a positive or negative impact on intention to adopt cloud computing services.

4.8.1 Selecting appropriate framework for the research question 1

In the literature are some frameworks that were used as tools to describe and achieve results from the papers. Three different frameworks were identified; Diffusion of Innovations (DOI), Technology-Organizational-Environmental (TOE) and Information processing view (IPV). TOE framework was explained previously in chapter 2.3. DOI is an innovation adoption model that consists of 5 different aspects, relative advantage, compatibility, complexity, observability and trialability Rogers, E. M. (1995). Information processing view focuses on information processing requirements because IPR shapes the adoption and diffusion of IT across different industries. They recognized also five variables, which were Process complexity, Clock speed, Supply chain complexity, IT-based production control and Supply chain management (eSCM) Melville, N., & Ramirez, R. (2008).

All three frameworks have common that they have been mixed together in previous cloud computing adoption and deployment related studies. Oliveira, T. et al. (2014:503) mixed TOE and DOI together. Wu, et al (2013) mixed DOI and IPV. In this research, such mixing wasn't seen appropriate because TOE already provides almost every viable aspect. It's also the oldest of the three frameworks, making it well established and recognized framework.

Table 2: Comparison of research frameworks

Framework	Diffusion of innovations	Technology-Organizational-Environmental	Information Processing view

Published	1995	1990	2008
Variables	• relative advantage • compatibility • complexity • observability • trialability	• Technological • Organizational • Environmental	• Process complexity • Clock speed, • SC complexity • IT-based production control • eSCM

Factors are constructed based on four articles that discuss cloud computing adoption. Citations ranged from 74 to 405 in these articles so they can be considered scientifically significant, especially when considering that the oldest article is only 5 years old. The studies were conducted in England, Portugal, USA and Taiwan.

A quantitative study conducted by Oliveira et al. (2014:503) in Portuguese market reached 369 valid responses with 18.5% answer rates. They focused on manufacturing and service sectors. Based on their study top management support, firm size, technological readiness, complexity and relative advantage have a positive influence in firm's adoption of cloud computing. (Oliveira, T., Thomas, et al. 2014:506).

A semi-structured qualitative study made by Alshamaila, Y. et al in 2013 was focusing on northern England SME companies. They discussed with 15 IT managers. Their finding was that uncertainty, geo-restriction, compatibility, trialability, size, top management support, prior experience, innovativeness, industry, supplier efforts, market scope and external computing support. Competing pressure wasn't found to be a significant driver of cloud computing adoption. Alshamaila, Y. et al (2013:250).

A quantitative study conducted by Wu, Y. et al (2013). Focused in U.S market in manufacturing and retail sectors. They contacted 1,232 managers each in unique company. They received 289 answers which yielded 23% answer rate. They found that business process complexity, entrepreneurial culture, compatibility affect to firm's cloud adoption.

In the last article, Low, C. et al (2011) aimed to find the determinants of cloud computing adoption. Their questioned IT staff and managers in high-tech companies in Taiwan and their sample size was 111, answer rating being 22%. They found that relative advantage, top management support, firm size, competitive pressure, and trading partner pressure characteristics had a positive role in cloud computing adoption.

From these 4 articles, all factors that existed more than in one article were taken to this study. These were top management support, firm size, competitive pressure, relative advantage, complexity, compatibility and technology readiness.

Table 3: Hypothesis construction based on prior literature (QUAN)

Factor	(Wu et al 2013)	(Low et al 2011)	(Alshamaila et al, 2013)	(Oliveira et al 2014)		Total	Exp Mean
Industry	Manufacturing and retail	High-tech	SMEs	Manufacturing	Service		
top management support		Positive	positive		Positive	Positive	>3,5
firm size		Positive	positive	Positive	Positive	Positive	>3,5
competitive pressure		Positive	negative			Not confirmed to be positive or negative	2,5<x>3,5
relative advantage		Negative	positive	Positive		Positive	>3,5

complexity	Negative		positive		Nega-tive	Negative	<2,5
technology readiness				Positive	Posi-tive	Positive	>3,5

In the table 3 are the hypotheses which are linked to research question 1. If the results were statistically significant they were included in the table, except in study that was conducted by (Alshamaila et al. 2013) as the study was qualitative. In the rightest column is total where each study was given positive or negative value when compared to previous studies and summing them. Top management support, firm size, relative advantage and technology readiness are found to have a positive correlation to adopt cloud computing services. Complexity is found to be inhibitor to adopt cloud computing. Competitive pressure isn't confirmed to have positive or negative affect on adopting cloud computing services.

Hypothesis 1: Top management support has a positive effect on cloud computing adoption

Hypothesis 2: Larger firm size has a positive effect on cloud computing adoption

Hypothesis 3: Relative advantage has a positive effect on cloud computing adoption

Hypothesis 4: Technology readiness has a positive effect on cloud computing adoption

Hypothesis 5: Competitive pressure has a no effect on cloud computing adoption

Hypothesis 6: Complexity has a negative effect on cloud computing adoption

Also, some factors were added to this study from previously mentioned articles as they provide more insight to this study. Below is some reasoning why they were included in this research. From (Low et al 2011) article trading partner pressure was taken as a factor because it was based on their study the most influential factor to adopt cloud computing their study. It was also statistically supported ($p < 0.01$). Expected correlation to adopt cloud computing services: positive.

Hypothesis 7: Trading partner pressure has a positive effect on cloud computing adoption.

For example, in (Wu et al 2013) article presented security concerns or perceived risks as one factor that should be studied further. The reason was that when going to cloud companies perceive that they might need to outsource their software and hardware to the third-party cloud provider. P.36 Armburst et al. 2010 argued that by doing so the client would give control of their information systems and data to the cloud provider.

Hypothesis 8: Security concerns have a negative effect on cloud computing adoption.

From (Alshamaila et al, 2013) study in the north-east of England, geo restriction was taken from their study as it was found to be a significant factor during the qualitative study. Writers suggested that geo-restriction could be one side of trust to be considered in TOE framework.

Hypothesis 9: Geo-restriction has a negative effect on cloud computing adoption.

4.8.2 Supplementary component (qual) for research question 1

The mixed research design provides more insight to both research question. The supplementary part is mostly open question. The first question is, however, closed question. It's included in this part because it supports other questions and it's done in an inductive manner.

The first question asks if the companies have cloud roadmap. This was suggested by Marston, S et al 2011 that by having the cloud roadmap the organization and researches could identify the needs and make actions to reach required requirements now and in the future. The second question is a direct question from research question. Third open question aims to find the motivations why cloud services are acquired.

Table 4: Research question 1 open questions (qual)

Identifier	Question	Concept / data driven

RQ1.1	Does your company have digitalization plans on how to meet future demands in your company (Cloud Roadmap)?	Concept
RQ1.2:	What plans your company has for the future related to cloud computing services?	Data
RQ1.3	For what reasons cloud computing services are acquired?	Data

4.9 Construction factors and hypotheses for research question 2 (QUAN + qual)

The aim of this research questions is to understand what the success factors are when deploying the cloud are. The view is also little different compared to research question 1. In some questions, the goal is to gather information if the companies have currently done the required steps to meet demands. For an example, in question 22. Managers were asked if the company has the required IT assets to acquire and scale cloud computing related technologies, instead of just asking does IT related capability have a positive effect on cloud deployment. By doing this, there would be better insight on the current situation on Swedish cloud computing markets.

For the research question 2, it was found that in literature existed fewer articles. In the field of success factors for cloud deployment, only two articles had done quantitative research in this area. This shows that there might be new factors to be found as they are relatively new. The first article made by (Garrison et al 2012) was published in 2012 with 151 citations. They had a random sample of 314 companies globally. The second article, also conducted by (Garrison et al 2015) has already 17 citations. An article released in 2015 focuses on Korean markets with 304 responds. Both articles aimed to find if managerial, technical and relational IT capability has a positive effect on cloud deployment success. The newer article also aimed to find if successful cloud deployment has a positive effect on firm performance. All the hypotheses were found to be positive and statistically significant.

Based on the articles we can assume that

Hypothesis 10: Technical IT Capability has positive effect on cloud deployment

Hypothesis 11: Managerial IT Capability has positive effect on cloud deployment

Hypothesis 12: Relational IT Capability has positive effect on cloud deployment

Technical IT capability is the collective resources that an organization can use to acquire and scale one's cloud technology to realize IT efficiency and reduce IT related costs. It helps the company to respond rapidly to technological shifts and to acquire cloud computing technology. With good technical IT capability, cloud computing technologies could easily be acquired, the IT personnel could harness the IT economies of scale. (Garrison et al 2012:65). In the presented question, we try to find out if the company has concentrated enough resources on Technical IT capability.

Managerial IT capability relates to skills that the management can coordinate IT related resources efficiently. Managerial IT capability is to also ability to understand both business and technological areas, and organization related knowledge which is required to have when understanding how emerging technologies could be exposed to increase organization's performance. (Garrison et al 2012:66)

The relational IT capability refers to an ability to form a positive association with client and cloud computing provider. If the previous studies made by (Garrison et al 2012 and 2015) suggest a positive relationship with these parties, we can assume that successful cloud computing promotion inside the client company has a positive effect on cloud computing.

We can also assume, based on (Garrison et al 2012 and 2015) articles, that promoting cloud benefits to employees have a positive effect on cloud deployment. We can derive from this that Cloud computing has negative to affect IT employee morale. This is because cloud services reduce employee workload. Armburst et al 2009:10 presented that cloud computing reduces need for provisioning IT resources to handle capacity as it increases and decreases necessary computing capacity on demand.

Hypothesis 13: Communicating cloud to client employees has positive effect on cloud deployment

Hypothesis 14: Deploying cloud computing has negative effect on employees

4.9.1 Supplementary component for research question 2

The two first questions aim to find inductively answers to questions which factors increase or decrease trust. This question is based on (Garrison et al 2012 and 2015) finding that the relational capability (trust) has a noteworthy impact on successful cloud deployment. The third question aims to find if cloud deployment is convenient and the last how the staff relates to cloud related technologies.

Table 5: Research question 2 open questions (qual)

Identifier	Question	Concept / data
RQ2.1	Which factors increase trust with the cloud provider?	Data
RQ2.2	Which factors decrease trust with the cloud provider?	Data
RQ2.3	Are new cloud services easily deployed?	Data
RQ2.4	How does staff relate to new technologies?	Data

4.10 Hypothesis summary

For the sake of clarity hypotheses and their corresponding questions are operationalized in Table 6. The questions aim to proof if the hypotheses have a positive or negative affect on

cloud computing adoption or deployment. A complete list of survey questions can be found in Appendix 3.

Table 6: Hypotheses and their corresponding questions

Hypothesis	Question
H1: Top management support	7. Do you consider top management support to have an impact when adopting cloud computing services? Why and how top management can support it?
H2: Larger firm size	8. Do you consider bigger firm size to motivate cloud computing adoption?
H3: Relative advantage	11. Do you think that cloud computing services give your company relative advantage? Which factors motivate the most?
H4: Technology readiness	13. Do you find cloud computing services to be compatible with your existing information systems?
H5: Competitive pressure	9. Has competitive pressure pushed your company to use cloud computing services?
H6: Complexity	12. Do you consider cloud computing services to be easy to use or complex?
H7: Trading partner pressure	15. Are your trading partners or partners in supply chain pushing you to adopt cloud computing services?

H8: Security concerns	16. Are you concerned about cloud computing security?
H9: Geo-restriction	17. Are you concerned where your data is stored when using cloud computing services?
H10: Technical IT Capability	18. Does your company have required IT assets to acquire and scale cloud computing related technologies?
H11: Managerial IT Capability	19. Has your company given enough weight to train human resources to acquire and handle cloud computing services?
H12: Relational IT Capability	20. Do you consider trust between your company and cloud provider as important factor? Which factors increase or decrease trust?
H13: Communicating cloud benefits to client employees	21. Do you consider that communicating cloud services and their benefits to employees to have positive effect when deploying cloud computing?
H14: Deploying cloud computing has negative effect on employees	22. Do cloud services have negative effect on employee morale? Do you consider that cloud computing services make some employees obsolete?

4.11 Research design summary

Figure 15 concludes research design. Both quantitative and qualitative have been presented. Also, the hypotheses and the anticipated positive, neutral or negative affect on cloud adoption

or deployment have been marked with +, 0 and – signs. Hypotheses 1 -9 based on TOE framework explains what factors affect to intention to adopt cloud services with the qualitative open questions RQ1.2 – RQ1.3. Hypotheses 10-12 based on (Garrison et al 2012 and 2015) studies, hypotheses 13-14 derived from that research and open questions RQ2.1 – RQ2.4 explains what makes successful cloud deployment.

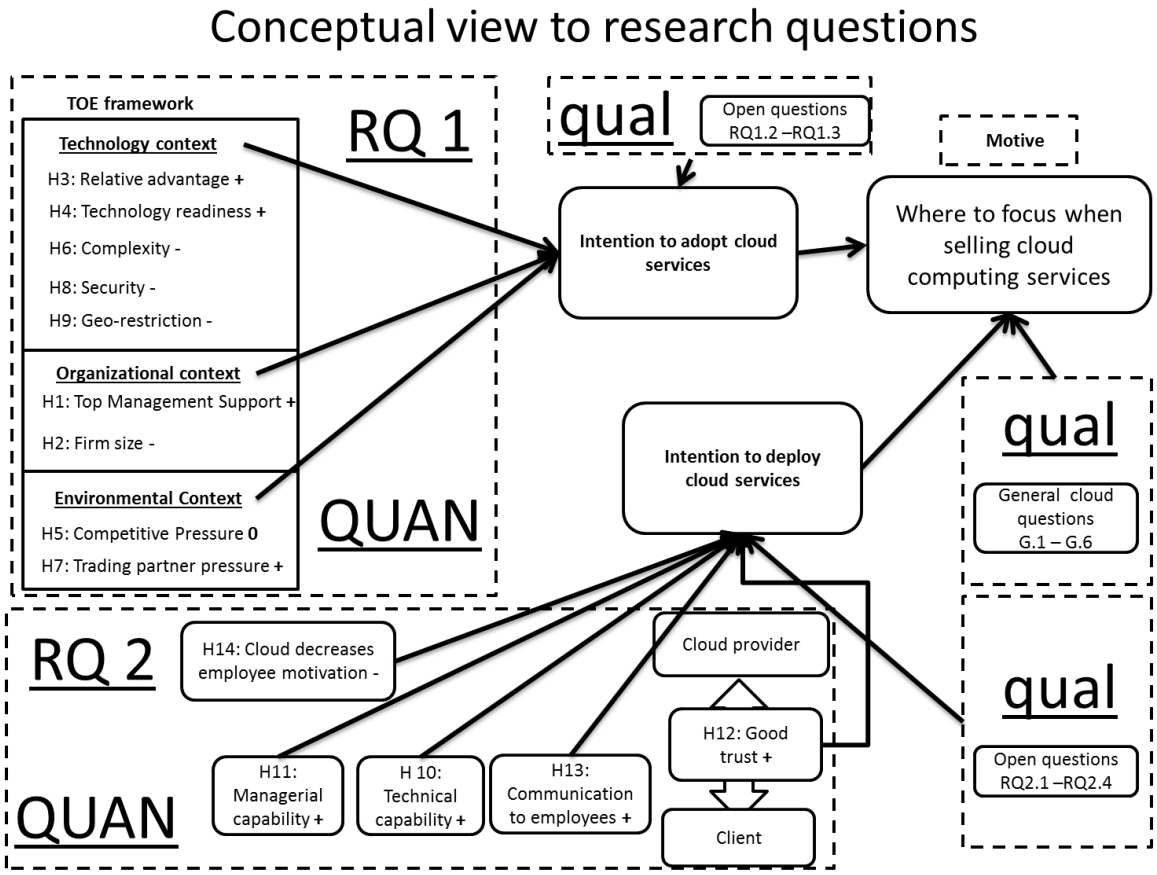


Figure 15: Conceptual view to research questions

5 RESULTS

The survey was sent to 186 managers in fields of supply chain, logistics, procurement, sourcing, and supply. Responses were gathered the through web form and phone interview during December 2016 – January 2017. Total answers gathered from the web and phone survey was n= 6, which means that the answer rate was 3,17%. Although this wasn't good answer rate, it was expected. When comparing to previous studies in cloud computing adoption and deployment, the answer rates have been between 10-23% (Garrison et al. 2015 and Wu et al. 2013).

Here are some arguments why the managers didn't answer to this survey. To be able to answer to answer to this survey, a manager should have knowledge in both SCM and cloud computing. The second reason is that these managers receive constantly questions to participate in different surveys and they are busy due to their work so they don't have time to answer to all of them. Third reason is probably cultural and language-related. There could have been higher answer rate if the survey and the email would have been sent in Swedish. This wasn't done because the thesis itself is written in English and it wasn't seen to be a problem to send surveys in English as managers are expected to work in global environment. Managers were given change to name their position if they wanted and 4 out of 6 did so. The respondents present valid positions from research question perspective (Table 7).

Table 7: Details on respondents

Manager	Company size in employees	Gender	Position / Role (if applicable)
A	Over 10000	Male	Business Development Director
B	Over 10000	Male	
C	Over 10000	Male	Supply Chain Director
D	Between 1000 and 5000	Female	

E	Over 10000	Female	Supply Chain Development
F	Between 1000 and 5000	Female	Procurement Manager

5.1 Demographic questions

Two out of six managers represented companies that had employees between 1000-5000. The rest four were all large companies with over 10 000 employees (Table 7), which supports Zhu et al. 2006: 1557 findings that large companies have resources and are capable of taking more innovation risks. The other reason might be that large companies have so big processes that they need more cross-knowledge between different business units.

5.2 Core results (Quantitative)

Hypotheses were constructed in chapter 4 based on the literature. The questions were presented with Likert 5 scale where in most cases 1 meant strongly disagree and 5 strongly agree.

Table 8: Mean, standard deviation and confidence interval

Question	Mean	Std. Dev	Confidence T 95%	Confidence min	Confidence max	CI < 1
H1: Do you consider top management support to have an impact when adopting cloud computing services? 1= No Impact, 5= High Impact	4,5	0,84	1,04	3,46	5,54	No

H2: Does bigger firm size help when adopting new cloud computing services? 1= Strongly disagree, 5= Strongly agree	2,833	1,17	1,45	1,38	4,28	No
H3: Do cloud computing services give your company relative advantage? 1= Strongly disagree, 5= Strongly agree	4,167	0,75	0,93	3,23	5,10	Yes
H4: Do you think that your company has the technical readiness to adopt cloud computing services? 1= Strongly disagree, 5= Strongly agree	4,333	0,52	0,64	3,69	4,97	Yes
H5: Has competitive pressure pushed your company to use cloud computing services? 1= Strongly disagree, 5= Strongly agree	3	0,89	1,11	1,89	4,11	No
H6: Do you consider cloud computing services to be easy to use or complex? 1= Complex, 5= Easy to use	3,833	0,75	0,93	2,90	4,77	Yes
H7: Are your trading partners or partners in supply chain pushing you to adopt cloud computing services? 1= Strongly disagree, 5= Strongly agree	2,667	0,52	0,64	2,03	3,31	Yes
H8: Are you concerned about cloud computing security? 1= Strongly disagree, 5= Strongly agree	2,667	1,21	1,50	1,16	4,17	No
H9: Are you concerned where your data is stored when using cloud computing services? 1= Strongly disagree, 5= Strongly agree	3	1,41	1,76	1,24	4,76	No

H10: Does your company have required IT assets to acquire and scale cloud computing related technologies? 1= No resources, 5= Highly concentrated	3,5	0,55	0,68	2,82	4,18	Yes
H11: Has your company given enough weight to educate personnel to acquire and handle cloud computing services? 1= No resources, 5= Highly concentrated	3,25	0,76	0,94	2,31	4,19	Yes
H12: Do you consider trust between your company and cloud provider as an important factor when deploying cloud computing services? 1= Strongly disagree, 5= Strongly agree	4,833	0,41	0,51	4,33	5,34	Yes
H13: Do you consider communicating cloud services and their benefits to employees to have a positive effect when deploying cloud computing? 1= Strongly disagree, 5= Strongly agree	4,167	0,41	0,51	3,66	4,67	Yes
H14: Do cloud services have a negative effect on employee morale? For example, making some employees obsolete? 1= Strongly disagree, 5= Strongly agree	2,5	1,05	1,30	1,20	3,80	No

Based on table 4, mean and confidence were used to determine if the results were statistically reliable. All the answers that had less than 1 confidence T with 95% probability were accepted. Reliability with 95% (or 0,05 (α = 5 %)) is perceived that the results are almost statistically significant.

In RQ1 top management support (mean 4,5), relative advantage (mean 4.16), technical readiness (mean 4,33) convenience (mean 3.83) was found to have a positive effect on adoption. Competitive pressure and geo-location (both mean 3) weren't seen to have positive or negative effect on cloud adoption. Trading partner pressures and security managers found to be slightly towards negative (both mean 2.66).

RQ2 aimed to find the successful factors in cloud deployment. The questions asked also if the companies have done required actions to meet them. Managers perceived that they have concentrated their resources to have cloud-related technical readiness (mean 3,5), they have concentrated enough resources to educate personnel to harness cloud benefits (3,25), trust with cloud supplier (mean 4,883) and communicating cloud benefits to personnel (mean 4.16) to have positive effect on cloud deployment.

Top management support, larger firm size, competitive pressure, cloud security, cloud geolocation and clouds negative effect on employee morale were found to be statistically insignificant. Comparing the results to the hypotheses presented in chapter 4, top management support and larger firm size hypotheses had a positive affect on cloud computing adoption. These were not supported by this study as the CI was larger than 1. Cloud geolocation had the largest scattering with CI 1,76 which implies that the importance of data location for managers differs noticeably. For the question if cloud deployment has a negative effect on employee morale the managers found it to slightly towards negative with mean 2,5.

Statistically most significant results were in trust with cloud supplier (mean 4,883) and communicating cloud benefits to personnel (mean 4.16) as they reached less than 1 confidence even when α was decreased to 1% (CI being 0.84).

5.3 Supplementary results (Qualitative)

The qualitative results have been presented in this 5.3 chapter. A number of answers have been referred with brackets () and questions with coding G.X, RQ1.X or RQ2.X to make results presenting and analysing simpler.

5.3.1 General questions

The first general question G.1 was:" What cloud computing services, more precisely SaaS (Software as a Service) services, your company is currently using?" Results were various. All the tools that respondents mentioned were used for different purposes. The closest ones to supply chains were SupplyON and Transporeon.

Table 9: SaaS services that companies are using

Product	Type	Parent company
Office 365	Office SaaS	Microsoft
Sharepoint	Document management and storage system	Microsoft
Qlickview	Business Intelligence (BI) for SaaS	QlikTech International AB
SAP Ariba	SaaS marketplace for buyers and suppliers	SAP SE
SAP Fieldglass	Vendor Management System (VMS) for SaaS	SAP SE
Scanmarket	Strategic sourcing	Scanmarket A/S
SupplyON	SCM and SCC for SaaS	SupplyOn AG

ShareSpace	Social Intranet (based on SharePoint)	Swisscom AG
Transporeon	Transport and Logistic SaaS	Transporeon Group

Table 10: General question results

Subcategory	G.2: IS changes in past 5 years	G.3: Challenges with cloud service	G.4: What are the main benefits of cloud services?	G.6: How cloud companies are validated?
Category 1	ERP	Integration	Sharing and communication	Existing customers and feedback
Total	2	2	3	2
Category 2	CRM	Usability challenges	Common platform	Integration with existing and legacy technologies
Total	1	2	2	2
Category 3	ECM	Aligning company processes with	Flexible & On-demand	Traditional vetting process
Total	1	1	2	1
Category 4	Procurement platform	Value of cloud services	Outsourced responsibility	Quality
Total	1	1	1	1
Category 5	BI	Selecting future-proof cloud service	Lower costs	Reliability
Total	1	1	1	1
Category 6	Online office suite	Information safety	Information transparency	Evaluation happens with together tech & biz units
Total	1	1	1	1

Category 7		Scalability	Big data usages	Evaluation done by HQ
Total		1	1	1
Category 8			Usability	
Total			1	

When questioned what information system changes companies faced during past 5 years (G.2), managers mentioned ERP (2), CRM (1), ECM (1), procurement platform (1) and Online office suite (1) changes.

Managers' stumble cloud-related challenges (G.3). Manager A said that: "We face some obstacles: It's the same solution for thousands of clients (Making our processes work with Ariba), integration issues (the lack of support for legacy systems) and Interface issues (usability, employees)." Manager B expressed: "Making a proper business case that is built on real facts and savings". Manager C urged for more Scalability and user friendliness! Manager D faced challenges to get companies working together to create new services. Manager E Selecting the right eco-system for the future. Which cloud services will be the right one for the future? For manager F, the information safety was the biggest issue. To summarize, legacy systems are burdening companies as they are still needed. Integration to the older system might cause trouble in some companies. Also, employees face some usability issues when going to the new systems

Managers perceived convenient communication, sharing capabilities, flexibility, availability on demand, smaller capital expenditures, less IT personnel to maintain systems, its usability, and accessibility as the main benefits of cloud services (G.4). When analysing the results, the answers provide broad and aligned answers with the standards and research papers. If we recall the NIST definition of cloud characteristics, the only characteristic that was missing from managers' answers was measurability (Mell & Grance 2011).

For the supply chain and cloud computing linking question G.5 mentioned SAP Ariba, Sharepoint, Bidding platform, EDI portal, Transporeon, ShareSpace, SupplyOn and SCM Star. Interestingly, one manager pointed out that they were not using any SCC tools.

Managers and the companies' they represent validate cloud providers by various criteria (G.4). Manager A said that they have two criteria: the first one is that cloud application should have SAP integration as that is used throughout the company. The second criteria are that cloud service should have integration with their legacy systems. Manager B said they use vetting process to go through new suppliers. Manager C said that previous references and feedback was important. Manager D mentioned that vendor should have high Quality of Service, be a reliable and known supplier. Manager E said that they SCM and Process & IT unit to evaluate from a business perspective and Group IT from a systems perspective. Manager F said that validation comes from the global HQ. When analysing the results one can find that it's crucial for cloud companies to have good references because manufacturing companies appreciate that (2). Cloud Company's ability to integrate cloud systems to client's existing and legacy system is vital.

5.3.2 Open questions in research question 1

Five managers said that their company has digitalization plan. Manager A said that they have digitalization strategy for sourcing and digitalization is an important business phenomenon in their company. Manager B said that their company is investigating how they could use the cloud in different areas and Manager C cloud services are used to get rid of manual tasks. Manager E said that they are moving to cloud services if there's need from technological and business perspective. Manager F said that they are developing more cloud services to automate processes. To summarize, most of the sample companies are ready for digitalization. Companies are looking to further automate their processes from the manual tasks with the cloud technology.

Table 11: RQ1 qualitative results

Survey question	RQ1.2: What plans your company has for the future related to cloud computing services?	RQ1.3: For what reasons cloud computing services are acquired?
Category 1	Automation	Reduced costs
Total	2	2
Category 2	Digitalization strategy	Convenience
Total	1	2
Category 3	Investigating possibilities	Improved performance
Total	1	2
Category 4	Acquiring cloud services if business and technology requirements are met	Use for big data
Total	1	2
Category 5		Up-to-date
Total		1
Category 6		Scalability
Total		1
Category 7		Automation
Total		1
Category 8		Transparency
Total		1
Category 9		Communication
Total		1

Why are managers acquiring cloud computing services (RQ1.3)? First, they mentioned the useful characteristics which were scalability, transparency and convenient implementation. Reduced costs, automation and improved processes, SaaS superiority over traditional setup which includes platform, software and maintenance staff, and communication with partners

were useful from the business perspective. Lastly, managers mentioned that cloud enables a convenient way of analysing big data and creating data visualization. Analysis: cost-reduction (2), convenience (2), improved performance (2) are all close to the concept of cloud having the relative advantage. Using cloud services to analyse big data was a bit unexpected but interesting result.

5.3.3 Open questions in research question 2

Based on Garrison et al (2012 and 2015) work, trust was seen so important factor in cloud deployment. Because of this, both positive and negative factors to cloud deployment were researched.

From the relational point of view, which is between the client who acquires cloud services and cloud supplier who provides the cloud to the client, the following factors were seen positively increasing trust in this relationship (RQ2.1). Mutual good communication and cloud supplier providing ideas how to run processes more effectively. Cloud supplier should have clear policies and adequate security. The communication and transparency between supplier and client is important. Managers urged also for good support and adaptive changes from supplier side. From the business point of view, managers said that references with previous clients and recognized brand improved trust Managers perceived that if the cloud supplier had capable salespeople that knew what they were talking about and they understood supply chain processes it was improving trust. To summarize, references are used both to validate the cloud companies (G.6) and if the cloud provider can be trusted. It's also important that the cloud provider understands client needs and makes the deployment process easy for the client

Table 12: RQ2 qualitative results

Survey question	RQ2.1: Which factors increase trust with the cloud provider?	RQ2.2: Which factors decrease trust with the cloud provider?	RQ2.3: Are new cloud services easily deployed?	RQ2.4: How does staff relate to new technologies?

Category 1	Cloud provider understands client needs	Cloud provider pushes license cost	Easier compared to traditional installation	Extra work for staff
Total	2	1	2	2
Category 2	References	Cloud provider overstates cloud benefits	Legacy systems are hindrance	Staff relates positively if they see benefits
Total	2	1	1	2
Category 3	Convenience	Siloed data	Cloud deployment process is slow	Staff adopts rather easily
Total	2	1	1	1
Category 4	Cloud supplier understands SC pro-	Opaqueness		Change management required
Total	1	1		1
Category 5	Clear policies	Complexity		
Total	1	1		
Category 6	Security	Lack of support		
Total	1	1		
Category 7	Transparency			
Total	1			
Category 8	Good support			
Total	1			
Category 9	Ability for chances			
Total	1			

When questioned from managers which factors decrease trust with the cloud provider (RQ2.2), the following aspects were mentioned. Manager A expressed hindrance factors in the license costs: "When cloud suppliers push license cost. They charge for each user. Everything cost another dollar. You have many discussions going on with the cloud supplier related to extra services which they want to sell. Cloud service is like buying a car without wheels, air condition or radio." Other decreasing factors were traditional sales people making up business cases that are just overstating all the benefits, closed and opaque communication, complex interface and lack of support. Analysis: When cloud provider is selling their services to clients, they should avoid pitfalls such as pushing client to buy such cloud services that the client feels uncomfortable or overstating cloud benefits.

To the last open question (RQ2.3 and (RQ2.4)), manager A said it's rather easily deployed and staff adopts cloud service rather easily. Some employees say that there's extra job with cloud services as it provides a new way of learning and that takes time. Manager B implied that installing cloud is like normal installation but easier to scale. Manager E said: "in many cases it is difficult to deploy new techniques due to legacy systems. The staff is in many cases negative to new technologies in the beginning but it normally improves over time. It's important to put time into change management." Manager F said that changes in a company take time to adopt but normally positive response if you see the benefit.

5.4 Results of Point of Interface (QUAN + qual)

In mixed (QUAN + qual) research the point of interface happens in the results part. Now when the both core and supplement component have been presented, we can mix them when applicable. Mean was used as a criterion to determine if the hypotheses and supporting open questions were accepted at the point of interface analysis. Mean for the corresponding hypothesis question should be more than 3,5 or less than 2,5 to indicate the negative or positive attitude towards each question.

All other hypotheses had an explanation from the supplementary component except top management support as there were no open questions regarding that question. Mixed results have been presented with mean from quantitative and number of managers who said the same

theme with brackets (). With these criteria's 5 hypotheses were accepted with qualitative data provided by the supplementary component.

H3: Relative advantage with mean 4,16. Positive themes were seen sharing and collaboration (3), common platform (2), flexibility & on-demand (2), outsourced responsibility (2), lower costs (2), information transparency (2), big data usages (2) and usability(2).

H4: Managers saw that they have Technology readiness with mean 4,33. Although managers were optimistic, in the open questions they faced burdening factors such integration (2) and usability challenges (2) and selecting future-proof cloud technology (1).

H6: Complexity. Managers saw cloud computing services to be easy to with mean 3.833. Cloud was seen to be convenient (2) and to have usability challenges (2).

H12: Trust. Trust was seen as the most important factor of hypotheses with mean (4.833). That was also anticipated and trust-related questions were divided into two. Managers said following factors to have positive affect on cloud deployment: cloud provider understands client needs (2), client reverences (2), convince with cloud provider (2), cloud supplier understands client SC processes (1), clear policies (1), security (1), transparency (1), good support (1), cloud provider is able to make changes (1). Decreasing factors were: cloud provider pushes license cost (1), cloud provider overstates cloud benefits (1), siloed data (1), opaqueness (1), complexity (1) and lack of support (1).

H13: Communicating cloud benefits with mean 4.167. Managers said that staff relates positively cloud technologies if they see benefits (2), staff adopts rather easily (1) and change management is required (1).

Table 13: Point of Interest for QUAN + qual research

Hypotheses	H3: Relative advantage		H4: Technology readiness	H6: Complexity	H12: Trust		H13: Communicating cloud benefits
Mean	4,1667		4,333	3,833	4,833		4,167
Related open ques-	G.4	RQ1.3	G.3	G.3	RQ2.1	RQ2.2:	RQ2.4
Category 1	Sharing and communication	Reduced costs	Integration challenges	Usability challenges	Cloud provider understands client needs	Cloud provider pushes license cost	Staff relates positively if they see benefits
Total	3	2	2	2	2	1	2
Category 2	Common platform	Convenience	Usability challenges	Convenience	References	Cloud provider overstates cloud benefits	Staff adopts rather easily
Total	2	2	2	2	2	1	1
Category 3	Flexible & On-demand	Improved performance	Selecting future-proof cloud ser-		Convenience with cloud provider	Siloed data	Change management required
Total	2	2	1		2	1	1
Category 4	Outsourced responsibility	Use for big data			Cloud supplier understands SC processes	Opaqueness	
Total	1	2			1	1	

Category 5	Lower costs	Up-to-date			Clear policies	Complexity	
Total	1	1			1	1	
Category 6	Information transpar-	Scalability	Information safety		Security	Lack of support	
Total	1	1	1		1	1	
Category 7	Big data usages	Automation	Scalability		Transparency		
Total	1	1	1		1		
Category 8	Usability	Transparency			Good support		
Total	1	1			1		
Category 9		Communication			Ability for chances		
Total		1			1		

6 DISCUSSION AND CONCLUSION

This chapter concludes this thesis. In table 14 hypotheses that were constructed in chapter 4 have been compared to the results that were presented chapter 5. The evaluation of results was done by looking the mean. Also, the confidence interval had to be lower than 1 to be confirmed.

- If mean was less than 2,5 and the hypothesis was negative, the results was confirmed
- If mean was between 2,5 and 3,5 and the hypothesis couldn't be accepted to be positive or negative, the results was confirmed
- If the mean was more than 3,5 and the hypothesis was positive, the result was confirmed

Results that were in line with previous studies were: Relative advantage (H3), Technology readiness (H4), Relational IT Capability (Trust, H12) and Communicating cloud benefits to client employees (H13).

Interestingly, cloud services were not seen to be complex to use (H6). The previous studies have shown (Wu et al. 2013) and (Oliveira et al. 2014) that cloud services are complex. This research showed with scale 1-5, 5 being easy to use that the 3.833 mean that cloud services are rather easy to use, at least in Swedish manufacturing companies.

Top Management support (H1), Larger Firm size (H2), Competitive pressure (H5), Trading partner pressure (H7), Security concerns (H8), Geo-restriction (H9), Technical IT-capability (H10), Managerial IT capability (H11) and Deploying cloud has negative effect on cloud employees (H14) couldn't be confirmed and these were identified as N/A (Not available)

Table 14: Comparing hypotheses to results

Hypothesis	Expected effect on cloud adoption or deployment	Mean	Confirmation

H1: Top management support	Positive	4,5	N/A
H2: Larger firm size	Negative	2,833	N/A
H3: Relative advantage	Positive	4,167	Confirmed
H4: Technology readiness	Positive	4,333	Confirmed
H5: Competitive pressure	No effect	3	N/A
H6: Complexity	Negative	3,833	Not confirmed
H7: Trading partner pressure	Positive	2,667	N/A
H8: Security concerns	Negative	2,667	N/A
H9: Geo-restriction	Negative	3	N/A
H10: Technical IT Capability	Positive	3,5	N/A
H11: Managerial IT Capability	Positive	3,25	N/A
H12: Relational IT Capability	Positive	4,833	Confirmed
H13: Communicating cloud benefits to client employees	Positive	4,167	Confirmed
H14: Deploying cloud computing has negative effect on employees	Negative	2,5	N/A

6.1 Limitations and evaluation of the research

Gathering and collecting data from survey respondent was one of the most challenging parts in this thesis for three reasons. The first one is that the questions required cross knowledge from managers both in supply chain and cloud computing. Because of this, or other reason

most of the managers seemed not to be interested in answering this survey. During contacting, some of the managers replied to emails such as “Please remove me from your survey” or “I can’t help you with this”. Second reason was that LinkedIn was used as a tool to gather names. LinkedIn is also a SaaS service that is used to connect professional around the globe. To connect to or to see managers one must have a broad network to be able to communicate with professional. Thesis writer had over 200 contacts in LinkedIn which helped to reach most of the managers in Sweden. Still, in some cases, not all managers couldn’t be identified. Broader network and closer contacts might have led to much bigger answer rates.

6.2 Implications

Most of the results from this thesis support existing literature and studies in cloud adoption and deployment. The only exception was question about complexity. In previous studies cloud computing was perceived to be complex. This study showed with mean 3.833, on 5 Likert scale 5 being the most convenient, that cloud services are easy to use. This can be because the cloud services have taken a well-established role in IT services. Previous studies, which the hypotheses were based on, were conducted between 2011 and 2014, so there has been 3-6 years’ time to develop. Figure 6 also shows that the global public cloud market size has expanded from 25 milliards $ in 2011 to 128 milliards $ in 2017.

The survey was built in a semi-structured way which asked both open and closed questions. Statistically most significant answers were questions under research question 2: trust with cloud supplier (mean 4.83) and communicating cloud services and their benefits to employees (mean 4.16). They were only questions that reached less than one confidence (CI = 0.86) with $\alpha = 1$ %. This means that the results in these questions are statistically significant. Trust has been seen in previous studies as a significant factor Garrison, G et al 2012 and 2015. Results from this survey support their results.

What’s completely new in this study is that communicating cloud benefits to employees has a positive effect on cloud deployment (Hypothesis 13). This idea was derived from Garrison, G et al 2012 and 2015 work that if the cloud trust is an important factor between cloud sup-

plier and client organization, it might also work to the other way, trust between client employer and their employees. The CI 0.86 with probability α = 1 % and mean 4.16 show that this hypothesis is positive and true. The result is also supported by open questions. Manager E said that staff has in many cases negative attitude to new technologies in the beginning but it normally improves over time. Because of this, manager E argued that it's important to put time into change management. Manager F said that changes in a company take time to adopt but normally receive a positive response if you see the benefit.

When reducing statistical significance from α = 1 % to α = 5 %, more results can be accepted when CI is less than 1. From research question 1 relative advantage (mean 4.16), technical readiness (mean 4,33) and convenience (mean 3.83) was found to have a positive effect on adoption. Trading partner or supply-chain pressure managers found to be slightly towards negative (mean 2.66). Relative advantage, technological readiness and convenience (convenience is the opposite of complexity, which was proved to be negative in hypothesis construction) were all positive and supported by hypotheses. However, trading partner pressure was found to slightly to be negative and wasn't supported. This might be because all the companies that were participating in this survey had more than 1000 employees. It might be that these companies are in their position creating trading partner or supply chain pressure for smaller companies to adopt cloud computing services. This might be one viewpoint to the future research; does firm size affect to trade or supply chain partner pressure? When recalling the research question one which was the following

- "What factors affect to cloud computing adoption in Swedish manufacturing companies, and what plans these companies have for the future related to cloud computing services?"

We can conclude based on this semi-structured survey that relative advantage, technical readiness, and convenience are positive factors that motivate companies to acquire cloud services. Answering to the second sentence in research question, 5 out of 6 interviewed managers said that their company has a digitization strategy. In summary, companies were investigating how cloud computing could be used to gain business benefits and they were looking ways of automating processes through cloud services. Companies were acquiring cloud services be-

cause they had useful characteristics such as scalability, transparency and convenient implementation. Reduced costs, automation and improved processes, SaaS superiority over traditional setup and communication with partners were useful from the business perspective. Lastly, managers mentioned that cloud enables a convenient way of analysing big data and creating data visualization. Research question two was as follow:

- "Which are the success factors when deploying cloud computing in Swedish manufacturing companies?"

The aim with the question was to find the success factors in cloud deployment and if the companies have done required actions to meet those. Managers perceived that they have concentrated their resources to have cloud-related technical readiness (mean 3,5) and enough resources to educate personnel to harness cloud benefits (3,25), they perceive trust as an important factor with cloud supplier (mean 4.883) and communicating cloud benefits to personnel (mean 4.166)

6.3 Future research

Different survey gathering strategy could have reached higher response rate. This study used mainly cold calling and LinkedIn strategy (Chapter 4.3), but any other research could have yielded the same or more results. Some viable strategies could be snowball or a quota sampling.

Unfortunately, the results presented in this study cannot be generalized to bigger sample because the sample size that was gathered in this study was 6, being too small for adequate quantitative research. However, some indications can be made for the future research, which are based on the following results: firstly, have cloud services become convenient to use (Hypothesis 6, mean 3.833). Secondly, does communicating cloud benefits to personnel promote cloud computing deployment (Hypothesis 13, mean 4.167). Thirdly, it was discussed that firm size might affect to trade or supply chain partner pressure when deploying cloud services. Smaller companies might face pressure from bigger companies, thus pushing them to acquire the same cloud services.

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APPENDIX 1: Largest manufacturing companies in Sweden

Name	City	Industry	Turnover in 2015
Volvo, AB	Gothenburg	Automotive	34 210 728 000 €
Ericsson AB LM	Stockholm	Information Technology and Services	27 030 104 000 €
H & M Hennes & Mauritz AB	Stockholm	Retail	19 563 115 000 €
Volvo Car Group	Gothenburg	Automotive	17 957 635 000 €
Skanska AB	Stockholm	Construction	16 754 132 000 €
Electrolux, AB	Stockholm	Home appliance	13 520 635 000 €
SCA, Svenska Cellulosa AB	Stockholm	Paper & Forest Products	12 623 536 000 €
Atlas Copco AB	Stockholm	Manufacturing	11 183 470 000 €
Scania CV AB	Sodertalje	Automotive	11 011 713 000 €
Sandvik AB	Stockholm	Manufacturing	9 397 373 000 €
SKF, AB	Gothenburg	Manufacturing	8 319 321 000 €
Assa Abloy AB	Stockholm	Building Materials	7 454 735 000 €
NCC AB	Solna	Construction	6 841 270 000 €
SSAB AB	Stockholm	Mining & Metals	6 224 849 000 €
Peab AB	Foersloev	Construction	4 857 800 000 €
Autoliv AB	Stockholm	Automotive	4 620 987 000 €

Boliden AB	Stockholm	Mining & Metals	4 405 255 000 €
Alfa Laval AB	Lund	Manufacturing	4 350 958 000 €
SAS AB	Stockholm	Airline	4 232 313 000 €
Stena AB	Gothenburg	Transportation/Trucking/Railroad	3 986 535 000 €
Husqvarna AB	Huskvarna	Consumer Goods	3 959 496 000 €
E.ON Sverige AB	Malmo	Oil & Energy	3 585 203 000 €
ABB AB	Vasteras	Electrical/Electronic Manufacturing	3 317 114 000 €
Getinge AB	Gothenburg	Medical Devices	3 309 797 000 €
Hexagon AB	Stockholm	Information Technology and Services	3 043 788 000 €
Saab (koncernen)	Linkoeping	Defense & Space	2 976 026 000 €
Trelleborg AB	Trelleborg	Mechanical or Industrial Engineering	2 715 161 000 €
IKEA AB	Almhult	Retail	2 489 075 000 €
BillerudKorsnäs AB	Solna	Paper & Forest Products	2 387 958 000 €
Nynas AB	Stockholm	Oil & Energy	2 366 907 000 €
LKAB	Lulea	Mining & Metals	1 773 399 000 €
Holmen AB	Stockholm	Paper & Forest Products	1 753 038 000 €
Tetra Pak, AB	Lund	Packaging and Containers	1 669 794 000 €
Bravida Holding AB	Stockholm	Construction	1 555 118 000 €
Nobia AB	Stockholm	Furniture	1 459 442 000 €

Nibe Industrier AB	Markaryd	Mechanical or Industrial Engineering	1 449 699 000 €
Indutrade AB	Kista	Manufacturing	1 300 602 000 €
Dometic Group AB (PUBL)	Solna	Consumer Goods	1 257 362 000 €
Eltel AB	Bromma	Construction	1 254 844 000 €
Sweco AB	Stockholm	Construction	1 246 743 000 €
Hexpol AB	Malmo	Chemical products	1 229 228 000 €
Elekta AB	Stockholm	Medical Devices	1 169 647 000 €
Siemens Industrial Turbomachinery AB	Finspang	Electrical/Electronic Manufacturing	1 099 183 000 €
Outokumpu Stainless AB	Avesta	Mining & Metals	1 093 269 000 €
ÅF AB	Stockholm	Mechanical or Industrial Engineering	1 078 336 000 €
Liljedahl Group AB	Helsingborg	Mining & Metals	1 076 085 000 €
GE Healthcare Bio-Sciences AB	Uppsala	Medical Devices	1 008 242 000 €
Beijer Ref AB (publ)	Malmo	Cooling and heating	915 225 000 €
Siemens AB	Upplands Vasby	Electrical/Electronic Manufacturing	887 792 000 €
Mölnlycke Health Care AB	Gothenburg	Medical Devices	882 875 000 €
Hilding Anders Holdings 3 AB	Malmo	Furniture	876 465 000 €
Lifco AB (publ)	Enkoeping	Medical Devices	864 915 000 €
Ovako Group AB	Stockholm	Mining & Metals	851 002 000 €
B&B Tools AB	Stockholm	Retail	850 984 000 €

Höganäs Holding AB	Hoeganas	Mining & Metals	830 870 000 €
Lindab International AB	Bastad	Building Materials	830 761 000 €
GKN Aerospace Sweden AB	Trollhattan	Aviation & Aerospace	802 399 000 €
Gambro Lundia AB	Lund	Medical Devices	789 028 000 €
Fortum Sverige AB	Stockholm	Oil & Energy	780 920 000 €
Svevia AB	Solna	Construction	762 014 000 €
Addtech AB	Stockholm	Mechanical or Industrial Engineering	729 630 000 €
Axis AB	Lund	Information Technology and Services	726 294 000 €
Axel Johnson International AB	Stockholm	International Trade and Development	709 464 000 €
Gunnebo AB	Gothenburg	Security and Investigations	662 463 000 €
Systemair AB	Skinnskatteberg	Mechanical or Industrial Engineering	634 754 000 €
Bombardier Transportation Sweden AB	Vasteras	Transportation/Trucking/Railroad	630 509 000 €
Elektroskandia Sverige AB	Sollentuna	Wholesale	621 604 000 €
Caverion Sverige AB	Stockholm	Facilities Services	608 451 000 €
Gränges AB	Stockholm	Mining & Metals	601 423 000 €
DeLaval International AB	Tumba	Machinery	591 750 000 €
Thule Group AB	Malmo	Consumer Goods	582 375 000 €
Stora Enso Skoghall AB	Skoghall	Paper & Forest Products	582 208 000 €
Inwido AB	Malmo	Building Materials	571 440 000 €

Tibnor AB	Solna	Mining & Metals	571 101 000 €
Metsä Board Sverige AB	Husum	Paper & Forest Products	570 613 000 €
ITAB Shop Concept AB	Joenkoeping	Retail	568 473 000 €
BSH Home Appliances AB	Solna	Consumer Goods	527 894 000 €
Haldex AB	Landskrona	Automotive	522 934 000 €
Brightstar 20:20 (SWE) AB	Kista	Information Technology and Services	520 962 000 €
Nolato AB	Torekov	Plastics	517 351 000 €
Cargotec Sweden AB	Kista	Mechanical or Industrial Engineering	506 103 000 €
Toyota Material Handling Manufacturing Sweden	Mjoelby	Automotive	500 348 000 €
Seco Tools AB	Fagersta	Mechanical or Industrial Engineering	494 877 000 €
Valmet AB	Sundsvall	Machinery	475 883 000 €
Meritor HVS AB	Lindesberg	Automotive	461 850 000 €
BE Group AB	Malmo	Mining & Metals	454 844 000 €
Trioplast Industrier AB	Smalandsstenar	Plastics	453 001 000 €
Munters Topholding AB	Kista	Machinery	443 067 000 €
IAC Group AB	Skara	Automotive	362 420 000 €
Nederman Holding AB	Helsingborg	Mechanical or Industrial Engineering	350 082 000 €
Schneider Electric Sverige AB	Solna	Electrical/Electronic Manufacturing	336 543 000 €
Viking Supply Ships AB	Gothenburg	Transportation/Trucking/Railroad	335 228 000 €

Metso Sweden AB	Trelleborg	Machinery	332 501 000 €
Nefab Packaging AB	Joenkoeping	Packaging and Containers	321 869 000 €
AQ Group AB	Vasteras	Mechanical or Industrial Engineering	320 950 000 €
OF Ahlmark & Co Eftr. AB	Karlstad	Manufacturing	319 416 000 €
Rexam AB	Malmo	Packaging and Containers	316 221 000 €
Akzo Nobel Surface Chemistry AB	Stenungsund	Chemical products	312 817 000 €
Fresenius Kabi AB	Uppsala	Medical Devices	312 346 000 €
Huawei Technologies Sweden AB	Kista	Information Technology and Services	309 423 000 €
Lagercrantz Group AB	Stockholm	Electrical/Electronic Manufacturing	306 453 000 €
Midroc Europe AB	Sundbyberg	Construction	305 385 000 €

APPENDIX 2: Swedish cloud statistic 2016 according to Statistics Sweden

Source: Statistics Sweden	Buy database hosting as a cloud service		Buy cloud storage services		Buy accounting applications as a cloud service		Buy CRM cloud applications		Buy computing capacity to run the enterprise's own software in cloud		Buy cloud computing as Public cloud		Buy cloud computing as private Cloud	
Share by Firm Size	Share%	± ci	Share%	± ci	Share%	± ci	Share%	± ci	Share%	± ci	Share%	± ci	Share%	± ci
10-49 employees	20	2	32	2	20	2	12	2	10	1	25	2	14	2
50-249 employees	27	4	38	3	25	3	19	3	18	3	33	3	26	3
250 employees	29	1	43	1	19	1	22	1	26	1	48	1	38	1
Share by Industry sector														
Manufacturing Industry	14	2	28	3	13	2	7	2	8	2	22	3	13	2
Energy and Recycling	21	6	24	7	10	4	8	4	10	4	27	6	16	5
Construction	16	5	32	6	23	6	7	3	7	3	23	6	9	4
Trade and car dealing	21	4	29	4	19	3	13	3	11	3	23	4	17	3
Transport and warehousing	18	6	24	6	19	6	10	4	12	5	23	6	12	5
Hotels and restaurants	14	4	23	6	15	5	9	4	7	3	13	4	8	3
ICT	39	6	63	6	42	7	41	6	36	6	53	6	38	6

Property and management	31	7	39	7	21	6	15	5	14	5	37	7	19	6
Other service companies	33	5	42	5	29	5	21	5	14	4	36	5	22	4
IT manufacturing and resale	36	6	59	6	39	7	38	6	33	6	54	7	38	6
Share by region														
Stockholm	26	3	41	4	27	3	19	3	15	2	29	4	24	3
Östra Mellansverige	20	5	29	5	16	4	12	4	10	3	26	5	14	4
Småland med öarna	20	5	27	5	19	5	11	3	8	3	25	5	11	3
Sydsverige	21	5	30	5	15	4	12	4	12	4	21	4	15	4
Västsverige	19	4	30	4	19	4	11	3	10	3	26	4	12	3
Norra Mellansverige	15	5	25	6	17	6	7	4	7	4	25	6	11	5
Mellersta Norrland	29	7	38	8		7	14	5	15	5	29	7	16	6
Övre Norrland	15	7	30	9	29	8	11	6	10	6	31	8	6	1

APPENDIX 3: Survey questions

General questions

1. What cloud computing services, more precisely SaaS (Software as a Service) services, your company is currently using?

2. What type of information system changes your company has had during the last 5 years? (New ERP, CRM, cloud services etc.…)

3. What are the biggest obstacles when choosing new / existent cloud services?

4. What are the main benefits of cloud services?

5. Do you use any collaboration tools for internal or external purposes? Which tools?

6. When choosing new cloud computing providers, how cloud computing services providers are validated?

Questions based on research question 1

7. Does your company have digitalization plans on how to meet future demands in your company (Cloud Roadmap?)

8. Do you consider top management support to have an impact when adopting cloud computing services? Why and how top management can support it?

9. Do you consider bigger firm size to motivate cloud computing adoption?

10. Has competitive pressure pushed your company to use cloud computing services?

11. Do you think that cloud computing services give your company relative advantage? Which factors motivate the most?

12. Do you consider cloud computing services to be easy to use or complex?

13. Do you find cloud computing services to be compatible with your existing information systems?

14. Do you think that your company has technical readiness to adopt cloud computing services?

15. Are your trading partners or partners in supply chain pushing you to adopt cloud computing services?

16. Are you concerned about cloud computing security?

17. Are you concerned where your data is stored when using cloud computing services?

Questions based on research question 2

18. Does your company have required IT assets to acquire and scale cloud computing related technologies?

19. Has your company given enough weight to train human resources to acquire and handle cloud computing services?

20. Do you consider trust between your company and cloud provider as important factor? Which factors increase or decrease trust?

21. Do you consider that communicating cloud services and their benefits to employees to have positive effect when deploying cloud computing?

22. Do cloud services have negative effect on employee morale? Do you consider that cloud computing services make some employees obsolete?