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INSTITUTIONALIZING CLOUD INFRASTRUCTURE: MAJOR CHANGE FACTORS AND BUSINESS REFORMATIONS

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ABSTRACT

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The purpose of this study was to investigate cloud infrastructure and platform acquisitions, deployment and institutionalization in the companies. The study perceived what factors had driven companies towards cloud computing and what were possible challenges for more extensive usage. Another point of interest was to clarify what had changed in the companies' operations from business model point of view and if changes occurred in value networks. The nature of the study was descriptive and its purpose is to create more understanding on this broad and complex topic. In the study a process model (PSIC) was used, which has been used earlier investigating information systems acquisition, deployment and changes in general. The study was carried out as qualitative and research method was chosen to be case study, which suited the process model. In the study there were three companies interviewed. As a result PSIC-models were created to describe cloud services' (IaaS and PaaS) institutionalizations.

The central challenges found were data security related issues and the need to find correct price model for each workload. Regarding the transfer of production information systems to cloud, companies continued being leery. Therefore cloud computing had not been institutionalized in the companies. Flexibility in different forms was the major driver and benefit. There is need for further qualitative research, to be able to make more general conclusion from the results. The study works best as a dialogue opener, which can be used to further understand cloud service acquisitions, deployments and institutionalization. The study illustrates the current status of the institutionalization, challenges and opportunities.

Keywords: cloud service, cloud infrastructure and platform, information technology and system, outsourcing, business model, value network, PSIC-process model

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Tutkimuksen tarkoituksena oli tutkia pilvi-infrastruktuuri- ja alusta palveluiden hankintaa, käyttöönottoa sekä käytön institutionalisoitumista yrityksissä. Tutkimuksessa hahmotettiin mitkä tekijät ovat ajaneet yrityksiä pilvipalveluiden suuntaan ja mitkä olivat mahdolliset esteet laajemmalle käyttöönotolle. Toinen mielenkiinnon kohde oli selvittää mitä yritysten toiminnassa muuttui liiketoimintamallien näkökulmasta ja oliko pilvipalvelut johtaneet muutoksiin mahdollisesti arvoverkoissa. Tutkimuksen luonto oli kuvaileva ja sen tarkoituksena oli lisätä ymmärrystä laajan ja monimutkaisen aihealueen parissa. Tutkimuksessa käytettiin prosessimallia (PSIC), jonka avulla on aikaisemmin tutkittu yritysten informaatiojärjestelmien hankintaa, käyttöönottoa ja muutosta kokonaisuudessaan. Tutkimus toteutettiin laadullisena tutkimuksena, jossa tutkimusmenetelmäksi valittiin prosessimalliin soveltuva tapaustutkimus. Tutkimuksessa haastateltiin kolmea eri yritystä. Tuloksien pohjalta luotiin lopputuloksena PSIC-mallit kuvaamaan pilvipalveluiden (IaaS ja PaaS) institutionalisoimista.

Keskeisenä haasteena tunnistettiin tietoturva-asiat ja oikean hinnoittelumallin löytäminen kullekin erilaiselle työkuormalle. Etenkin tuotantojärjestelmien siirron suhteen ollaan edelleen varautuneita, täten pilvi-infrastruktuuri ei ole vielä institutionalisoitunut yrityksissä. Suurimpana työntötekijänä ja hyötynä koettiin olevan pilvipalveluista saatava joustavuus eri muodoissa. Lisätutkimuksia on syytä tehdä, esimerkiksi määrällisenä, jotta tuloksia voitaisiin tehdä laajempia päätelmiä. Tutkimus toimii parhaiten keskustelun avaajana, mitä voidaan käyttää ymmärtääkseen pilvipalveluiden hankintaa, käyttöönottoa ja institutionalisoitumista yrityksissä. Tutkimus avaa institutionalisoitumisen nykytilaa, haasteita ja mahdollisuuksia.

Asiasanat: pilvipalvelu, pilvi-infrastruktuuri- ja alusta, informaatioteknologia- ja järjestelmä, ulkoistaminen, liiketoimintamalli, arvoverkko, PSIC-prosessimalli

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1 INTRODUCTION

These days it seems that cloud computing is stretching everywhere and people are using cloud computing technologies without even noticing it. Many times cloud computing solutions and technologies are hidden for the end-user. Cloud might have some hype around it, but there is plenty of unused potential within it. IDC has analysed that during 2013 uptake of on-premises clouds, hosted dedicated clouds, and virtual private clouds reached 40 % growth (Ahorlu, 2013). Other IDC studies forecast that there remains potential for replacing or supplementing corporate IT systems with infrastructure as a service (IaaS) and so far only a small share of the potential market has been achieved. In 2011 public and virtual private IaaS were worth a combined 1,6 billion USD and is forecasted to grow to 6,3 billion USD in 2016. In 2011 dedicated private cloud market was worth one billion USD and is expected to grow to 9,3 billion USD in 2016 (Ahorlu, Bradshaw & Eibisch, 2013.).

Without a doubt this thesis is actual as the cloud hype is moving from the hype stage to realization on a bigger scale. Therefore it is interesting to investigate what kinds of changes occur in these organizations that deploy cloud computing technologies and services and at what stage the cloud institutionalisation is at as of now.

1.1 Introduction to the theme and thesis

The thesis investigates institutionalization of cloud computing and what kind of transformations it has for the organizations and on their businesses. This study is one of a kind as there is no other study, as far as the undersigned is concerned, which has studied cloud computing institutionalization by using PSIC-model. There are three companies that have been interviewed and those results are reflected against previous literature. The research problem, aim and scope are described in more detailed in a chapter 1.2 and the entire structure description of the thesis can be found from the chapter 1.3. In this chapter is a little his-

tory of IT-Outsourcing presented. This way it is easier to understand the progression towards cloud technologies and its deployment.

At the beginning of the IT-outsourcing phenomenon the focus was on the decision whether the companies should provide IT services internally or externally. At the later stage organizations started to refine the scope of outsourcing which lead to distinction between selective and total outsourcing. In the past traditional outsourcing model, the physical resources were kept either by the customer or the provider (Leimeister, Böhm, Riedl & Krcmar, 2010.). According to Leimeister et al (2010) the central motives for outsourcing decisions are still mainly economical benefits such as flexibility of costs and cost savings, but there are as well technological advantages, innovation, strategic aims, and business-oriented advantages, more precisely will to increase service quality or increase flexibility of the business.

Customers are expecting more customer-specific innovations, cost efficiency, efficient and flexible delivery of IT services from their service providers. Above challenges posed by clients has emerged the new phenomenon of cloud computing. This new model of cloud computing heralds the paradigm of an asset-free provision of technological capabilities (Leimeister, et al 2010.). Predecessors of the cloud computing have existed for some time, but the cloud term became somewhat popular around 2007, when major information technology companies announced collaboration in that domain (Vouk, 2008). The latest approach to outsourcing is the relationship management, which is a key factor to a successful outsourcing project (Leimeister, et al 2010).

It seems that organizations are still paying attention on economical aspects when outsourcing IT, but these links to financial performance indicators are not always that straightforward and therefore it is interesting to investigate this topic in more detail. Today IT outsourcing can be complex entity where various partners are co-operating towards creating value for the final users. Cloud usage is seen as one way of outsourcing in this study.

1.2 Research problem, aim and scope

This study is investigating why organizations are deploying cloud computing, especially infrastructure as a service (IaaS) and platform as a service (PaaS). The goal is to reveal factors where organizations pay attention when deploying the above-mentioned services. Another interesting point is to denote those factors and why organizations are reluctant to move towards cloud or why not doing it on bigger scale. Second goal in this study is to illustrate key reformations of the changes that deploying cloud results in the organizations' business and in the organization itself. These changes are studied from the business model and value network point of views.

There exists a high number of studies on the software as a service (SaaS) level, but there has not been that many studies investigating how these three levels are orchestrated together and what benefits IaaS and PaaS models can give to organizations, which are enabling SaaS services for the end-customers.

Previous literature has pointed out factors favouring a move into cloud as well as resistance factors. This study focuses on Finnish information system industry and is illustrating if those factors pointed in the literature are applicable. There have not been many information system researches done in cloud computing, using process theory like in this study. This thesis is descriptive and creates more understanding around this broad topic. The thesis is seen as theory testing and moreover uncovers factors that have not been mentioned before in the previous literature. Research questions are formulated as

1) *Why are organizations acquiring IaaS and / or PaaS services and how have the organization moved towards cloud computing environments?*
2) *What kind of affects have the cloud infrastructure / platform deployment had for the organization's business and for the organization itself?*

1.3 Thesis structure

This study has in total eight main chapters, the first chapter is introduction and the last one includes summary and conclusions. In the first section in chapter two is described the target area of this study. The aim of the chapter is to introduce what cloud computing is and in what forms it can be deployed. The second chapter presents what the current studies and literature say about cloud. These theories are presented in a later stage when the results from the empirical study are reflected against them. This chapter is to deepen the understanding of the themes around cloud, which are dealt with throughout this study.

The third chapter presents theory of the business models and value networks and how they align with cloud services. These are presented as the empirical study investigates whether changes occurred on them or not. In the fourth chapter the framework used (PSIC) is presented and it is opened up. The fifth chapter presents the execution of the empirical study, meaning the chosen research method as well as the data gathering and processing.

In the sixth chapter the material from the empirical study is processed, meaning the results from the interviews. In the seventh chapter the results from the empirical study are presented, and conclusions & implications are drawn. The eighth chapter concentrates wrapping up the study and summarizing what has been done, why and what were the results and the limitations and the future research suggestions are pointed out.

2 CLOUD COMPUTING

This chapter presents cloud computing in general and what there has been written in the previous literature. Moreover business and economic point of views of cloud computing are discussed. This chapter acts as background for the forthcoming chapters and themes that are discussed. The aim is to explain perfunctorily what cloud computing is and what different levels and deployments models exist.

2.1 Cloud computing in general

Information technology has had tremendous impacts from the emergence of cloud computing over the few years, where large companies strive to provide more powerful, reliable and cost-efficient cloud platforms, and business enterprises are looking for reshaping their business models to gain benefit from this paradigm (Zhang, Cheng & Boutaba, 2010). Even though cloud has gained much hype and interest in business, there still does not exist only one generally accepted definition for it. Here are presented two different definitions for cloud. Vaquero, Rodero-Merino, Caceres, Lindner (2009, p. 51) describe cloud as the following:

> Clouds are a large pool of easily usable and accessible virtualized resources (such as hardware, development platforms and/or services). These resources can be dynamically reconfigured to adjust to a variable load (scale), allowing also for optimum resource utilization. This pool of resources is typically exploited by a pay-per-use model in which guarantees are offered by the infrastructure provider by means of customized SLAs (service-level agreements).

Second definition is from the National Institute of Standards and Technology (NIST) (Mell and Grance, 2011, p. 2), which is widely accepted in the industry and there cloud is described in the following way:

> Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models.

It is important to note that the NIST definition omits virtualization as key criteria. In this study cloud is understood as a mixture of all these previous descriptions. What in this study is seen as important is dynamic on-demand self-service providing computing resources for organizations with great flexibility, speed and an ability to scale up and down resources with billing model, which is based on the resource usage. What technology lies behind the definition is not considered that important for the general description. Also Stadtmueller (2014) argues, "the cloud is primarily a provider model- an efficient way to deliver IT resources to users".

The main reason for many existing different definitions of cloud is that cloud computing, unlike other technical terms, is not a new technology, but it is rather a new operations model that brings together a set of existing technologies to run business in a different way (Zhang, et al 2010). Such related technologies are for example grid computing, service-oriented computing (Dillon, Wu & Chang, 2010), utility computing, virtualization, autonomic computing (Zhang et al 2010), and cluster computing (Buyya et al 2008).

2.1.1 Cloud essential characteristics

Five essential characteristics of cloud computing are presented by Mell and Grance (2011); Dillon et al (2010), which are on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service. According to Zhang et al (2010) there are seven characteristics of cloud computing, which are multi-tenancy, shared resource pooling, geo-distribution and ubiquitous network access, service oriented, dynamic resource provisioning, self-organizing, and utility based pricing.

Self-service means that consumers can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically and there is no need for human interactions with each service provider (Mell & Grance, 2011.). This automated resource management feature yields high agility and service providers can quickly respond to rapid changes in service demand (Zhang et al 2010).

Broad network access promotes use by heterogeneous thin or thick client platforms and the capabilities are available over network and accessed through standard mechanisms (Mell & Grance, 2011.). Hence any device with internet connectivity is able to access cloud services (Zhang et al 2010).

Cloud provider's can serve multiple consumers using multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. For example resources are storage, processing, memory, network bandwidth, and virtual machines (Mell & Grance,

2011.). Assigning shared resources dynamically provides much flexibility to infrastructure providers for managing their own resource usage and operating costs (Zhang et al 2010).

Rapid elasticity means that capabilities are provisioned, in some cases automatically, to quickly scale out, and rapidly released to quickly scale in. For the consumers the capabilities appear to be unlimited and can be purchased in any quantity at any time (Mell & Grance, 2011.). Computing resources can be obtained and released on the fly, based on the current demands, which can significantly lower operating costs (Zhang et al 2010).

Measured service means that resource usage can be monitored, controlled, and reported, providing transparency of the utilized service and this can be done automatically by cloud system's metering capabilities (Mell & Grance, 2011.). Negotiated service level agreements are important objective of every cloud provider (Zhang et al 2010).

Zhang's et al (2010) point out two more essential characteristics. Utility-based pricing is the same as pay-per-use and this pricing model can occur on different cloud architectural levels. Multi-tenancy means that services owned by multiple providers can be located in a single data center, where the performance and management issues of these services are shared among service - and the infrastructure provider.

In many occasions virtualization is considered as key character of cloud, but Stadtmueller (2014) argues it is not necessary, bare metal servers provide flexibility and scalability on higher levels of performance and consistency. Bare metal cloud solutions are persuading cloud-sceptical businesses and performance-sensitive workloads (high Input/Output processing requirements), which earlier may not have been thought suitable for cloud deployment. Bare metal cloud server is dedicated to a specific tenant, it is not multi-tenant, and the basic unit is an actual server, which configurations (such as number of processors, memory and storage) user can choose. Moreover bare metal cloud fulfils many key characteristics of cloud such as on-demand capacity, usage-sensitive pricing, and self-servicing and broad network access. (Stadtmueller, 2014.).

2.1.2 Cloud service models

Cloud computing systems are seen to fall into one of five layers: applications, software environments, software infrastructure, software kernel, and hardware (Yousseff, Butrico & Da Silva, 2008). These five layers are presented in the figure 1 in the main block. In the figure vertical arrows represent continuous (24/7) services divided according to the layersoft cloud technology architecture, while on the left side are functional off-line services (horizontal arrows) and component providers (Autere, et al 2010).

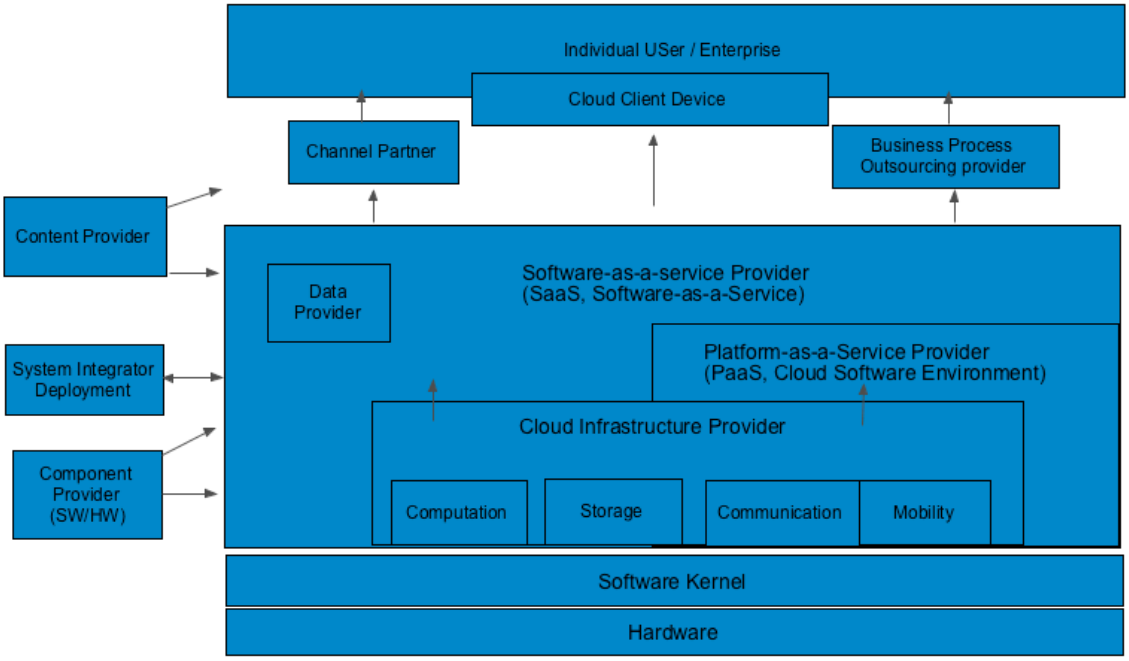

FIGURE 1 The expected cloud industry structure (Autere, 2010, p.28)

Cloud application layer, such as SaaS (Software as a Service) is the most visible layer to the end-users of the cloud. Cloud application services are commonly provided through web-portals. Cloud application layer can be developed on the cloud software environments or infrastructure components (Youssef, et al 2008).

From SaaS can be derived concept of Business Process as a Service (BPaaS), which is not shown in the Youssef's, et al's ontology. In the BPaaS enterprise cloud providers offer methods for the modelling, utilization, customization and (distributed) execution of business processes, traditionally referred to as workflows. In this model the cloud consumers can rely and access predefined process descriptions, customize the processes, and remotely execute the process in the cloud (Accorsi, 2009.). These on demand applications offered by cloud providers allow companies to outsource their processes (Bentounsi, Benbernou & Atallah, 2012).

Platform as a Service (PaaS) is normally used by cloud application developers when implementing their applications and deploying them on the cloud. Platforms are programming-language-level environments with well-defined Application Programming Interfaces (APIs) facilitating the interaction between the environments and the cloud applications (Youssef, et al 2008.). Platform is the level where the systems run on (Vaquero, et al 2009). PaaS can be seen as a solution stack, which consumes infrastructure and incorporates run-time environments, databases, middleware and programming environments (Autere, et al, 2010.).

The cloud infrastructure is a fundamental resource to other higher-level layers, which in turn can be used to construct new cloud software environments or cloud applications. Services offered in this third layer can be categorized in to three sub-categories: computational resources, data storage, and communications (Youssef, et al 2008.).

Infrastructure as a Service (IaaS) is seen as a form of hosting, including network access, routing services and storage. IaaS provider is generally providing the hardware and administrative services needed to store applications and a platform for running applications (Bhardwaj, Jain & Jain, 2010.). Virtual machines are the most common form for providing computational resources to cloud users (Youssef et al 2008). Through virtualization infrastructure providers are able to split, assign and dynamically resize these resources to build ad-hoc systems as demanded by customers (Vaquero et al 2009). Ahola, et al (2010) differentiate IaaS and PaaS in the following way:

> "The biggest difference between PaaS and IaaS seems to be that PaaS usually assumes a certain kind of application model, together with associated libraries and system software, whereas in IaaS the developers have more freedom to select the systems they want to use".

Data Storage is the second infrastructure resource, which allows users to store their data at remote disks and access them anytime from any place (Youssef, et al 2008) just like operating on a local disk (Wang, et al., 2008). Data as a Service (DaaS) facilitates cloud applications to scale beyond their limited servers (Youssef, et al 2008.).

Communication as a Service (CaaS) supports requirements such as communication capability that is service oriented, configurable, schedulable, predictable and reliable. Beyond these CaaS is seen to support network security, dynamic provisioning of virtual overlays for traffic isolation or dedicated bandwidth, guaranteed message delay, communication encryption, and network monitoring. CaaS is seen to be the least discussed and adopted cloud service in the commercial cloud systems (Youssef, et al 2008.).

Software Kernel cloud layer provides the basic software management for the physical servers that compose the cloud. At this level the software kernels can be implemented as on operating system kernel, hypervisor, virtual machine monitor and/or clustering middleware (Youssef, et al, 2008.).

Hardware and firmware are seen to be the bottom of the cloud stack, which are the actual physical hardware and switches. Users of this cloud layer are normally big enterprises with huge IT requirements for whom the Hardware as a Service (HaaS) providers operate, manage and upgrade the hardware on behalf of the consumers (Youssef, et al, 2008.).

2.1.3 Cloud deployment models

There exist four generally accepted cloud deployment models: private cloud, public cloud, hybrid cloud, and community cloud. In a private cloud the cloud infrastructure is operated solely for an organization. Management of the private cloud can be done by the organization or a third party and can be located on premise or off premise (Mell & Grance, 2011.). Public cloud infrastructure is made available to a general public, but it can also be more reduced focus group such as large industry group. Public cloud is normally owned by the organization selling cloud services (Mell & Grance, 2011.).

Hybrid cloud infrastructure is a composition of two or more clouds that remain unique entities, but are bounded together enabling data and application portability. Community cloud infrastructure is shared by organizations that have common interest towards this kind of solution for specific reasons such as security (Mell & Grance, 2011.). The deployment model depends on the interest of the acquiring organizations and benefits and disadvantages should be considered on each case.

In the figure 2 are modelled different cloud deployment models. Fully shared platforms (public cloud), physically shared but securely partitioned platform (virtual private cloud) and fully dedicated platform (dedicated private cloud) are normally located on service provider site. Customer can self run private cloud on their premises or cloud can be managed for the customer on their site from fully dedicated platform (Ahorlu, et al., 2013.). Managed private cloud solutions can be also on service provider's premises.

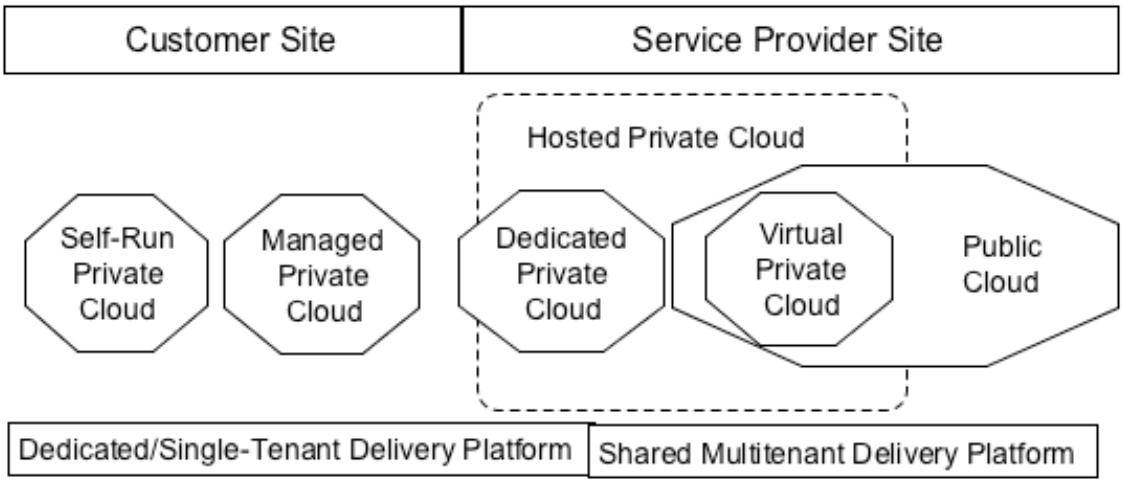

FIGURE 2 Cloud service deployment models. (Applied from Ahorlu, et al., 2013, p.3)

2.2 Benefits of cloud computing

Many times cloud benefits are tackled from the cost point of view (Marston, Zhi, Bandyopadhyay & Ghalassi 2011), but like recent literature illustrate that there are many other aspects in favour of cloud-based solutions like Phaphoom, et al (2013) state that the cloud adaption drivers have shifted from cost to other benefit areas. Gartner analysis reveal that consumption-based billing is an attractive value proposition for cloud computing services; nevertheless many organizations are finding more tangible benefits from cloud computing than just at the bottom line (Smith, et al 2013). What cloud computing really brings to IT is efficiency and business agility (Marston, et al 2011).

Cloud provides mechanisms for expanding product channels, technology integration and collaborations, enhanced analytical capability, and removal of non-value oriented work. It also provides an easy way to try new trial versions with the customers and gauge their interest. Cloud platforms make it easier to

combine enabling technologies to serve market requirements and improve business agility giving organizations flexibly and rapidly response to changes in business environments. Outsourced manual work is seen to increase work satisfaction and accelerating creativity. Enhancements of resources are seen to support innovation and value creation processes. It is also stated that cloud can contribute to improved organizational image, enhanced variability and capability of new products (Phaphoom, et al 2013.).

Employee's collaboration is facilitated by cloud platforms with integrated development and deployment environments. Work can be shared easily and access to applications built by others is rather easy. When public PaaS is used there is not many problems related software purchases, maintenance and integration issues and developers can focus on software development, which leads to improved productivity (Phaphoom, et al 2013.).

Besides cloud saving companies money it can also reduce the number of employees that the company must hire. From this standpoint cloud computing solutions are extremely beneficial for new businesses trying to get started (Aljabre, 2012). In conventional hosting models capacity is underutilized some days of the month while data center is provisioning for the peak load and instead, cloud computing comes cheaper as organizations pay by the hour price for computing resources. Hourly rent rate might be more expensive than the in-house solution, but the pay-as-you-go model potentially leads to cost savings in total. Pay-as-you-go purchased hours can be distributed non-uniformly in time and even if the pricing was more expensive than buying and depreciating a comparable server over the same period, it is argued that the cost is outweighted by the cloud computing benefits of elasticity and transference of risk (Armbrust, et al, 2010.). The simplified resource management is seen important, due to the risk of over-provisioning and under-provisioning of resources. Also organizations that are using public cloud are ensured to align with technological advancements (Phaphoom, et al 2013.).

Hardware benefits arise from virtualization, which provides a way to consolidate distributed hardware resources, allowing for standardized and centralized management. Cloud computing can reduce the number of servers in their maintenance scope by allocating and de-allocating underutilized resources to serve different departments. Talking about system quality, cloud is seen to facilitate security, resilience and scalability management processes. Economies of scale and concentration of hardware units can reduce the cost per resource unit when for example parameterizations are implemented at larger scale and it is easier to ensure that security processes are executed in a consistent manner. Features such as multi-location deployment and redundancy enhance availability of systems running on cloud infrastructure. Also business continuity planning is getting benefits from cloud computing compared to geographically dispersed data centers (Phaphoom, et al 2013.).

Cloud does provide a way to increase efficiency of maintenance and recovery process. Upgrading systems is mitigated with virtualization management tools, which are featured with workload migration between hardware platforms. In general the manual workload is reduced by cloud computing technologies when the work can be done in a more automated manner

(Phaphoom, et al 2013.). End-user support issues have also proven to be less of a concern with cloud-solutions as single code base and multi-tenant architecture make it easier for the provider to respond to a set of common problems rather than diagnosing customer specific issues. User interfaces are seen to be user-friendlier and workflow design more closely match today's business processes. Legacy applications were often designed to accommodate IT requirements rather than to meet-user needs (Kaplan, 2007.).

Linthicum (2009) has noted six general benefits that cloud computing enables:

1. Costs: cloud computing is normally cheaper solution than building up data center. Costs are based on usage, which makes it the core benefit.
2. Data networking: cloud solutions locating in Internet enable creating additional value for organizations in many ways. Additional value is achieved when other Internet components can be combined with cloud services and this with coming information shared in multipolar organization.
3. Innovativeness: Cloud services and the solutions they enable are new, modern and innovative. Cloud services offer new ways to create benefits and additional value for the capital invested in services.
4. Scalability: organizations utilizing cloud services are capable increasing capacity as much and whenever they want. Resources can be scaled based on the need.
5. Rapid set up of cloud environment: deploying cloud services is rather fast, only taking hours or few days. Cloud resources are normally available after registration into the system.
6. Cloud computing is a green choice: not every firm need to possess their own data center. Cloud computing is marketed as an environmentally friendly choice.

2.3 Evaluating cloud in economical terms

Information technology does not have inherent value, which means that just posing technology does not confer any benefit or create value, but benefits result from effective use of IT assets. Benefits arise when IT enables working differently (Peppard, Ward & Daniel, 2007.). Financial benefits are seen to appear as a consequence of efficient business operations, new approach to IT maintenance, and economies of scale. Operational costs are reduced by the reduced cost per transaction, the ability to scale, and standardizing systems and processes (Phaphoom, et al 2013.). One of the main advantages is the possibility to reduce the quantity of upfront IT investments and turn them into operational expenses (Phaphoom, Wang & Abrahamsson, 2013; Etro, 2009). Generally speaking cloud appeals to many organizations, because they do not have to acquire additional devices to support new applications and therefore the money

can go to other uses (Kaplan, 2007). Cloud computing is also seen to reduce IT management, operational, and maintenance costs as well as datacenter's cost variability to prepare for unpredictable and changing demands (Phaphoom, et al, 2013.). As expenses are reduced these savings can be directed for new investments /strategic projects for direct business benefits (Aljabre, 2012; Kaplan 2005).

Successful IT investments will have a positive impact on all levels of the business value hierarchy (figure 3) (Weill and Broadbent, 1998). The business value hierarchy illustrates different levels where business value is created and how information technology business value can be measured. The first two levels concentrate more on system performance and cost measures and the two upper levels focus on economical indicators.

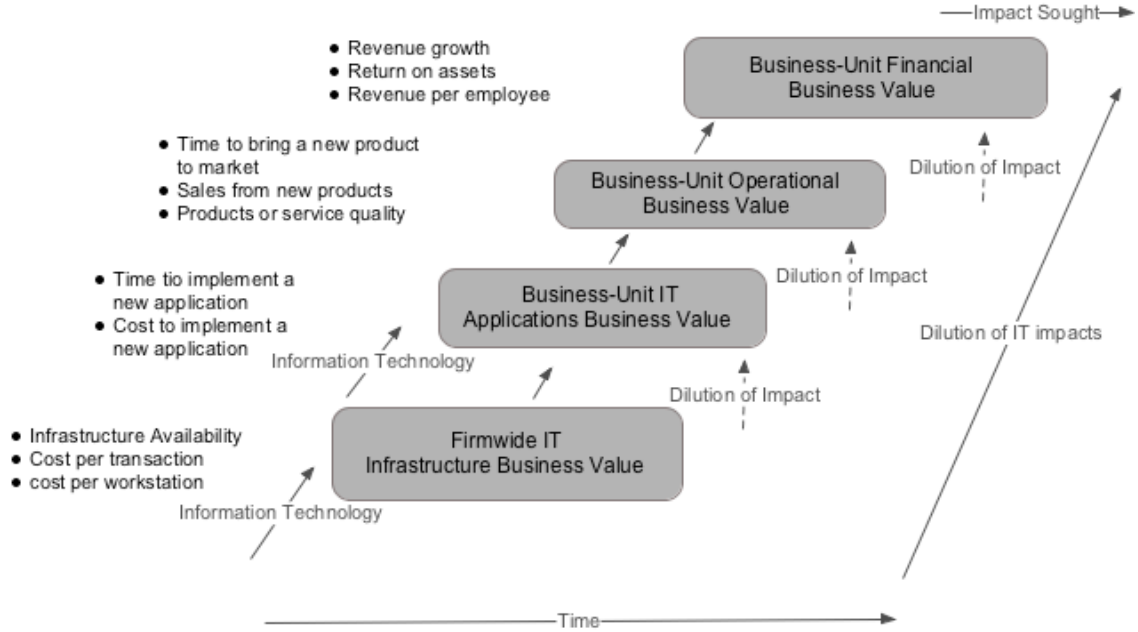

FIGURE 3 Business value hierarchies and IT investments (Weill and Broadbent, 1998, p.50)

The first level of business value is provided by the firmwide IT infrastructure, measuring for example availability. The second level of business value is provided by business-unit IT performance, measuring for example time and cost of new application implementation. The third level comes from business-unit IT performance of the business, measuring new products' quality and time to market. The highest level measures financial performance of the firm (Weill and Broadbent, 1998.).

Investments in IT are made at the two bottom levels of the hierarchy and measuring takes place at the bottom two levels and performance at all four levels, which is key to assessing business value. As the impact moves up the levels, other factors, such as pricing decisions and competitor moves, dilute the impact. This leads to the fact that measuring benefits is much easier at the bottom levels of the hierarchy where are not so many dilution factors (Weill and Broadbent, 1998.).

Cloud pricing model is based on usage and this provides an ability to pay for computing resources on a short-term basis, which in turn creates flexibility in financial planning. Datacenter's cost variability is reduced as it becomes unnecessary to prepare IT resources for unpredictable demand in advance. Physical space requirements are not needed in the same way, which can lead to lower real estate costs. From strategic point of view the benefits are the ability to reduce upfront IT investments, transform capital expense to operational expense and increased flexibility in investment distribution (Phaphoom, et al 2103.).

Measuring cloud benefits in economical terms is not always fast and easy job. There are techniques available to quantify the amount and timing of benefits of IT implementation in financial terms, such as return on investment, internal rate of return and net present value (Love, Irani, Standing, Lin & Burn, 2005). Anyhow, according to Vouk (2008) it is complicated task to measure return on investment and total-cost-of-ownership, but the cost of service construction, maintenance and commonality definitely play a role. Besides of all the costs (direct operational expenditures and indirect costs) also cash flows resulting from the underlying business models should be taken into account when valuating cloud-computing services (Klem, et al, 2009). Phaphoom, et al (2013) note that manifesting certain types of benefits require time and cannot be precisely quantified in mathematical terms.Cloud providers charge for their services based on utility computing model. Therefore, the pricing schemes can be used in order to determine the direct costs of the cloud-computing scenario. There are such indirect costs as learning to use tools, gaining experience with cloud computing technology, or failing to meet business objectives, but there is no easy way to measure how these can be done (Klems, Nimis & Tai, 2009.).

It has been investigated that the use of cloud infrastructure promises enterprises a reduction in IT costs and faster time to market and improved scalability. While the workload is stable and predictable, public cloud's unit cost is higher than the private cloud's or in-house infrastructure solution's unit costs. Anyhow, public cloud infrastructure offers a good change to respond on uncertainties and unpredictable situations, when the demand exceeds the threshold value, even the unit cost might be more expensive. Therefore hybrid cloud can be the most cost-effective solution in overall in certain situations, where the optimal cost division between the private and the public capacity is found out (Mazhelis & Tyrväinen, 2012).

2.4 Adoption challenges

Cloud computing is not just about pure benefits. In the literature can be found many factors why organizations are still feeling reluctant moving to cloud. Organizations might deploy cloud in someway, but the speed and amount at which it occurs might not always satisfy all the vendors.

One of the biggest adoption challenges is that someone else is responsible organization's application performance and service provider safeguards corporation's data; therefore organizations have to think if they are ready to this kind

of change (Kaplan, 2007). Third-party data control concerns include due diligence, auditability, contractual obligations, cloud provider espionage, data lock-in, and transitive nature (cloud providers might use subcontractors over whom cloud users have even less control). Many major corporations that have already deployed cloud are for the most part putting only their less sensitive data in the cloud and testing the waters with smaller projects (Chow, et al 2009). One solution to security issues is to split and mix data into different clouds and interfaces, but this solution comes with extra financial cost and it can also affect the system performance (Dillon, et al 2010).

Besides of third-party data control issue there are concerns of traditional security and availability. Traditional security concerns involve fear of computer and network intrusions or attacks that will be made possible or at least easier by moving to the cloud (Chow, et al 2009.). Even there exists enormous amount of security in the cloud, still the data is transmitted through normal underlying Internet technology and therefore the concerns which are threatening the internet are also threaten the cloud (Subashini & Kavitha, 2011). These traditional concerns include Virtual Machine (VM) level attacks, cloud provider vulnerabilities, phishing cloud provider, expanded network attack surface, authentication and authorization, and forensics in the cloud. However, cloud providers argue that their security measures and processes are more mature and tested than those of the average company. Availability concerns include uptime, single point of failure, and assurance of computational integrity (Chow, et al 2009.).

IDC study shows major challenges that prevent cloud computing from being adopted. From the survey can be picked up concerns, such as integration problems with in-house IT, lack of customization abilities, concern that cloud will cost more, bringing back in-house might be difficult, and not enough major suppliers yet. There are also some concerns about the costing model; while cloud can reduce the infrastructure cost, it can on the other side raise the cost of data communication. Therefore, transactional applications may not be suitable for cloud computing from a pure economic point of view if the cost saving do not offset the extra data transfer cost (Dillon, et al 2010.).

Providers can provide cloud-computing services collaboratively and there can appear heterogeneity on security approaches and privacy mechanisms (Takabi, Joshi & Ahn, 2010). It is seen important that cloud-computing solutions include activity-reporting mechanisms to demonstrate accountability and to provide an audit trail (Kaplan, 2007). Business continuity strategy is a key factor for large customers to migrate to cloud (Armbrust, et al 2010). Disaster recovery plan is other crucial factor, which has to be in place for any unplanned emergencies. Disaster recovery is essential part ensuring safety of the enterprise data and minimal downtime for enterprises (Subashini & Kavitha, 2011.).

Chow, et al (2009) state that many of the cloud related issues are essentially old problems in a new setting, although they may be more acute. This statement is aligned with earlier chapter where is referred to Zhang, et al (2010) that cloud computing is not a new technology, but it is rather a new operations model that brings together a set of existing technologies to run business in a different way. Dillon, et al (2010) write that at the time of their paper release organizations were more conservative in employing IaaS compared to SaaS.

2.5 IT acquisitions

Earlier outsourcing decisions were made around cost reduction, but sourcing motivations have evolved towards meeting more complex needs besides the cost savings (Kerin, Sutula & Halferty, 2013). Cloud should not be pursued for its own sake, it should represent a means to grow and differentiate the business (Stadtmueller, 2012a). Outsourcing IT gives an opportunity to focus on core competencies and there is no such need to run business with technical employments (Phaphoom, et al 2013).

There are identified different types of IT investments, problem-based – and innovation-based interventions. In the problem-based interventions, organizations can usually identify and quantify the benefits of removing known problems through new ways of executing business processes and activities. In innovation-based interventions, the possible benefits are not always clear and due to uncertainties the objectives and scope may well change during implementation as organizations learn what can be achieved with the new technology (Peppard, Ward & Daniel, 2007.). In the problem-based intervention an organization invests in IT primarily to improve performance to: overcome an existing disadvantage against competitors, prevent performance from deteriorating in the future to a level that would put it at a competitive disadvantage, achieve stated business goals, or remove constraints preventing opportunities from being taken. In an innovation-based intervention, an organization invests in IT to exploit a business opportunity, to create potential competitive opportunities, or building new organizational capabilities by: doing something new with IT, working in a new way using IT, or using new technology to do something that was not possible before (Peppard, et al 2007.). Cloud industry is quite competitive and competition occurs also at the customer satisfaction level (Aljabre, 2012).

According to Linthicum (2009) organizations, which are planning a move to cloud computing, should understand the current problems and possible cloud-based solutions, compare costs versus the proposed cloud-based solution, model current state (as-is) and target state (to-be) at system architectural level, define value propositions, define hard and soft factors, and create a business for the use of all the stakeholders.

Partnering strategies matter, they seem to have impact on financial implications. The organizations that perform the best are pursuing more business-oriented, innovation driven outcomes from their sourcing relationships. These best performance executors place a higher priority on business objectives and agility and are able to innovate and capitalize on those growth opportunities. These organizations are more focused on anticipating market and technology shifts and therefore responding faster than competitors (Kerin, et al 2013.). To be able to succeed on cloud it is suggestible to select a partner with the most robust cloud portfolio, allowing building cloud strategy, without backtracking (Stadtmueller, 2012b).

3 BUSINESS MODELS & CLOUD VALUE NETWORK

This chapter presents business models and value network theories. This chapter is important in the latter stage when the empirical part is investigated whether the institutionalization of IaaS & PaaS technology has had some changes on organization's business models or / and in value networks.

3.1 Business models

Osterwalder and Pigneur (2010, p.14) define the business model: "A business model describes the rationale of how an organization creates, delivers, and captures value". Baden-Fuller and Haefliger (2010, p. 1) describe business model as "a system that solves the problem of identifying who is (or are) the customer(s), engaging with their needs, delivering satisfaction, and monetizing the value. Teece (2010) express that "a business model articulates the logic, the data, and other evidence that support a value proposition for the customer, and a viable structure of revenues and costs for the enterprise delivering that value".

Business model can be opened up through Osterwalder's and Pineur's (2010) nine building blocks, which show the logic of how a company intends to make money:

1. **Customer segments**: organizations serve normally customer segments that can be grouped into various distinct segments. By grouping the customer segments aims to find profitable customers.
2. **Value propositions**: organizations need to answer on customer problems and satisfy their needs with value propositions. Value proposition is an aggregation, or bundle, of benefits that an organization offers customers.
3. **Channels**: describe the way the value propositions are delivered to customers through communication, distribution and sales channels, in other words company's interfaces with the customers.

4. **Customer relationships**: companies should clarify the type of relationships they want to establish and maintain with each customer segments.
5. **Revenue streams**: are results from value propositions successfully delivered to customers meaning the cash a company generates from each customer segments. There might be multiple revenue streams and they can have different pricing mechanics.
6. **Key resources**: key resources refer to all the assets that are required to offer and deliver the previously described elements. Key resources can be owned by the company, leased or acquired from key partners. These resources can be physical, intellectual, human or financial.
7. **Key activities**: key activities that are needed to offer and deliver the previously described elements, such to said the most important actions the company must take to operate successfully.
8. **Key partnerships**: organizations do not hold all the activities within the company, but some of them are outsourced and some are acquired. Alliances are created to optimize the companies' business models, reducing risks, or acquiring resources.
9. **Cost structure**: all the business model elements result in cost structure and therefore the cost structure describes all costs incurred to operate a particular business model.

In the figure 4 these building blocks are modelled in a Canvas. Fritscher and Pigneur (2010) have grouped the building blocks in four perspectives. Value proposition is in the middle in its own perspective, cost structures and revenues are grouped into financial perspective. Activity perspective indicates how value proposition is produced and customer perspective how it is consumed. Arrows represent strong relationships between blocks and the relationships are named to give better understanding of their nature (Fritscher & Pigneur, 2010.).

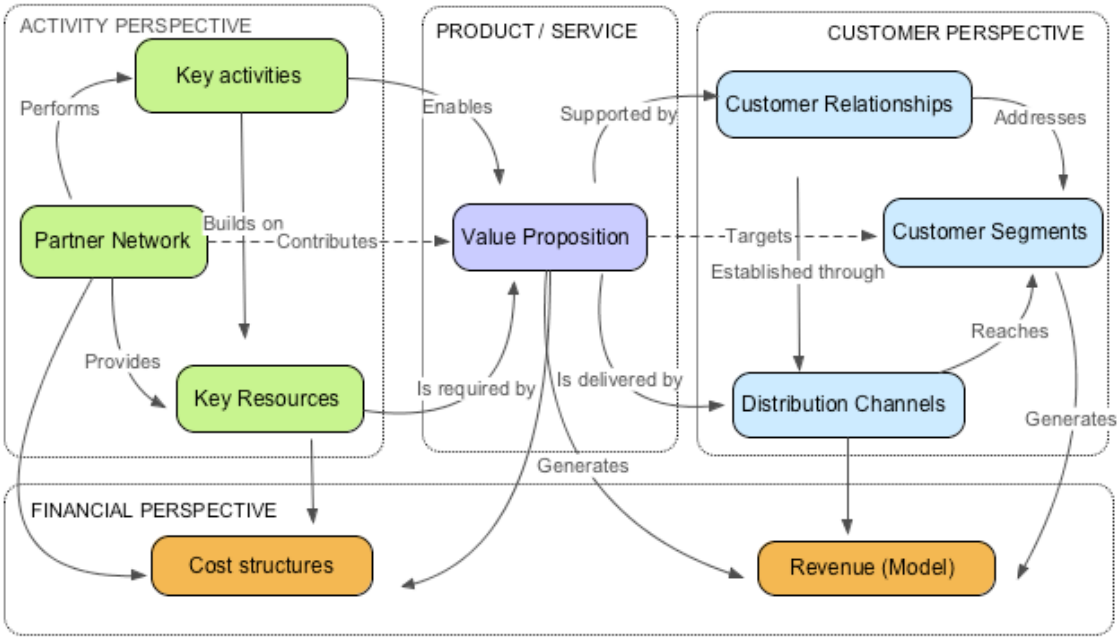

FIGURE 4 Business Model Canvas. (Fritscher & Pigneur, 2010, p.32)

Normally new ideas and technologies are commercialized through business models (Chesbrough, 2010). Markets vary over time and software firms must adjust their offerings and business models to adapt changes in the market conditions (Ojala & Tyrväinen, 2011a), but also change in a firm's product can lead to changes in its business model (Baden-Fuller & Haefliger, 2013). By shaping, adapting and renewing business models companies can create value over extended periods. Anyhow these changes cannot always be anticipated fully in advance, but they might need trial-and-error learning. Important capability fuelling business model change is to identify, experiment with and exploit new business opportunities. To realize these opportunities requires resources and competencies (Achtenhagen, Melin & Naldi, 2013.). If same technology is commercialized in two different ways, it can yield into two different returns (Chesbrough, 2010), a poor choice can lead to lower profits while a good choice to superior profits (Baden-Fuller and Haefliger, 2013). Chesbrough (2010, p. 355) states, that: "it is probably true that a mediocre technology pursued within a great business model may be more valuable that a great technology exploited via a mediocre business model". Anyhow, business models are often transparent from its gross elements and somewhat easy to imitate, therefore it is usually just a matter of time before and evidently successful new business model elicits imitative efforts (Teece, 2010).

Technological innovations influence on firm's performance (Baden-Fuller and Haefliger, 2013), but there is no single objective value that technology itself has and its economic value remains latent until it is commercialized in some way via a business model (Chesbrough, 2010; Teece, 2010). Firm's resources, competences, its organizational system and the value propositions it offers are interacting in a way that increase or decrease firm's performance. Hence when a change occurs in organization, it does so systematically, so that each changing

element may impact the others, keeping business model in a permanent state of disequilibrium (Demil and Lecocq, 2010).

3.2 Cloud business models

Cloud can open doors to more efficient, responsive and innovative ways of doing business and companies worldwide are beginning to recognize those capabilities generating new business models and promoting competitive advantage (Berman, Kesterson-Townes, Marshall & Srivatsha, 2012). Basically cloud computing employs service-driven business model where hardware and platform-level resources are provided as service on an on-demand basis. Conceptually, every layer of the architecture can be implemented as a service to the layer above it. Vice versa, every layer can be perceived as a customer of the layer below. Different cloud providers can provide various services on different architectural levels; it is entirely possible that for example PaaS and IaaS providers are parts of the same organization (Zhang, et al 2010.).

Infrastructure layer comprehends business models that provide enabling technologies as basic components for cloud computing ecosystems (Anandasivam & Premm, 2009). Platform layer provides value-added services on top of a cloud infrastructure, both from a technical and a business perspective. Application layer represents the interface for the customers and it is delivered through the layers below, which are opaque for the final user (Weinhardt, et. al., 2009.).

Cloud computing is referred many times to utility computing as firms can rent computing power (both hardware and software) and storage and pay on demand, as any other utility such as energy and electricity. Outcome of the cloud computing is that there has been an evolution toward a utility business model in which capabilities are provided as service (Etro, 2009.). According to Weinhardt, et al (2009) cloud can achieve commercial success only by developing adequate pricing models that foster an efficient way to allocate and valuate composite services.

3.3 Cloud value network

Cloud is used to improve, transform and create new organization value chains, resulting in shifts in who creates value, as well as how it is created, delivered and captured (Berman, et al 2012). Leimeister, et al (2010) note that there is plenty of potential in cloud computing to revolutionize the mode of computing resources and application deployment, even breaking up traditional value chains and creating new business models.

Business environments are complex and networked in cloud computing when different service providers cooperate to create. In the figure 5 there is general model of cloud ecosystem when cloud service may be facilitated by a

mutual dependence among different level service providers (Ojala & Helander, 2014.).

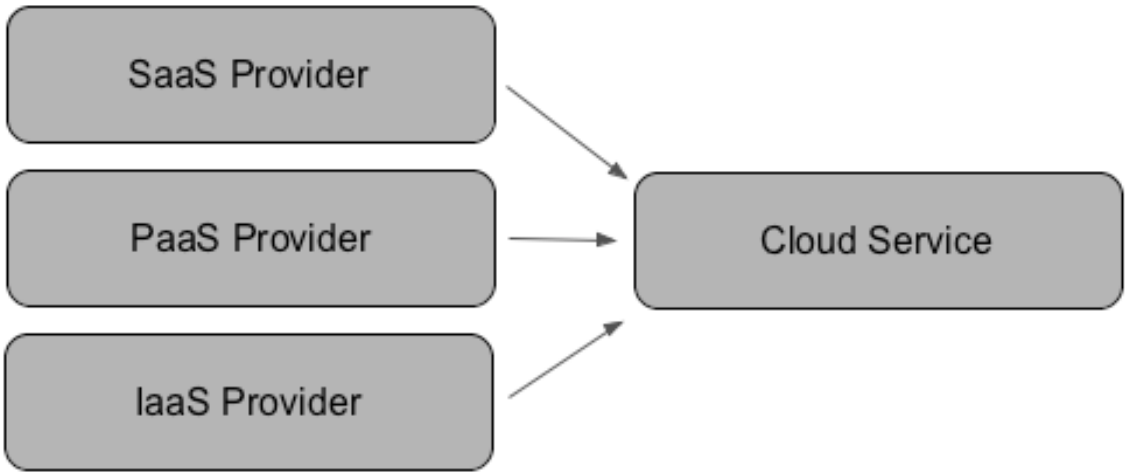

FIGURE 5 Cloud service enabling layers. (Ojala & Helander, 2014, p.1)

According to Leimeister, et al (2010) Allee (2002) point out that regarding to services there exists rather a value network, which generates economical value and other advantages through complex dynamical exchanges between companies. These value conversions are acts of converting or transforming financial to non-financial value or transforming an intangible input or asset (such as human knowledge, internal structures, ways of working, reputation, and business relationships) into a financial value or asset (Allee, 2008).

Value creation on value networks can be said to rely on a mediating technologies to link clients or customers being or wishing to be interdependent. Common service enables interactions between organization and its customers. Exchange relationships offered by a mediation service go beyond its immediate customers to customers of other mediation service providers, which is the base to a structure of interconnected mediation services (Stabell & Fjeldstad, 1998.). Understanding cloud value creation is challenging due to the diversity in requirements, inherited technical complexity, unstructured service schemes, and since the complex structure of the value network grows exponentially (Mohammed, Altmann & Hwang, 2010).

In the cloud computing value network can be recognized the following stakeholders: consumers, providers, enablers, and regulators. Consumers are the end-users, providers are maintaining the end-user applications and systems running, enablers build up the infrastructure and provide services around the infrastructure, and regulators are those parties that have affect for example on different standards or regulations (Marston, et al 2010.). According to Leimeister, et al (2010) there are two more actors to point out: brokers who are seen offering new services or solutions combining pre-existing services or parts of services to form new services to customers and Currie (2000) note other group, consultants, who support the selection and implementation of relevant services to create value for their business model.

In the figure 6 are entailed the most common or most like value paths or possible interrelations between the specific parties. There is illustrated how service provided by one party is valuable for other participants, who consume the service to further provide their own service offering. All the parties within the network change services for money, add value for others through service refinement, and eventually provide services that fulfil the needs of the customers (Leimeister, et al., 2010.).

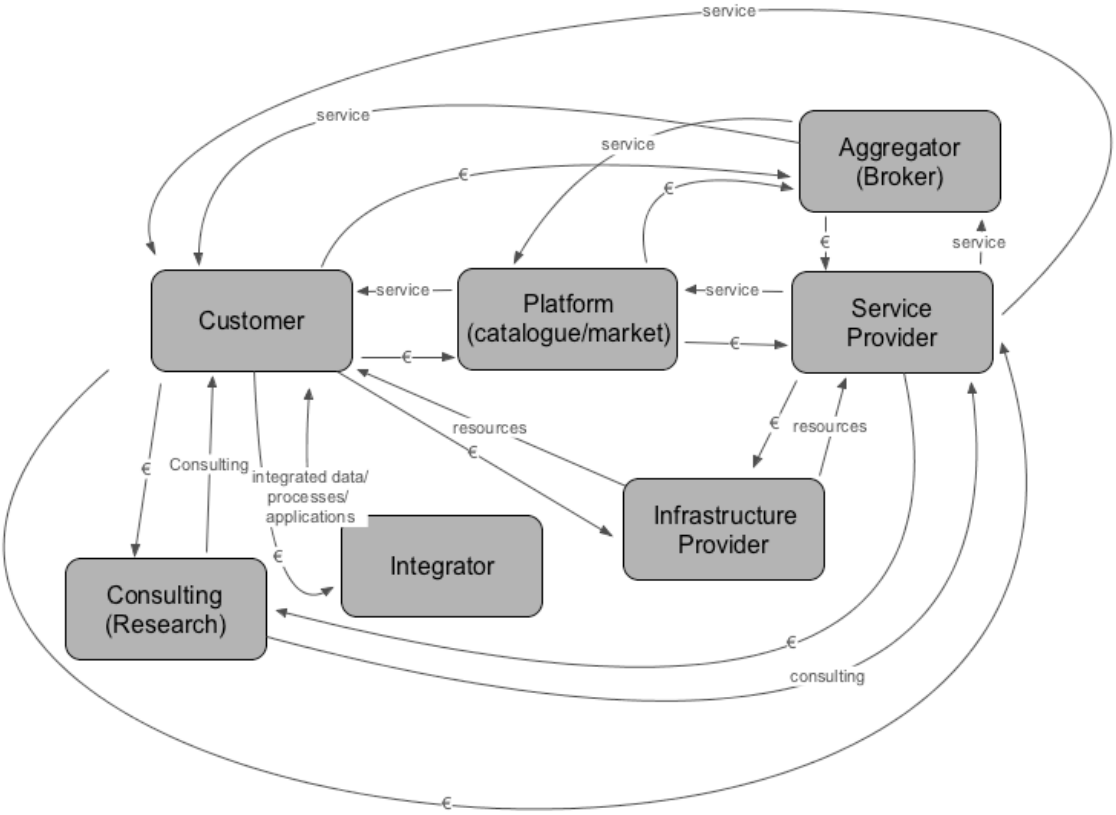

FIGURE 6 A generic view of cloud computing value network. (Applied from Leimeister, et al. 2010, p.10)

Looking at different layers from value network perspective, these platforms can be perceived as some kind of market place, where various cloud computing resources from different levels are integrated and offered to the customers (Leimeister, et al 2010). Firms need to recognize who the actors are (or will be) in the firm's value network. Additionally firms have to understand value of the firm's offering and how this value can be delivered to benefit all actors in the network (Ojala & Tyrväinen, 2011b). According to Ojala & Tyrväinen (2011b); Larsson and Starr (1993); Prashantam and Dhanaraj (2010) networks are dynamic and can change over time. Cloud value network takes care of many activities and for the user it can be viewed as outsourcing IT management activities related to maintaining an information system. For the vendor, the business means highly automated software business with effective delivery network, involving operating as a service business and requiring efforts in the management of customer relations (Ojala & Tyrväinen, 2011b).

4 THE PSIC MODEL

In the thesis is used a process model called Punctuated Socio-technical IS change (PSIC) model. With the PSIC-model, this paper is illustrating all the major change factors that occurred while interviewed enterprises were acquisitioning cloud computing and trying to institutionalize it. The idea in this thesis is to get as profound picture as possible of what happened during the acquisition process and why those different events occurred and how they affected to decision-making and business models. In this chapter the PSIC model is presented so that the functionality can be better understood at the later stages.

4.1 PSIC model process theory

The benefit of the PSIC model is that it recognizes complex, both the incremental and punctuated, socio-technical change in the context of information systems multiple levels – the work system level, the building system level, and the organizational environment (Lyytinen & Newman, 2008). Lyytinen & Newman (2008) describe IS change covering the generation, implementation, and adoption of new elements in an organization's social and technical subsystems that store, transfer, manipulate, process, and utilize information.

4.1.1 Socio-Technical change

Socio-Technical (S-T) model views organizational systems as four major components: task, structure, actor, and technology, which are interacting and aligned. Socio-technical systems during IS change are seen open and due to this, systems need to continuously adapt to the surrounding environment to maintain the system state aligned. In a stable state the system can respond adequately in relation to its task, and its performance is not seen to deteriorate. On the contrary there exist system instability, when the four components are not in equilibrium the system responses are less predictable in relation to its task, and its performance can deteriorate. Therefore two states can be distinguished and

when the system moves over time between the two states it generates various patterns of change (Lyytinen & Newman 2008.).

In S-T model any component can become incompatible with others due to increased variation (i.e. malfunctioning, learning, replacement), which creates misalignment, labelled as a gap. A gap can be any contingency in the system that, if left unattended, will reduce the system's performance and threaten its viability. Gaps are generated many times by abrupt events, which are also known as critical incidents. These events can occur due to a system failing, a financial crisis, or key people leaving. These critical incidents form the necessary conditions for a system state to change and these changes would have not occurred without the event (Lyytinen & Newman, 2008.).

Gaps can invite two types of responses from the system; a) other components adapt incrementally as dictated by the system's deep structure or b) the system will rewrite its composition rules, that is, its deep structure. It can be said that the way system responds to a gap depends on three factors; 1) system's current deep structure, 2) its composition rules, and 3) history. Actions to remove these gaps from the systems are specific types of events called interventions (Lyytinen & Newman, 2008.).

4.1.2 General process model

When changes are successful the work system is always seen as punctuated, due the fact that IS development involves the idea of a deliberate work system change. When narrating the process one needs notions of events, which are changing socio-technical states and stringing them into sequences as depicted in Figure 7. These event boxes are representing socio-technical events, arranged in a way that they show path dependent change in a system at one level. Each of these event boxes can be read as a possible move in the system's evolutionary path ordering, aligning, or misaligning its S-T components. Each event box can affect to the system state, either restoring the equilibrium or leading to disequilibrium (Lyytinen & Newman, 2008.).

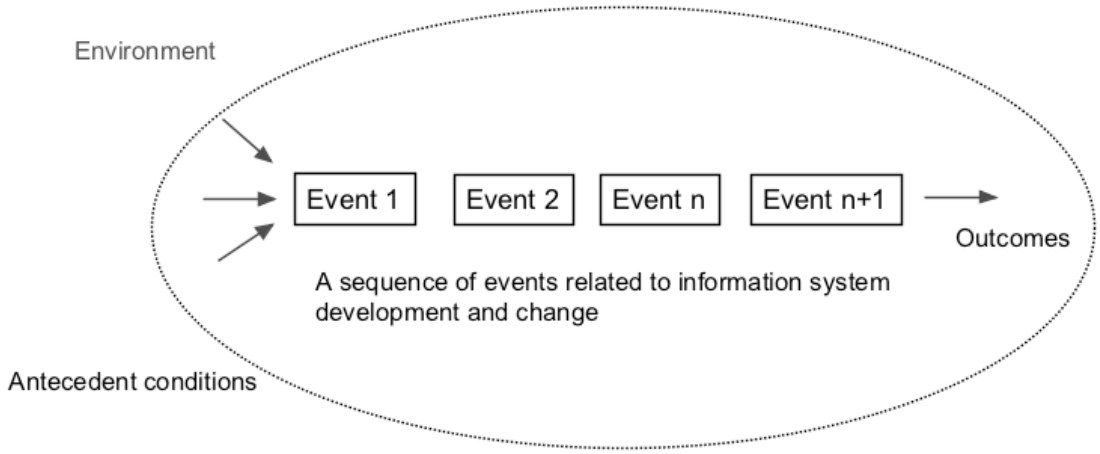

FIGURE 7 General process model. (Lyytinen & Newman, 2008, p. 599)

First all the relevant data related to IS change is abstracted into a set of events, and these events must meet the criterion to be potentially critical incidents, which could have changed some system states. Each event is connected to its antecedent conditions indicating those conditions that were necessary to produce that event. When the antecedent conditions and their relationship for any event is clear, the whole system history can be traced up to that point. Then it is possible to obtain the model for each system level. Moreover the vertical connections can be analysed and the connections show the interventions, non-intended effects between the different system levels (Lyytinen & Newman, 2008.).

4.2 Describing the PSIC diagram and analysis

The model conveys a view of a singular and discrete change in a S-T system state. The system changes consist of sequences of events and their interactions and this applies to all system levels and when the events are pairing different socio-technical states it yields to horizontal analysis. The events are contextualized and a model needs to be expanded with a narrative about the environment. The narrative is created by analysing those strings of events located in those environmental levels, which show how they vertically produced or interacted with the events in the building and the work system. Events can have varying impacts on the different system states. Therefore it must be studied what kind of impact the particular event in this context had. Some of the events can result in multiple changes and need to be modelled as one joint change, or defined separately depending on the desired granularity (Lyytinen & Newman, 2008.).

Impacts can be divided into four types of outcomes: 1) events can fail and the system retains its current misalignment, 2) events transition the system into a new equilibrium without affecting the deep structure, 3) events can punctuate the system into a new deep structure, or 4) events can even add new misalignments into the system state. Human factor and retained history are involved in the process and therefore the failed attempts need to be recognized to explain learning or other path dependent outcomes. Any change can start to traverse across levels due to the multi-level nature of change and this is why it is needed to depict how systems interact hierarchically. This vertical impact can be seen when higher-level system influences a lower system by intervening in it. There are also upward impacts when the influence flows from a lower level system to a higher one. Examples of these vertical influences are when a building system triggers the work system to punctuate when a new technical system is being adopted; a punctuated work system results in the dismantling of the building system, or a deep change in the work system can lead to a strategic reorientation of the organizational environment (Lyytinen & Newman, 2008.).

Various sources can be used to obtain data of the change, such as interviews, reports about changes in work systems, technical system documentation and maintenance documentation, changes in organizational charts and direct observation (Lyytinen & Newman, 2008.). Klein and Myers (1999) state that the

proposed process description constitutes some kind of interpretive act. Those events that are not seen to threaten the system operation, or abruptly change its component alignment are seen as incremental, while those events that undermine the system, or change qualitatively their operation, or outputs are seen as punctuations (Lyytinen & Newman, 2008.).

Process analysis starts by searching triggers to engage in IS change so as to remove a gap and punctuate the work system, or to use new opportunities to enhance its technological core. These triggers can occur due to external pressure or due to vicarious learning (Lyytinen & Newman, 2008.). Keil (1995) notes that the duration of the analysis is determined by events, which signal when the new work system is successfully implemented or the building system is withdrawn and the legacy work system remains intact.

There are five operational steps in process. In the first step author describes the overall IS change sequence of events as a narrative. This step includes investigator's independently looking for elements that represent critical incidents and identification of antecedent conditions for each such event. If there are differences among the actor's stories, those should be maintained faithfully and investigator should not impose his or her own opinion over things. This baseline story can be quite long as it includes rich narration of the events that affect any of the three systems (Lyytinen & Newman, 2008.).

In the second step the building system and work system activities are analysed as interactions between four socio-technical components. In the third step PSIC vocabulary is used describing the overall process. In these steps events are mapped onto types and classified according to the PSIC model into S-T diamonds. In the fourth step organizational contexts for interactions with focal systems are analysed. This means looking for evidences about events in the in the organizational and competitive environments that influenced the building and / or the work system (Lyytinen & Newman, 2008.).

In the fifth and the last step, the four previous steps are combined and the overall process diagram is drawn as in figure 8 applied from Lyytinen & Newman (2008). In this step the visual map of the IS change is compiled in the form of PSIC diagram, which shows relationships between the events and gaps can now be detected and identified (Lyytinen & Newman, 2008.).

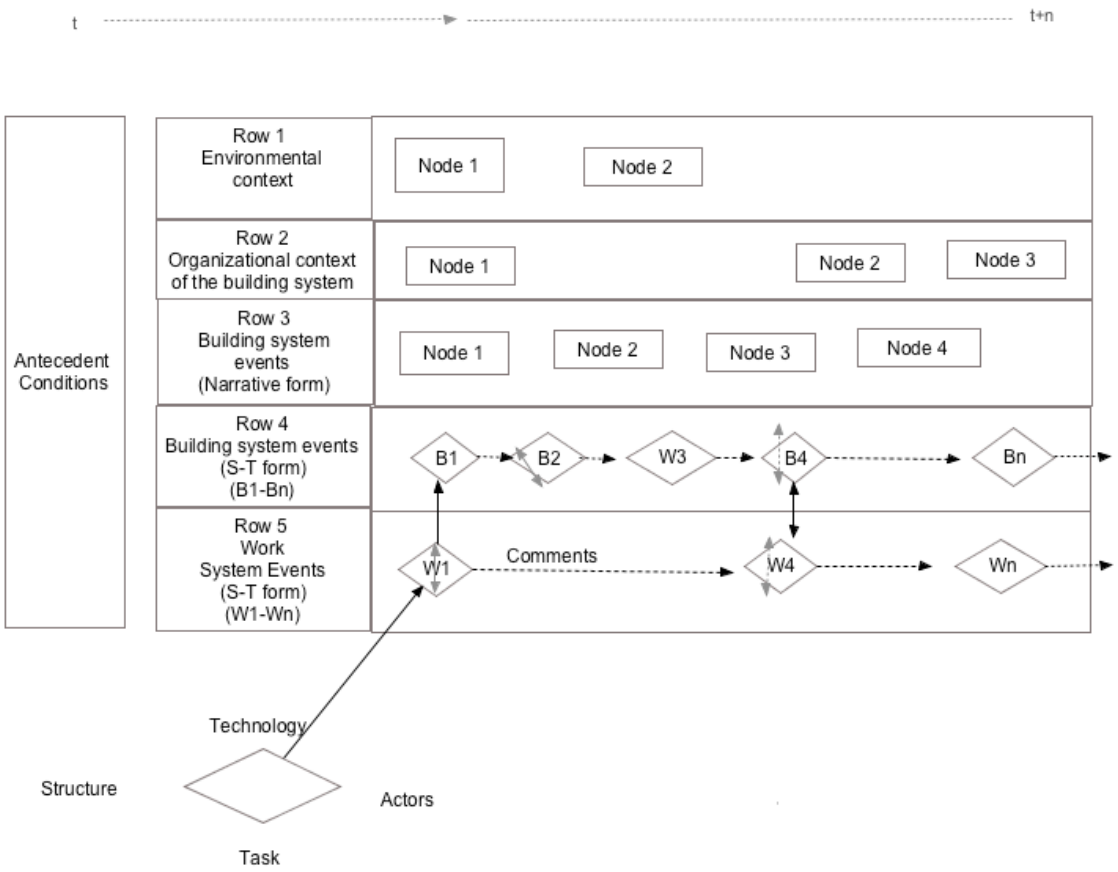

FIGURE 8 PSIC diagram (Applied from Lyytinen & Newman, 2008, p. 602)

In the figure 8 the first line represents significant events in the (competitive) environment. Second row illustrates organizational environment of the building system, which includes such changes as entry and exit of key personnel, changes in resource, scoping, mandates etc. The third row identifies in a brief narrative form those critical events that can be seen affecting the building system. In the fourth row these events are repeated in the S-T diamond form in a sequenced way. These diamonds are labelled accordingly as B1, B2 etc. Grey arrows represent the researchers' agreed judgements of gaps that arose between S-T elements at those moments of the system evolution. Multiple gaps can occur simultaneously and in overall the more there are black arrows, it indicates the growing severity of the crisis, such as on-going and severe problems. In the last row the diamonds represent events in the work system and they are labelled consecutively as W1, W2 etc. These work system diamonds correspond to the numbering of events in the row four and they portray the interaction with the building system and its evolvement. These interactions between different systems are illustrated with the black arrow and its direction can be upward or downward. If there is no arrow between two level diamonds, it indicates that the system continues to function (Lyytinen & Newman, 2008).

5 METHODS

This thesis is based on case studies where interviews are used as a data collection method. The core of the thesis is a process theory (PSIC) with which the acquisition of the cloud computing in different enterprises is illustrated in a best possible way. There is a great interest to reveal the causations why companies are moving to cloud or what is preventing the move. Another part what the case studies are illustrating are the changes in the business models & value networks after deploying cloud computing, especially IaaS or PaaS.

This chapter describes how the research was done in detailed level so that the readers can better understand the steps and how the results were achieved. In the research were used Eisenhardt's (1989) eight research steps.

5.1 Case studies in general

From the time perspective, case studies do not have to concern only the present, but it is also a powerful method to describe the past, where the object of the research is described, analysed and compared to other cases in general. Nature of the case studies can be theory testing, describing or the type that create new theories. Case studies can be based on single case or multiple cases and they can be qualitative or quantitative. One speciality of the case study is that it does not necessarily need to create new theory, but it can increase the knowledge about what kind the world is (Järvinen & Järvinen, 2011.). Uusitalo (1991) states that case studies may reveal information that other methodologies such as survey studies may not show up. This thesis is describing events that happened in the past, which might not lead to new theory, but for sure increases the understanding of the phenomenon around cloud and at the same time the thesis checks whether the findings stand in line with previous literature.

Case studies are providing a history, description, or interpretation and typical experiences of events, where the researcher is increasing the understanding of the context in which certain events occurred. Case studies represent research strategies that can be based on assortment of evidences (Cunningham,

1997.). In his article (1997) Cunningham introduces four different types of case studies, which are narratives, tabulations, explanatory and interpretative cases. This work follows more the last type, the interpretive case study, investigating and interpreting events from the past.

Eisenhardt (1989) states that case studies are especially appropriate for new topic areas. In her paper is pointed out eight steps in the case study process, which are:

1. Getting started
2. Selecting cases
3. Crafting instruments and protocols
4. Entering the field
5. Analysing data
6. Shaping hypothesis
7. Enfolding literature
8. Reaching closure.

The study process starts from defining the research question and in the second stage the appropriate scope is chosen. In the third stage the data collection methods are chosen and they can combine quantitative and qualitative methods. Entering to field is flexible part of the process where data is collected. In the analysis stage analysis can be carried out within case or on cross-case pattern using divergent techniques. Shaping hypothesis intends to confirm, extend, and sharp the theory in hand. Enfolding literature means comparison with conflicting and similar literature. Finally theoretical saturation is achieved when only marginal improvements are occurring (Eisenhardt, 1989.).

It is stated that data collection is more demanding in case study environment than in controlled tests. Researcher has to come up with good questions and interpret the answers. Many times it is problematic that the questions have to be created during the interview on the fly and the researcher has to be good listener and moreover understand hints between the lines. Sometimes it is needed to adapt to conditions and change the approach, nevertheless it does not mean giving up with the initial research targets (Yin, 2009).

In this research case studies were chosen, as it is proper tool to use PSIC-model. Research is qualitative and the aim is to increase understanding around the topic and check whether the findings stand in line with previous literature. The case studies are explaining causations of the companies turning to cloud and event chains that occurred in the past. There exist much research around cloud, but this study is approaching the topic slightly from a different point of view. There are not many researches that have investigated cloud deployments using process models, not to mention PSIC framework.

5.2 Data collection method

Yin (2009) states that there exist at least seven sources where the data can be collected, which are: documents, archives, interviews, free observation, participating observation, and artefacts. Myers and Newman (2007) write that the qualitative interview is one of the most important data gathering tool in the qualitative research and moreover Hirsijärvi, et al (2009) and Hirsijärvi & Hurme (2008) argue that interview is a good methodology when work concerns unknown or less explored topic and when answers cannot be forecasted.

In this study the most important data collection method is interview, which in this specific case is between open and semi-structured. Järvinen, et al (2011) note that semi-structured interviews have pre-defined questions from hypothesis and it increases statistical generalization while open interviews serve for analytical and theoretical generalization. Hirsjärvi, Remes and Sajavaara (2009) describe benefits of interviews compared to other data collection methods, as it is really flexible method that can be adjusted as the interview process progress and the questions and their order can be changed. They add that there are more possibilities to interpret the answers than for example in post questionnaire. Koskinen, Alasuutari & Peltonen (2005) points out that in business economics qualitative research is increasing understanding on target company's activities.

There are guidelines that are pointed out when performing qualitative interview. It is important that researcher has to locate oneself before the interview starts and give appropriate information for the interviewed. The social distance between the subject and the interviewee must be removed. It is important to represent a variety of voices by including variety of subjects in the sample from different organizational levels. The interview is somewhat artificial situation where occur interpretations on subject level, by the interpreter, and by the audience in question. It is suggested to use models such as mirroring to help the researcher to access the subject's world in the subject's language. In open and semi-structured interviews there is no strict script followed and therefore it is crucial to be flexible, improvise, and be open. Confidentiality of disclosure argues that the researcher has to provide needed level of security for the inputs of the interviewed and asking feedback of the written findings to avoid confusions. Finally the ethics of interviewing; the researcher has to have needed permissions, respect the interviewed and their inputs and efforts and fulfilling commitments to individuals and organizations (Myers & Newman, 2007.).

5.3 Planning and executing the interviews

Yin (2009) notes that good case study is more valuable if it has good action plan behind it. As suggested in the first stage of the Eisenhardt's model (1989) this case study was prepared in general level and the research questions were

formed. In the second phase the research scope was defined and theoretical background investigation started.

As Yin (2009) notes practice and creation of test cases are important for lessons learned purposes before the actual data collection phase. In this research the test case was done with another student who studies and works on IT-sector. After the test case, the case study was improved based on the findings. At this time the theoretical background found its final stage.

In the third stage interviewed enterprises were chosen and contacted as the researcher knew beforehand that they held experience from cloud computing and therefore were suitable for this case. Then the pointed personnel were asked whether they had the will and resources to participate. Before every interview there was an invitation sent, in which the purpose, scope and execution of the thesis and interview was summarized. Before and during each interview the interviewer followed Myers' & Newman's (2007) guidelines to guarantee smooth progress of the interviews.

In the fourth stage, in the empirical stage, the interviews took place at the customer's premises in Finnish. In this thesis were agreed nine interviews, three from each enterprise. Interviews started with a small introduction of the thesis, which explained what the interview was all about and what were the goals. After that the recording of the session was agreed[1]. Then the interviewed gave an introduction of his role and experience in the IT-sector and in the enterprise. After these first steps the actual interview or conversation of the themes took place. Each theme was handled at the time and even the interviewed had answered on some theme earlier in part of some other question, it was asked again in its own theme's slot. This was done to improve the reliability of the answers. There were no exact predefined questions, the interviewed had chance to discuss the themes on his own words and the interviewer asked more specific explanations if they were needed.

5.4 Analysing the interviews

5.4.1 Analysing the material

In the fifth stage analysing was split into two parts; analysing the material from the PSIC point of view and other parts using more traditional methods. In this chapter are explained the process of analysis using traditional methods and PSIC analysis in the next chapter. All the interviews were transcribed from mp3-files from word to word in Finnish and integrated into a research database, which consisted altogether of 67 pages of transcribed text. The number had been higher, but there were no permission to record one session and that interview's results are based on the notes that were taken during the interview. Each professional had its own colour in the transcribed text to easer the analysis and recognise the person. Each company had their own file. If some statement from

[1] There was no permission to record one session

the research database was considered worth of writing down to the thesis, it had to be translated from Finnish to English. It has to be bear in mind that this can cause some differentiations from the original idea of the response.

Material was treated inductively. Material was divided to themes, which Hirsijärvi and Hurme (2008) explain as a method to pick-up features that are common for various interviewed. Similarities were recognized using affinity diagram method. In affinity diagram method similarities are recognized from material and grouped to themes and then to subgroups (Britz, et al. 2000). Themes were used to iterate the material closer to the theory. Then recognized themes were contextualized, which means approximating the material as part of the research problem.

The sixth and seventh stage of Eisenhardt model in this work consisted of finalizing theming and iterating it as close as possible to the literature. In the eight and final analysing stage analysing process is ended when material iteration is not providing more value for the thesis. These results are presented on chapters six and seven and the final wrap-up of the study is presented on chapter eight.

5.4.2 PSIC analysis

There were used methods as suggested in the work of Lyytinen, Newman & Al-Muharfi (2009). The following analysing steps were followed as this PSIC[2] model has been used in previous real case. The initial analysis was suggested to be descriptive. The PSIC model was used as sensitizing device to identify critical events. The goal was to find why those events occurred and what were their causations. Then Strauss and Corbin's (1998) microscopic technique was used where all the transcribed texts were analysed in a detailed way. First all the paragraphs were analysed and then line-by-line to find the components and how they affected to each other. PSIC analysis happened with-in the case. Once the components were recognized, and their interrelationship was clear, they were judged as balanced or punctuated change activities. These chains of events were then linked to their antecedent and posterior conditions. In the last phase of the analysis the full narrative of the chains of events was carried out and PSIC diagrams of the change process were modelled. Then the project trajectory was finalised on each system level. All the events, activities and stages were recognized and judged as balanced or unbalanced by the thesis writer from the material database.

It has to be noted that PSIC analysis was not as detailed and micro-levelled, as it might have been in some previous real life cases or as suggested in the literature. There were three enterprises' data that had to be analysed and modelled as a PSIC-diagram and then the final findings were compared on cross-cases. Moreover those actions that the interviewed companies had taken towards IaaS were more ad-hoc actions than long time projects and the new

[2] The entire PSIC model is introduced in more detailed in the chapter 4.

technology or operational model of IaaS usage was not that far institutionalized that it could had been described on really micro-level.

5.5 Unveiling interviews

5.5.1 Description of the interviewed professionals

Järvinen, et al (2011) suggest that the persons should be selected based on how much they know about the topic. In this research is used so-called snowball effect, where interviewed are asked to name the next person who could have crucial input for the research.

Interviewed professionals are described in the table 1. All interviews were held in Finnish. From each enterprise were interviewed three professionals. Three was found to be a good number of interviews, as the organizations do not have too many resources and time for extra curriculum workloads. Also during the third interview of each organization it was seen that the material became somewhat saturated and it was hard to find new information. If there had been limitlessly resources available for the interviews, there would had been a chance to dig up more micro-level information for the PSIC diagram from different operational levels, but it was not seen necessarily in the limits of this master thesis. To have an idea Lyytinen et al. (2009) had interviewed during 11 years altogether 63 persons involved in the ERP-project. Keeping in mind that in this case were involved three different companies in couple of month's timeframe, the results cannot be as detailed as in previous papers.

TABLE 1 Interviewed enterprises and their job roles

Interview sequence number	Enterprise	Job role	Experience in the current role
1	A	IT-Architect	+ 10 Years
2	A	Senior Trainer	+ 10 Years
3	A	Chief Information Officer, CIO	+ 4 Years
4	B	Head of Department	+ 1 Year
5	B	Development Manager	+ 7 Years
6	B	Head of Department 2	+ 3 Years
7	C	IT-Architect[3]	+ 10 Years
8	C	Development Manager	+ 10 Years
9	C	System Manager	+ 2 Years

All the interviewed persons had had a long history in the IT-industry and four of them had had over ten year of experience in the current role. Regarding the gender all participants were male. Six of the roles can be categorized as mana-

[3] The interviewed did not allow recording of this session.

gerial positions. The rest three can be categorized as experts with plenty of decision-making power. Even the interviewed present managerial and expert level positions, many of them have had also operational level experiences from cloud computing. Absolut accounting numbers were not discussed so pure financial and accounting personnel was not interviewed, anyhow all the managers were able to discuss of the financial impacts in more general.

IT can be stated that these interviewed are ideal for this thesis and present in a suitable way different voices from operational level through managerial level up to the level where they can take a stance on financial and accounting related questions.

5.5.2 Description of the interviewed enterprises

The company A is software and service-company and they have specialised in telecommunications. The company A is international enterprise and their team consist of almost 700 professionals globally. The company has been working since the mid eighties and their turnover in Finland was over 80 million euros in 2013.

The company B is information system's solution and service provider and they have customers from financial and energy sector among the others. The company is based in Finland and they have over 500 employees. The company has been working since the early nineties and their turnover was over 90 million euros in 2013.

The company C is a Finnish based organization, which has around 3000 employees. Their turn over was close to half billion euros in 2013. The company competes on other sectors than IT or IS.

Two of the companies can be seen more like pure IT companies and the company C has internal IT department serving the company's business needs. These companies are a good mixture representing voices from different industries and also comparing more traditional IT companies' viewpoints to a company that is not competing in pure IT related line of business.

6 FINDINGS

In this chapter are presented the material and the results from the analysis in a detailed way to support the conclusions that are later presented in this thesis. This chapter describes the trajectories of the cloud acquisitions and deployments. Here are illustrated opinions of the interviewed persons and organizations of the cloud computing and the benefits and challenges that they have encountered or are still expecting to find in the future.

Here are presented findings from the PSIC-framework. Going through every smallest detail of each diagram is out of the scope of this study, but the overall cloud trajectory is depicted. It has to be stated at this stage that it was clearly seen that cloud (IaaS/PaaS) usage is far from institutionalized at these companies and therefore it was difficult to use this PSIC-framework as detailed as it has been used in previous research.

In every diagram are shown process events that were picked up from the material database. The overall diagram shows the cloud development process as an interconnected chain of events. These events were interpreted to maintain the overall system in equilibrium or lead to disequilibria. Due to the fact that there were no sophisticated modelling tools in use, there were no space in the diagrams to open every event (task-actor-structure-technology), but their explanations can be read from the texts below the diagram. The change in each case emerged out of the implementation activities including selecting, designing, testing and rolling out the system.

In every case the companies first owned the machines and later the IT was outsourced and machines were virtualised at some stage and then finally came the cloud solutions into the picture. The analysis of these activities shows that in overall the cloud acquisition and deployment followed a punctuated pattern. In all three cases the cloud infra solutions are used thus far mostly for development purposes and proof of concepts, but production systems are not yet running on cloud infrastructure or platforms.

The companies also had SaaS solutions and some of these services are running on top of cloud technology, but the companies does not have direct agreement with the infrastructure provider. Though these solutions are running on top of cloud technology, in this thesis it is more interesting to concentrate on

more detail those cases where companies have made agreements with IaaS-providers, which capacities they then use on their own purposes.

On this chapter every details and events of the PSIC-diagrams are not opened up to save space. The entire PSIC-diagrams can be found from appendix and there are short explanations for every event. This chapter concentrates picking up the most important events and tasks that are significant for answering the research questions.

6.1 Cloud trajectory in the company A

The PSIC-diagram of the company A can be found from the appendix 1. In antecedent conditions the company had their own data center and own internal IT-staff. The virtualisation project was initiated, as there was a need to have more servers in number and there was not enough money to buy so many physical machines. Physical machines were virtualized slowly on most parts during few years. Then company decided to outsource its IT as it was not the core competency of the company and it gave the possibility to reduce investments and buy capacity with relatively short-term contracts allowing some flexibility.

One major driver towards cloud was the will to stand in the frontline of the development and show also for their customers that they are willing to try new innovations and put them into practice. The CIO stated: "we have to be able to tell to our own customers if our applications work in cloud, so we want to get familiar with different selection that there is". Also at the time cloud solutions came available the providers were contacting the company actively and that affected the company's will to take the first actions towards cloud infrastructure solutions. The CIO told:

> "Probably to a large extent it affected that cloud providers were actively in contact. Then we decided to make trials and carry out pilots in the beginning. We have had plenty of pilots, some of them have been successful and stayed in production and some have not been successful and have ended there".

If speaking only public IaaS solutions there has not been a project around it, they have been more like ad hoc solutions, which had been built for some specific purpose. IT-Architect describes IaaS solutions that have:

> "They are either test environments or for our product development, if we have not had own machine to offer for that or then on most parts educational environments, because trainers or trained persons need to have access to that environment. In our case to get into our intranet through firewall and such is a terrible process and plenty of things need to be ordered, but cloud is easy to access from outside. Then we have test environments for customers we provide software and they can do the testing from the Internet".

The following statement of the CIO describes the attitude towards cloud technology solutions of the company A and what they are looking for with the solutions:

> "For me it is not important what the cloud is, but what is important is what kind of the contracts are... i.e. our partner has external public cloud, own public cloud and private and so called traditional capacity services, which are contractually, in my opinion, pretty same. Then the question is how much flexibility the contracts can provide, which fits where the servers and services are running i.e. permanently on monthly or yearly basis, which is such that it is needed only for couple of hours and can be deactivated for night and it gives cost savings immediately."

From the statement it can be seen that there are many different workloads and services and the contract and pricing is really important when deciding what services and solutions should be moved to cloud. There are many possible future outcomes for the company deploy cloud infrastructure. It is expected that the company A's solutions are purchases as managed services in the future, and again cloud infrastructure under is facilitating this transformation on the business. Also the company is planning to build their systems in a way that it would be possible to change providers quickly. The CIO described the outcome:

> "We have to build our products in a way that the environments are easy to build up and destroy enabling the transition to other cloud provider depending on who has the best offer at that time… sure our partners and customers require that our products are cloud eligible, quickly implementable and transformable and so on, when we will do this job we can benefit more of the IaaS price".

6.1.1 Critical events at the company A

There were situations, which lead the working or building system to a state when other actions had to be taken to stabilize the system with its surrounding environment or on organizational level. There were events that did affect the system, but were not classified as critical. One example of an event, which was recognized as critical, is when the infrastructure users were disappointed with the speed of the virtualized machines (B1). First product development was not willing to move to virtualization world, but there was a manager change and product development started to accuse IT-department that it was their fault that they did not have enough virtual machines and they could not proceed with their tasks. IT-architect described: "It can be a small thing that turns the boat, that which directions it goes. Especially it was seen that if management is favouring some line, it can move forward pretty fast, if they do not take a stance on it the progress might be slow."

After outsourcing the IT and IT-staff to the outsourcing partner there was not always enough upper level knowhow in the house (W3 & B3). There were situations that only the outsourcing partner had deep understanding of the company's systems and therefore the company did not always manage to make reasonable orders. There had been a long project around Linux server for the education department and then suddenly one manager put that on hold and

told the trainers to try public cloud based solutions (B4 & W4). This caused disappointment among those users that already had ready VMware images and they had to start again on cloud, anyway that did not last long as cloud was seen really handy.

If the outsourcing lead to a lack of upper level knowhow, the movement to cloud caused that the staff needed more skills on technical level than with the outsourcing partner (W5). They had to understand configure environments and servers again by themselves. Other event (B5) that led to a need for training was that one department did not get its cloud usage invoice, but it was paid from general pool, which caused that there were too many provisioning and machines were not deactivated. Then the cloud bill rose almost exponentially and after that there has been continuous training on this issue. The company wants to keep IT-management and bureaucracy on light level. In the future costs would be easy to allocate based on their usage, on the biggest cases the company is already doing so.

There is going to be a project (B7) to build a new self-service portal where the users could order public clouds in the limits what the company decides. Different portals are somewhat difficult to use and they need expertise, the new portal is seen to raise the efficiency of the staff.

As the steps towards cloud infrastructure solutions are mostly ad hoc and small, possible unbalanced situations are quickly reacted by the organization and stabilized. There have not been massive migrations, which could have really profoundly shaken the organization's stability. As IT-Architect puts it: "when public cloud operators came into the picture, we started little by little. First we went with some test machines and then with something else, but there is no clear or absolute dividing line that at that time we started to use cloud". In case of the company A the progress of moving to cloud has been really following punctuated pattern so far.

6.2 Cloud trajectory in the company B

The PSIC-diagram of the company B can be found from the appendix 2. In the antecedent conditions the company had their own machines at partner's data center as well as in own installations. The company B represents an industry sector, which has tight data privacy requirements and the company runs society critical systems, therefore there are no space for downtime or any problems. The company is owned by its customers, which make the relationship peculiar. When IT-was outsourced the machines were virtualized at the same time. IT-outsourcing partner relationship did not work as well as was planned and new provider was chosen to build a virtual private cloud solution. The company has also public cloud IaaS-solutions, but they are only for development and testing purposes. The company has cloud strategy created and they are always checking new solutions whether they are cloud suitable or not.

Virtual private cloud was decided to acquire on the group executive level. One driver towards cloud virtual private cloud infrastructure was customer's interest. Head of the department described it:

> "Customer's need was one initiator, our customers wanted to buy flexible capacity and we have this kind of customer-ownership relationship, quite close relationship actually. One of these customers had started to look for this kind of environment and almost bought it from somewhere else, when we decided that as a service integrator we should offer it. Then we had some internal needs for it and started to create this virtual private cloud environment so that we could offer flexible capacities for the customer usage and create customer servers on top of it".

For the public cloud the customer's have been a bit conservative and therefore the need for the public cloud arouse inside the house. This decision to acquire public cloud came mainly from the development department. Pushing factors were the cost, flexibility and time-to-market. The IT-outsourcing contract has plenty of requirements that raise the general costs, does not offer flexibility and do not bring added value. Development manager explained: " probably the flexibility is the number one thing, we have as of now a bit flexibility, but it has nothing to do with the cloud flexibility". One thing worth of mentioning is the company's value proposition, which is to be in the frontline of the technological development and therefore follow and show the customers what is going on in the world.

The company has other project going on and it is related to cloud infrastructure. The company is changing their platform to an open platform so that 1) it is easier to get knowledgeable staff into the house, 2) to have platform where is possible to have different kinds of capacities and 3) to be able to automate operations. This project is done with cloud point of view and the head of department stated:

> "we are trying to eliminate manual functions, which in my opinion is in accordance with cloud, we are trying to herd the servers as cattle, not to pet them. We have gone to that direction that the technology has changed, but it is hard for me to say absolutely that how this way of thinking goes, as they cross each other in my mind. We have clearly made readiness in both ends".

This cloud topic is related to another trend in the world, the company is trying to be agile in general. The head of department stated: "cloud service is certain enabler or element, which makes it possible to transform to that kind of agile world, not that cloud is necessarily an intrinsic value in itself. Cloud is not that big thing in itself, which could revolutionize the world". The company has plans to go through their software development and enterprise architecture in a way that it supports cloud services.

The company has to do active selling work for their own customers, as they are seen a bit conservative regarding to cloud services. In the future it migh be possible to sell their solutions as SaaS. There are activities going on to check the cloud suitability of the new services. Also old services are investigated if they could be transformed to cloud. Head of the department described:

"we have started to check through systematically what is transformable. There does not exist actual decision that everything would be transformed or that x quantity would be transformed from the current ones. The only decision made so far is that we always check the cloud option, which is profitable from the business case point of view, and then decide if transformed."

6.2.1 Critical events at the company B

After the IT was outsourced the agreement was on some parts for some purposes too strict (W1). These tight requirements in the contract touch privacy and network infrastructure issues and are increasing the overall costs. There was not enough flexibility to run tasks and the provider was not operating as agile as it was expected (W2). These were seen as critical events, which led to look for a more flexible model from a different provider. IT personnel stayed in in house regardless the outsourcing agreements.

Users criticized the virtual machines, but there are not that much experiences from public cloud (W3). Users were disappointed, as virtual machines did not match the dedicated servers. Some users feel that there is still a need for option to have dedicated capacity, not only virtual. Sometimes the I/O need is so high that virtualization cannot follow. The company was too slow to react on their customer's needs (W4). This caused the company to re-create its functions to be generally more agile.

Cloud services come as standard services; there are not many possibilities to modify them (B1) and this has to be accepted by the personnel. Head of the department 2 described:

> "if you think about that our basic service thing is that our hosting services are outsourced and it is not wanted that our staff would do things as patching or such. If you acquire platform from the cloud, in which you do not necessarily have acquired or is not included, that every server are patched, so then someone has to do it. This makes it that it does not entirely follow our original strategy that everything is outsourced. But then we buy these capacities, where we do these things... Operational model is under discussion".

It is not totally clear how to tackle the conflict between the flexibility and competitive usage of cloud. The cloud strategy has not been implemented up to the operational level, which is expecting that management would make decisions on specific topics (B2).

Big problem for the company was the lack of self-service abilities (W5). Tasks such as provisioning and de-provisioning came from the supplier side and it wasn't fast enough and this way slowed the time-to-market. There were reacted on two different ways, from the group executive level and by the development department. Head of the department explained:

> "with the public cloud the history is that we did not have enough flexibility with the capacity, so we needed capabilities to create servers quickly. Then our development department got frustrated with the situation and decided that they did not have that much time to wait. There is a need to have servers created quickly and create environments and provision servers by themselves and get proofed some things. Then

> we decided that they build up those, but kind of it has been their independent decision, while the private cloud deployment was decided by our group executives".

This is not the wanted final stage as the company has a need for further automation, especially there are problems to react to load spikes (W6). The company has made a qualification form to check the cloud suitability of the services, but it does not always provide the absolute truth whether it will work in the cloud (B3). Development manager described:

> "we have tested and then we have had to come back. And then we have had cases where we thought we can do it in cloud, then that it is not possible and then again that it is possible. So it is this kind of turning, like dancing on a rope, as there is not that kind of a tool that you cannot always say clearly. So there are data privacy issues, costs and business requirements, so they are the three determinative factors, so through those we try to decide and deploy".

The company's end-user services do not entirely respond to the needs and wills of the end users (W7). End users would like to use more own devices, but that is strictly against the data privacy rules. The exact solution is under investigation. Also the company has encountered problems with the data privacy issues such as the data location or back up system and those have not in every case served for the solution it was thought to serve (B4). Head of the department 2 described:

> "I have a contradictory feeling, on the other hand cloud services are really secure, at least I believe that provider's servers and data centers somewhere abroad are secure, but then you do not have the same possibility to control those. And as an example: the cloud administrator can follow the sun through-out the world, so there come these kinds of administrative data privacy issues. What if an administrator from other country can watch our data and if something happens, which country's regulations we should follow?"

The virtual private cloud arouse due to a customer need, which led to a new operating model in the company (B5). Capacities are purchased from provider and then resold to own customers. All the new cloud operations are causing that personnel roles and knowhow needs are under checking (B6). These new operations might lead to a new organizational model. For example how should the development and operations departments co-operate more closely is under investigation. There was formed a new integration team. Public cloud infra does not always contain managed services and the company has not discussed the topic entirely through (B7). The group executives have made a decision that 247 services' administration should be outsourced. This leads to the fact that if critical services were deployed in public cloud, there would be a need for a new managed services partner.

The company had doubts about working with service level agreements in the future (B9). There is no full understanding how to make agreements with providers and customers. Head of the department explained: "sort of we have to find another model for that customer still wants to penalize us, so what

should we do as there does not exists this kind of back-to-back model anymore. There we have many open questions".

The company had as well doubts of the future architectural solutions and how to minimize latency issues (B10). So the network traffic should be well designed that the traffic does not go back and forth all the time. The company has made a decision that critical services are tried to split for two providers to fulfil regulator's requirements (W8). This will affect to the future cloud solutions and disaster recovery plans.

The cloud strategy deployment is still under its way, for example it was not yet decided how to combine the agility, flexibility and governance. It was not sure whether everything should be centralized for one team or should capacities be split to different departments (B11). There was a fear that it was getting a bit out of the hands that who can buy cloud and where. There are many different opinions and the business is changing with a great speed. The company is planning to investigate further what are the real requirements for cloud services. In a summary the overall change is not yet known, there are needed many trials, studying and experiences (B12). The head of the department 2 stated:

> "I think everyone has to take a stance in some level, I believe that in one year we have pretty good understanding of the cloud as we are having so many cases and are getting forward. From my opinion what is relevant is that cloud is not used as reason itself, but what you want to achieve with it and what it gives to you".

6.3 Cloud trajectory in the company C

The PSIC-diagram of the company C can be found from the appendix 3. In the antecedent conditions the company had own data center, which consisted of owned or leased physical machines. Due to the nature of the company's structure and its industry it had various local smaller geographically disperse data center locations. Company created a joint venture with an IT-firm, which hosted the machines. That joint venture was not successful and it was ended. There was a public tendering to choose new hosting partner and at the time started project of virtualizing the machines. After that one part of the hosting was given to a new partner that constructed a virtual private cloud for the company. After having the virtual private cloud environment in their data center the company started to further investigate cloud possibilities and created a cloud strategy. At this time started to come many SaaS and PaaS solutions in to the picture and finally public cloud, IaaS, was deployed for development purposes. Moreover the company is constructing IaaS based disaster recovery. Development manager stated out:

> "our attitude, should I say during the last three or four years, has changed radically and it is probably due to the cloud strategy and because we managed to do the base work regarding the data protection, privacy and location requirements set for the cloud, so after that it has been rolling forward smoothly".

The company C IT-architect described that agile methods had pulled the company more towards cloud usage, especially in the development department. From his opinion it took too long to have capacities and there were too many parties involved in the process. Development manager described the move in the following way:

> "First of all from the cost point of view it is always tempting option. And the second, we have seen that it is not always necessarily the most efficient, rational and not even the most reliable way to produce the service by ourselves. We are looking for the smartest way to produce each service".

IT-architect described that the development, which has been taken to cloud, has affected the organization in a way that now there are conversations around, which production systems might fit to public cloud, but there are no final decisions made on this topic. The development manager pointed out:

> "we do not have much IaaS acquainted outside, but we have private cloud in our data center. Then we are speaking a huge amount of our production systems that are in the cloud. So where is the limit of cloud? Maybe our private cloud is not the most sophisticated yet, there is not really smooth orchestrating and such… so we are in the beginning in that sense".

So the company has deployed production systems in their own data center in the private cloud, which is hosted by a third part. There are projects going on around public cloud deployments in the company. The system manager explained:

> "There is a big project ongoing. In the project there is first clarified how to build up and unify infrastructures. Previous tasks try to enable cloud type deployment and systems are tried to make more cloud agnostic. When systems are cloud agnostic, it would be easier to transfer workloads from a cloud provider to another. We do not want to tie ourselves up with some specific."

There are many potential future outcomes for the company. IT-architect described one of them: "Other important factor is storage capacity, which is a big thing, we need plenty of it and the need is growing all the time…so cloud storage solutions are really considerable". Other project, which is using cloud infrastructure solution, is the disaster recovery site. IT-architect described that the idea is to built service provider free solutions when it comes to cloud solutions and cloud infrastructure. From his opinion cloud solutions enable other changes in the company and on the way the company operates. Mobility is one of the mentioned ones. He also forecasted that in two years the company would use cloud in many ways that it is not using as of now. System manager commented the future in the following way:

> "I do not believe that there is going to be a giant migration suddenly, that all would be transferred to cloud. If we managed to exploit the cloud in an efficient way, we would like to deploy the most modern solutions, which would not have strong rela-

> tionships to the old legacy systems needing migrations. It might be a domino effect; if older systems are taken to cloud then the more we should transfer background systems there as well. So at least now we have the idea that only new solutions, which have been originally designed to work in public cloud, are deployed in cloud".

6.3.1 Critical events at the company C

There were challenges with the service the partner was offering (W1). It was felt that the service was not enough proactive. One of the major reasons why the company is turning towards cloud-based solutions is its network (W2). The solution was built by earlier outsourcing partner / joint venture. The network solution does not meet these days network requirements and is causing challenges for the company. The system manager described the situation on the following way:

> "Previous partner has built the network, so there is plenty of legacy, which leave their hand mark. From there have aroused wants and needs to specifically move to cloud, because this our network infrastructure is pretty complicated and partly a little bit like black box, which causes plenty of practical challenges in work. There is will to correct the situation by moving to cloud".

The company was not satisfied with the situation there was with the administration and maintenance of the systems (W3). Those tasks were felt as burden for the employees. Another critical event or better-said situation was when provisioning in the old model took too much time due the bureaucracy (W4). Cloud is seen to be a good solution as many things are more automated or easier and this way it saves users time.

What also fastened the interest toward cloud was when the company rearranged itself and two cloud-enthusiastic came into the systems development team (B1). These members started to drive for modern working methods and automation that reduced manual workloads. Other event that really turned the heads toward cloud was the moment when the cloud strategy and roadmap was created (B2). There are handled systems, system families and their cloud opportunities, meaning the opportunities to turn them to cloud.

There have been some unsuccessful trials such as the portal for virtual private cloud (B3). The portal was supposed to bring automation to the process, but is never worked as expected and there were needed too much manual work after all. This solution was rejected, but there is a need for improved technology automation in the future. Application Programming Interfaces (APIs) are expected to provision the machines in the future. Now the provision goes through sub-contractor's ticketing system and is seen as one sort of bottleneck.

The company is trying to tackle many existing problems with a so-called green field project (B5). The system manager describes the situation:

> "Especially in this multi-provider environment we have many challenges… To have a server like that we have had to cooperate with so many parties. Every step takes plenty of time, and cloud deployment has not as such removed these challenges. But what we are doing right now in this Proof of Concept (PoC) is this green field im-

plementation, that there we start from the clean table and try as much as possible bypass known bottlenecks and precisely at once to configure such an environment, that when it is done, then it would be possible to genuinely automate provision services in a way that they truly work".

6.4 Theme – Drivers towards cloud

All the companies have acquired public cloud infrastructure for testing and development purposes and virtual private cloud infrastructure also for production systems. At this stage are only considered drivers for public or private virtual cloud infrastructure, but not towards virtualization (the step all the companies went through before cloud solutions) or services that have been purchased, which run on IaaS. Therefore the drivers only stand for deliberately deployed IaaS solutions for the company's own usage. Nevertheless, the answers are not split to public and private cloud. In the table 2 can be seen answers from the interviews, themed under more general titles. On each theme can be seen which company and which role or interviewed answered on that one. Answers were not all exclusive, different names and words were used and therefore up to some point theming are based on the thesis writer's judgment.

TABLE 2 Drivers towards cloud solutions by companies and interviewed

Drivers towards cloud IaaS acquisition	**Company & interviewed**
Need for flexibility, agility and ability to react	A1, A2, A3, B1, B2, B3, C1, C2, C3
Self-service (shorter order time)	A1, B1, B2, B3, C1
Cloud strategy	B1, B2, C1, C2, C3
Customers expectations/curiosity/need	A1, A3, B1, B2
Cut down investments (Capex –> Opex)	A3, B1, B2, C2
Active selling from provider side	A3, B3, C2
Difficulties with networks	A2, A3, C3
Cost savings	B1, C1, C2
Time-to-market	B1, B2, B3
Need to outsource everything, but core business	A1, B1, C3
Will to stay in the technological frontline	A3, B1, C2
Cloud partner offers better solutions	C2, C3
Cloud has unlimited capacities	C2, C3
Automation (scalability)	B1, C3
Mobility	C1
Lessen multi provider environment challenges	C3
Machines (servers) got old	A3

All the interviewed answered that one driver was the need for flexibility. Another popular theme was the need for self-service, which is highly linked to the flexibility, the more companies can do by themselves, and the less they are dependent from the supplier actions. Another one, which was also related to this self-service and flexibility, was the time-to-market. The more companies can

have flexibility, agility and self-services in their tasks the faster they can get to the markets as the ordering times are getting shorter.

Cloud strategy had been created in companies B and C. This driver does not come from the technology or the new business model that cloud enables, but still though it was a major driver for these two companies. The companies felt that there was unconsciousness of the cloud and cloud strategy managed to remove the doubts and answer for what and why should cloud be used. The IT-architect of the company C described that cloud strategy was one initiator towards the cloud technology interest and further deployments and the development manager described that when the basic work was done in the cloud strategy it fastened the process. Also in the company B the development manager explained that cloud strategy is essential part for the process of deploying cloud, as in this way the decisions are based on orderliness.

The fourth most popular driver was customer expectation, need or curiosity. In case of the company B the customer had a real need for cloud infrastructure. In case of the company A customers were really interested of cloud based solutions and therefore the company had to start testing their solutions on a cloud infrastructure. All the companies had one interviewed who claimed that the active selling from the provider side was one driver and had real influence on the decision-making.

One of the major drivers in every organization was the will to turn the Capex operating model to Opex and not to invest big amounts, but to pay on short-time basis. Related to this all the companies stated their will to outsource everything, but their core business. B and C companies informed that one driver was the fact that they were expecting cost savings. All the companies replied that they are also trying and getting to know with cloud solutions, as they want to stay in the frontline of the technological development. The CIO of the company A stated: "actually due to the fact that we have to show to our own customers and be able to tell them about whether our solutions work in cloud or not so we want to familiarize ourselves with the cloud offerings". Head of the department of the company B stated:

> "One of our values is to be a vanguard of the development for the customer, to show and follow the trends, understand what happens in the world and then try out what options we have regarding to capacities".

Development manager of the company C stated:

> "Of course it is the way to keep up with the technological development, without huge investments, which otherwise would be needed frequently, because the providers bring those technologies available all the time".

The company A had had problems with the networks and accessibility and cloud solutions really were a game changer here. The senior trainer stated: "we have now options, when you travel and train around the world, it is good that you can do the server in Europe, Asia or America, depending on where the training takes place". With cloud solutions they can easily access and create their servers from and to all around the world. The company C has a legacy

network solution from the previous joint venture partner and it is felt as a black box and there cloud infrastructure and network solutions are thought to less the pain.

Companies B and C took up that they do not only want cloud solutions as of now, but they are expecting that in the future they will be even more sophisticated and they could lessen manual tasks of their staff by automation. System manager of the company C:

> "…that we truly want to automate things instead of someone does or system administrator does manually and different companies here and there, therefore we want all the services in our hands so that we can press a button and create infrastructure and allocate it… not only that I can click in some portal, but that API can say or application can say through API that give me new server with these specifications".

The company C believed that cloud providers provide better solutions as stated by system manager: "public cloud provider's infrastructure has been built by the world's best humans and not like in our case by the Finnish best or one of the best ones". They have almost endless resources, even for huge companies and data usage as stated by the Development manager: "…there does not actually exist upper boundary, even for our size operator there would not come limit against, unless we created everything here on our own data center".

What was seen as an opportunity for the company C was the chance to reduce the challenges and number of providers in their multi-provider environment. C company believed that cloud infrastructure solutions can easier mobility challenges and help their staff to react to the changing world and work from various locations. The company A had a specific driver, their machines got old and just about the same time cloud solutions were available and they were decided to test and deploy.

6.5 Theme – Adoption challenges

All the companies had their reasons why they were not deploying cloud (IaaS or PaaS) solutions or not doing it on a bigger scale. The challenges are listed on the table 3. The biggest challenge in every company was the data privacy issues, data locations and who can access the data. These caused uncertainties for the companies and they were not sure what they could deploy to cloud. Their own customers had sometimes quite restrictive data privacy policies, which wrote off many production systems that cannot be deployed on cloud infrastructure. One big doubt was that who can really access the data and from where. The companies cannot take risks with their own customers systems before they know the answers in detail for their doubts. These data issues do not only arise from the customers, but there are industry regulators, who have their requirements and guidelines, which have to be followed accordingly. In some cases the regulators had not taken the final opinion, which lead that the companies had to wait for the final call. The IT-architect of the company A stated:

> "...if we started to sell SaaS to our customers, we have challenges with the information security. In many places there is that data cannot be taken outside of the borders, or in EU that outside of EU and in some countries there is a clause that data can be used inside the EU, but not all EU countries agree that data could be really taken there. This causes challenges to this."

TABLE 3 Adoption challenges of cloud solutions

Cloud computing adoption challenges	**Company & interviewed**
Data privacy & location & accessibility issues	A1, A3, B1, B2, B3, C1, C2
Business continuity	A1, A3, B1, B2, C1
Back-ups / data recovery	A1, B1, B2, C2, C3
Performance	A1, C2, C3
Availability & Reliability	B2, B3
Future architecture (latency issues, network traffic)	B1, B2
Regulatory requirement	B1, B2
Cost	B3, C1
Geographical requirements	C1
Copyrights	C1
Old systems not directly cloud suitable	C3
Skill shortage (business & technical)	B1
Pricing models	A3

Another important challenge, which came up was the concern of the business continuity. The companies are only partnering with the ones that are seen to stay in the business long enough and as stable ones. The companies were not sure if they could recover data in case of problems or when changing provider and therefore there were thought in case of company A whether they should have back up copies themselves or not. Like IT-architect stated:

> "What we think is do we need some kind of back up solution for us. So data is on cloud and it replicates between cities and so on, and it should not be lost, anyhow if the cloud operator ends functioning, should we have copy of all the critical data somewhere and where would it be?"

The company A IT-architect described performance concern that the customers do not trust the machines are equally powerful as physical machines and they are afraid the costs of the powerful virtual machines. Another concern was that what kind of future architecture should be to minimise the latency and network traffic. There were concerns if high availability solutions can be achieved with cloud infrastructure and are they reliable enough.

Cost in some cases were felt as driver, but in other cases as a challenge for the further future deployments. The cost depends on what the designed workload is, if it is 247 workload, the cloud might not be the cheapest solution, but for ad hoc testing and development purposes it on contrary could be very interesting option.

Due to the industry and its structure the infrastructure has to locate sometimes physically really close, which writes of cloud solutions in some of the company C workloads. Also the company store copyright material and if the

material is stored on cloud, the risk that the material spreads illegally is seen higher. The company C stated also that there is no will to transform old systems to cloud as there might come up so many challenges along it. Therefore they only plan to deploy the newest and already cloud suitable solutions to the cloud. Company B felt that one challenge was that they did neither hold enough technical nor business skills, which the head of the department described:

> "Lack of skills. We do not have understanding what the things mean, what are the benefits what we achieve. Then we don not have technical capabilities of how they are in practise build-up and how can we get connection from there to the existing servers".

The company C system manager described the incongruity of the cloud possibilities and challenges:

> "Surprises…hmm…on the other hand how easy it is to operate on the cloud, but when we have started to figure out true deployment on a large scale, we have started proudly and boldly that now we go there and create new and beautiful and that we can benefit from everything, but the practical realities came ahead. There are so many things that have to be taken into consideration. Thus there come all of a sudden many constraints that we cannot migrate everything, but it is wise to migrate only the latest and greatest outputs, which have been designed in principle to operate in cloud environment. That kind of gullible optimism has disappeared along the way".

Cloud infrastructure might be intriguing option, but it does not mean that everything can be deployed into the same place with the same pricing structure. The company A CIO commented:

> "There maybe the unit price is not that relevant as the pricing structures are so different. One service has to run 247 with the same workload, like web-service, and then this is worth of purchasing from one provider with one kind of a contract. And then some other is that type that you only need peak capacity few hours now and then for example to some performance jobs. There some other cloud service is better and the pricing structure. We search for each usage of cloud service their optimal place".

6.6 Theme – Business models

The cloud computing IaaS or PaaS acquisitions seemed not to have that dramatic change on the companies' business models. Really generalized - the cloud might change more the cloud provider's business models. Business models of the companies that acquire IaaS and PaaS might change more when they start to deliver their own solutions and systems as SaaS for their customers. The companies did not own the most part of their machines in earlier stages; instead they had acquired virtualized capacities from their outsourcing providers. Therefore the cloud move did not have that great affect. What really has

changed was the contract flexibility. Cloud technology was not seen as new technology, but rather a new operational model.

6.6.1 Business model changes in company A

In the table 4 the company felt that four out of nine of the basic building blocks had not had any significant impact on the business models. Their value proposition had changed, as they were able to provide proof of concepts, demo and testing environments faster for the customers, anyhow that has not been used actively in the selling situations. Distribution channels had not changed, but training sessions were able to arrange in different and easier way, which really helped trainers work.

Cloud acquisitions have not had direct changes in the IT-staff number, but with cloud solutions the IT-staff can be located anywhere of the world. IT architect described the impact on activities: "the activities itself have not changed, but the way that they are done, have changed". Now the activities can be done from self-service portals, as an example, as earlier the provider had to do many of those activities. The CIO described the impacts on cost structure:

> "maybe on average this has been a price neutral, we have searched for cost savings, but I do not believe that we have those achieved. But the tied-up capital in IT has dramatically come down and that is important for us. This has brought flexibility, now the costs are scaled we want them to scale".

TABLE 4 Business model changes in company A

Nine basic building blocks	**Impact (interviewed)**
Customer segment	*No impact*
Value proposition	Improved PoC (A3)
Distribution channels	Training environments (A1 & A2)
Customer relationship	*No impact*
Revenue models	*No impact*
Key resources	IT-staff world wide disunity (A3)
Key activities	Internal training for new activities (A1). In the future own systems as SaaS (A3).
Key partnerships	*No impact*
Cost structure	Less investments, more operational expenses (A1) No tied-up capital on IT, scalable costs, traditional solution prices down (A3)

6.6.2 Business model changes in company B

In the table 5 can be seen that three out of nine basic building blocks were not seen to have any significant impact on business models. Company's customer segment is the same, but as they are reselling virtual capacities they have achieved new customers from different industry. Regarding to value proposi-

tion, it was felt that there were no changes; nevertheless the current promises can be fulfilled in a better way. To customer relationships there were no impacts.

Distribution channels have had a big change as the customers can buy their capacities directly from the company, which has led to changes in the revenue models as overall service can be split to smaller pieces and customers can buy fragmented services. Key resource number has not changed, but the cloud acquisitions might lead to organizational reformations creating new departments and new job roles. Then these new activities need training, which the company provides internally and suppliers provide training on their solutions.

The company is expecting to have changes in their partnerships. If they start deploying production systems to cloud, then they would need a new partner to host their environment. What comes to cost structure the company has deep understanding of the virtual private cloud benefits, but public cloud is not yet known. The head of the department explained the topic regarding public cloud costs:

> "if we speak the cost of the capacity coldly as CPU, MEM and disk space amount, there are no cost savings. We do not even strive for that kind of savings or at least as of now we have the understanding that we are not going to get those cost savings, which could make a difference for us. Only the savings could come from namely flexible usage when we would pay per usage".

TABLE 5 Business model changes in company B

Nine basic building blocks	**Impact (interviewed)**
Customer segment	*No impact**
Value proposition	*No impact** Maybe current promises are fulfilled in a better way (A3)*
Distribution channels	New operational model to sell capacities for customers (B1)
Customer relationship	*No impact*
Revenue models	Not only overall service, pieces sold from the entirety (B2)
Key resources	New roles and skills discussion on-going, new teams built-up (B1)
Key activities	Internal and external trainings for new activities (B1, B3)
Key partnerships	Expected to happen changes (B2)
Cost structure	Virtual private cloud benefits known, public cloud under investigation (B1). Balance sheet is flat, no significant investments (B2)

*New industry customers **Customer promise impact.

6.6.3 Business model changes in company C

In the table 6 can be seen that four out of the nine basic building blocks did not have impact on business models. The company felt that this is not a solution, which brings many benefits for their end-users. Distribution channels were seen to change for the internal staff. Cloud solutions were seen to mitigate the acces-

sibility from different locations and devices and this way help their staff to me more mobile in their work.

Cloud solutions were seen as well designed and that way mitigating the administrative and maintenance operations, which leads that there are fewer specialists tasks needed in the future. Activities are thought to change; there will be less manual work as more and more automation is used. There will be less customization work, as solutions will come as standards.

Key partnerships are evolving over time in every enterprise, but cloud solutions could really mitigate multi-provider challenges that the company is facing. To accomplish a task they have to contact with many different companies, but what cloud is enabling is to have many of these services from one place.

Again the same story stays for the company C, there are no big investments needed and Capex operating model is transferred to Opex operating model. IT-architect described that the investment amounts can get really high and they are many times more difficult to handle from the accounting point of view and moreover now it is easier to anticipate the costs. There are seen possibilities for cost savings; even the solutions based on monthly pricing were not always the cheapest ones.

TABLE 6 Business model changes in company C

Nine basic building blocks	**Impact (interviewed)**
Customer segment	*No impact*
Value proposition	*No impact*
Distribution channels	Mobility (C1)
Customer relationship	*No impact*
Revenue models	*No impact*
Key resources	Cloud solutions well designed, less specialists needed (C3)
Key activities	Less manual work through automation (C3). No customization, standard products (C2).
Key partnerships	Some of the old ones disappear, new to substitute them (C2). Mitigate multi-provider challenges (C3).
Cost structure	No investments, Capex –> Opex (C1, C2).

6.6.4 Wrapping-up business model changes

From the table 7 can be seen a short directional summary of the changes what claud IaaS or PaaS acquisition cause when used business model canvas nine basic building blocks. It can be seen that there were no changes on customer segmentation or customer relationships. Cloud infrastructure acquisition did not have dramatic change on the companies' value proposition, only in one case, A, it was felt that it had changed something, but it is not though used actively in selling situations. Distribution channels went through changes in every organization or the most correct would be that cloud infrastructure opened new possibilities for the companies, in which they saw opportunities to interlock with the customer in a new way.

Mostly the cloud infrastructure itself, when acquired, did not offer changes on revenue models. In the only positive case it was due to the fact that the company saw a market opportunity, not that cloud had led to it directly or automatically. Two of the companies were expecting changes on key partnerships. Both B and C companies were planning to partner with a hosting partner if they moved their critical production solutions to public cloud.

From the changes can be seen that cloud infrastructure acquisitions led to internal changes, not that much changes that were visible for customer or end-users. Three strongest changes were internal ones: cost structure, key activities and key resources. Basically the organizations gain flexibilities on costs structure and they have to adapt to the new operational model by restructuring key resources and adapting to the new key activities.

TABLE 7 Business model changes wrap-up

Nine basic building blocks	**Company A Impact**	**Company B Impact**	**Company C Impact**	**Total**
Customer segment	No	No	No	3 No
Value proposition	Yes	No	No	1 Yes, 2 No
Distribution channels	Yes	Yes	Yes	3 Yes
Customer relationship	No	No	No	3 No
Revenue models	No	Yes	No	1 Yes, 2 No
Key resources	Yes	Yes	Yes	3 Yes
Key activities	Yes	Yes	Yes	3 Yes
Key partnerships	No	Yes	Yes	2 Yes, 1 No
Cost structure	Yes	Yes	Yes	3 Yes

6.7 Theme – Value networks

Mostly the companies stated that there had not been changes in the value network structure itself, but partners instead for certain functions had changed. It was also expected that there will be stronger changes in the value network structures in the future when the companies start using cloud solutions in a bigger scale and especially when they start to offer their own production solutions on cloud infrastructure. The feeling in every company was that if they were transferring their critical production workloads on public cloud, they should have a partner who manages the environment.

The CIO of the company A and IT-architect of the company C stated that they have to build their own solutions in a way that they can easily and quickly change infrastructure providers. This is not changing the value network structure itself, but it will change the way the value network operates. There will be shorter and more flexible contracts and providers can be changed almost at any time if not satisfied of the service. Then the CIO added that there might come new roles such as cloud brokers, who sell capacities from different providers through one easy accessible portal.

Company B head of the department stated that in the future the cloud infrastructure providers might not be treated as partners as of now. Cloud contracts are flexible, short term and standard. It was felt that it is going to be difficult to have the same kind of back-to-back sanctioning model as there exists now. In the future there might not exists same kind of service level agreements as these days and it was felt to change the operating and value network operations. Also the head of the department was wondering how would the licensing model be arranged in the future. Again this doubt will not change the value network partners, but the way it operates might have some changes ahead. Many times new operational models bring uncertainties, but they can once in a while clarify issues. The company B head of the department felt that after they started using cloud infrastructure their roles and responsibilities became clearer.

The system manager of the company C felt that in the future, at least in their case, there could be fewer partners in the value network, meaning that the current fragmented services could be bought from one infrastructure solution provider and this way mitigating multi-provider environment challenges. In their case their virtual private cloud partner was helping them to move to public cloud and they were together planning the solution, even the services might not be running on their infrastructure.

TABLE 8 IaaS and PaaS acquisition changes on value networks

Cloud computing value network changes	**Company & interviewed**
If solutions production solutions deployed on cloud, changes expected (e.g. 247 operating partner)	A3, B1, B2, C2, C3
Changing infrastructure provider on the fly	A3, C1
Cloud providers not partners, cloud agreements as standards (hard back-to-back sanctioning models, no traditional SLAs)	B1
Software partner role clearer for all parties	B3
What will be the licensing model in the future, who will paid the licences on different cases	B1
Virtual private cloud provider proactively developing the infrastructure and consulting towards public cloud	C3
Fewer partners in value network, no need for complex multi-provider environment	C3
Cloud brokers	A3

Generally speaking the companies had not institutionalized their cloud infrastructure usage and they did not have many experiences of what kind of changes there had been on the value networks. The companies were forecasting some changes for the value networks in the future, but they were not able to name many of them. The findings can be found from the table 8. On the other hand the companies were able to show pain points and changes there have occurred or were expected to occur in the way the value networks operate.

6.8 Theme – Business benefits from cloud

As it can be seen from the table 9 there was a long list of benefits and many of them were common for various companies and then there were some specific benefits that only one interviewed stated. Every interviewed from each company stated that the flexibility has been the key benefit. Of course flexibility can include many things inside, but mostly they were related to the fact that the companies had greater possibilities to create, copy, de-activate servers and environments and the cost of the service consisted only on the parts that the company had truly used. Example given, the servers and environments can be created as self-service, they can be configured accurately, servers provisioned automatically and instances are easy to copy to different physical and logical locations and this all can lead to lesser time-to-market.

All the companies defined that one mode of the flexibility is the possibility to sign contracts without long commitments. The CIO of the company A defined: "The biggest benefits are the flexibility and scalability. We do not have to engage and tie capital into any own systems and neither to long contracts as cloud contracts are flexible". On the other hand the price was a hard question, the CIO was not sure of the price reductions due to cloud as all the IT prices had come down in last few years.

All the companies had benefit that they did not have to invest money to have infrastructure and this way there was not as much tied-up capital on IT as earlier. So the capital expenses had gone downwards and operational expenses upwards. All the companies felt that they had received benefits from cloud infrastructure and platform scaling abilities and automation functions. This way there were fewer manual tasks, even though the automation and scaling possibilities are expected to improve in the future. The company B head of the department defined: "what supports our general strategy is that we do not want to own and invest, so we could decrease our Capex. We want to minimize investments on hardware, physical capacities and that is what cloud enables". The company C system manager explained:

> "…it is in itself absurdly cheap when you do not have to invest to any hardware. When you order something, there is no need to order through subcontractor when every hour costs surprisingly much, so with that single one-time charge you can run a server easily a month in a public cloud. And that is in small scale, but when you deploy more and more it easily recurs…"

Companies A and C felt it important that the servers can be accesses outside of the companies' installations. Also it was felt important that cloud infrastructure deployment had lessened bureaucracy in their operations. For the company A it was important that in public cloud the server can be located in geographically favourable location, based on where the work was carried out.

Companies did not feel like that they had had direct cost savings, but they needed fewer physical machines and like the IT-architect of the company A defined:

> "I do not think that we have achieved that monthly costs had decreased, but what is seen is that now we have servers, virtual clouds and private clouds, tenfold times more than we had few years back... So costs have not increased… If we calculate the price per server it has decreased to a fraction compared the time before cloud".

For the A and C companies it was beneficial that in the cloud operational model they did not have to pay one-time charges when creating new servers. The senior trainer also stated that in this new cloud model the company has less risk in case the machine broke down. And moreover it was easier to operate with the clients, as there was no need for customer premise testing environment. What the CIO of the company A felt is that they have benefitted indirectly economically from the cloud solutions. He defined:

> "Maybe the greatest benefit is that the cloud possibility exists, so all of these who offer more traditional solutions know that cloud is a realistic choice. They know that we have gone there in some cases, so when we have renovated the old traditional contracts, we have managed to get the price down significantly, which had probably not been possible unless the providers knew that the cloud is realistic option for us".

The CIO also felt that along the cloud services the outsourcing of other functions came easier. And the IT-architect of the company told that cloud solutions enable mobility solutions, which give greater flexibility and presence for their workers on geographically disperse locations. The development manager of the company B felt the reliability had increased along cloud solutions and that the general service quality had increased as well. What was seen as opportunity and great benefit for the company C was the opportunity to mitigate multi-provider challenges along cloud solutions. The company C development manager summarized the benefits:

> "We are expecting benefits from reliability, accessibility from where ever and whit what so ever… Hmm.. Flexibility, we can get capacities on demand and reduce it and we only pay what we use. It is a long time dream, but now it is finally coming true."

TABLE 9 Benefits from IaaS / PaaS cloud solutions

Benefits from the cloud computing	**Company & interviewed**
Flexibility to create & copy & configure servers (easier and faster)	A1, A2, A3, B1, B2, B3, C1, C2, C3
Less investments, no tied-up capital on IT (Capex –> Opex)	A3, B1, B2, C1, C2, C3
Scalability & automation	A1, A2, A3, B1, C3
Accessibility to servers from outside	A1, A2, C1, C2
Total cost savings	B1, C1, C2, C3
Lessens bureaucracy	A2, C1, C3
Contract flexibility (no long contracts)	A3, B1, C2
Server can be situated in geographically favourable place	A2, A3
Price per machine decreased	A1, A3
No extra cost when creating new machines	A1, C1

Time to market	B2, C1
Lessens risks if machines brake down	A2
Traditional solution prices have come down	A3
No need for customer training environment	A2
Easier to outsource other functions	A3
Fewer physical machines	A1
Mobility	C3
Reliability	C2
Improve the service quality	C2
Fewer challenges in multi-provider environment	C3

7 DISCUSSION OF THE RESULTS

This chapter reviews the entire research, looking how the research questions were answered to and how the objectives were met. In this chapter are compared the findings from the previous chapter six with the past literature and the theoretical model used a framework for this thesis. In this chapter are presented the implications for practitioners and researchers that arouse from the thesis.

7.1 Pointing out the research question

The thesis aimed to reveal those factors and points where organizations pay attention to when they are deploying IaaS or PaaS solutions as well as to denote why organizations were reluctant to move to cloud environments or not doing it on a bigger scale. Another point of interest was to illustrate key reformations of the changes that cloud deployment results in the organization's business and in the organization itself. The research questions were:

1) *Why are organizations acquiring IaaS and / or PaaS services and how have the organization moved towards cloud computing environments?*
2) *What kind of affects have the cloud infrastructure / platform deployment had for the organization's business and for the organization itself?*

7.1.1 Answering the first research question

To point out the research question of the reasons why organizations acquire IaaS and / or PaaS, it can be argued that the reasons are not even closely only economical. The main reasons deploying IaaS and PaaS solutions were the need for greater flexibility through self-services, automation, improved scaling and short-term contracts, which are aligned with Linthicum's (2009) findings, nevertheless he suggested that one benefit of the cloud computing is its greenness, but that was not felt important among the participants. The cost savings itself was not that strong reason, but the will to reduce investments and turn Capex

model to Opex was a strong factor. These findings are in the line with Kerin, et al (2013), Phaphoom (2013) & Smith, et al (2011) that sourcing motivations are not just the cost savings they are more complex reasons. Nevertheless like Phaphoom, et al (2013) & Etro (2013) also stated, the will to reduce investments is a key driver moving towards cloud. The amount, which is not spent on investments, can be spent on other uses like suggested by Aljabre (2012) & Kaplan (2005).

What was also seen was that cloud did not have inherent value as suggested by Peppard, et al (2007) and the benefits arouse when the companies worked differently like building their own solutions as cloud suitable to increase automation. When comparing what cloud deployment brought to the business with the Weill and Broadbent (1998) model it can be seen that if cloud was used in correct usage, it reduced the cost per transaction, but the true value was created on upper levels as the time to market was reduced and service quality improved, but it did not affect the financial business value level creating revenue growth on these case studies, which though was expected result. It was found out in these case studies like Mazhelis and Tyrväinen (2012) wrote that the optimal cost structure could be achieved when combining public cloud with other solutions. It was seen that public cloud price is not yet comparable with other solutions on constant production workloads and also there were many doubts about the data privacy issues.

The PSIC-framework was used to answer to the first research question's second part. As Lyytinen, et al (2009) stated the PSIC-model is used to create a process model at micro-level of how systems as material carries of institutional logics are locally adopted and institutionalized. The result was that IaaS and PaaS solutions were not yet institutionalized in the enterprises, the adoption process was still ongoing and there were many cloud tendencies, which made it difficult to go deep to micro-level. With the framework were revealed the cloud trajectories of the three companies on general level.

All the companies had outsourced at least partly their IT-services and moreover the servers were on the most parts virtualized before moving towards cloud environments. So far none of the three companies had put production systems into a public cloud, but into a less sophisticated virtual private clouds. The public cloud deployments were mostly used for test, development and proof of concept purposes on ad hoc basis. Therefore public clouds had only a small percentage of the total volumes of the companies' capacities. All the companies had disequilibrium moments during their cloud deployments, which were stabilized by corrective actions. The analysis of the PSIC-models shows that the cloud trajectories were influenced also by environmental context, it was not only pure internal decision to move towards cloud environments, but there were also influence from outside of the companies. Although public cloud acquisitions were on most parts driven by in-house needs so far.

Overall the cloud trajectories of these case studies followed a punctuated pattern. On most parts the companies have enjoyed somewhat stable trajectories, there have been small issues with deployments, but as there has not been any major migrations, the major problems were avoided. As suggested by Lyytinen & Newman (2008) the interventions the companies made could have lead

to three different outcomes (stable configuration, a failure and deepening crisis) and in these case studies the interventions were mainly successful leading to stable configurations.

Here is summarized the answer to the first research question. What cloud infrastructure and platform really did for the companies was to empower the IT staff and decision-makers with great flexibilities regarding the lengths of services, tasks and generally their own solutions. The companies cloud trajectories followed punctuated pattern and they faced some difficulties during the deployment, but so far the progress has been small on every company. The companies first have outsourced most of the IT, virtualized servers, deployed production workloads into virtual private clouds and on ad hoc basis use public cloud for test, development and proof of concepts. The companies are investigating the possibilities to move production solutions into a public cloud and offering their own products as cloud service.

7.1.2 Answering the second research question

To answer the second research question of the cloud environment acquisition affects into the organizations' businesses and to the organizations itself, it can be argued that the cloud infrastructure/platform acquisition itself did not lead to dramatic changes. In the case studies were asked if something had changed in the Osterwalder's & Pigneur's (2010) nine building blocks point of view. The strongest changes were felt on the cost structure, activities and resources, which can be described as internal changes. There were not many important changes observed that had visible effects on the outside of the companies. These companies were recipients of the changes from the cloud providers' side, which is on line with Baden-Fuller & Haefliger (2013) statement that technological innovations have influence on firm's performance. In these cases the cloud has had influence both on the provider's and buyer's business. Like Anandasivam & Premm (2009) pointed out that infrastructure layer comprehends business models that provide enabling technologies as basic components for ecosystems and then Weinhardt, et al (2009) stated that only the application layer represents the interface for customer and it is just delivered through the platform and infrastructure layers. It was seen in the case studies that cloud was considered more importantly as application level subject and what happens below is just enabling part. Acquisition of the enabling parts did not lead to dramatic changes.

Companies had also more plans to modify their own business. Like Ojala & Tyrväinen (2011a) point out that markets vary over time and software firms must adjust their offerings and business models to adapt changes in the market conditions. Companies had some kind of ideas to move their own solutions to cloud infrastructure and maybe even offer them as SaaS, which might then lead to stronger changes on other main areas or building blocks of the canvas model and leading to external changes on the business models. Chesbrough (2010) and Teece (2010) have pointed out that the value is released when it is commercialized some way via business models, which in these cases could be new revenue

from new offerings. Anyhow, it was too early to start analysing those affects on the companies' business models and out of the scope of this study.

Case study companies felt that they had not had immediate strong changes on their value networks, but that there were expected such to occur. In the case studies were found same stakeholders as suggested by Marston, et al (2010), Leimeister, et al (2010) & Currie (2000). In the case study consultants played a big role for companies B and C during their cloud trajectory and regulators had also a role for them. If the companies were deploying production solutions on cloud, they would need new service partners. Also integrators' role was seen to be important in many cases in the future. What was thought to change was the infrastructure provider's role. Companies' own solutions were planned to be build-up in a way, which enables infrastructure provider changing swiftly. Also there were noticed that in the future there might come new aggregator roles such as brokers, who sell different capacities from one portal. Firms were conscious of their current actors in their value networks and they had pretty good understanding what those might be in the future, which was seen important by Ojala & Tyrväinen (2011b). As suggested by Ojala & Tyväinen (2011b), Larsson and Starr (1993) & Prashantam and Dhanaraj (2010) the dynamic nature of the networks was also proven in the case studies.

Here is summarized the answer to the second research question. By acquiring cloud infrastructure or platform the companies faced mostly light internal changes, but depending on the future decisions regarding their own solutions, which are sold to the customers and production workloads, there might occur many changes that have influence on external parts of the company and value network. The change process is ongoing and therefore difficult to measure or forecast in detail.

7.2 Implications to research and practice

In this study was used Lyytinen's & Newman's (2008) PSIC-model as a framework. The PSIC-model has been used earlier investigating an ERP-system implementation and its institutionalisation in a company. In that work Lyytinen, et al (2009) managed to study events from socio-technical (task-structure-actor-technology) point of view in micro-level and described the nature of the information system change in the company.

In this study the same PSIC-model was used to study the cloud trajectories in three enterprises and it can be argued that the nature of the change has been different and more multidimensional. The logic was to find out what kind of the IaaS / PaaS acquisition processes had been in different organisations, why the moves happened and what had changed in their businesses during the trajectories. The results of these studies suggested that IaaS / PaaS usage had not been institutionalized on these case study companies. This study came to the same result with Chow's, et al (2009) that companies are testing public cloud with smaller projects.

Cloud was hard and somewhat immature topic as it came out in various contexts that: after all what is cloud? There still does not exist one generally accepted definition for cloud in the industry and it caused challenges during the study. What made this topic really difficult as well was the fact that acquisition of IaaS or PaaS does not have same kind of project closing as implementing an ERP-system. Different participants spoke of different environments, cloud providers, platforms, and then there were public cloud, private virtual cloud, dedicated private cloud and managed private cloud. Then the companies had their own plans to create cloud software solutions, which were also linked to using IaaS and PaaS solutions and the providers' capacities. Therefore it can be argued that the PSIC-model was not the best fit for this kind of multidimensional study and it was difficult to investigate a cut piece of the complicated entirety. Anyhow, in this study are illustrated successfully the general cloud trajectories of each enterprise, which followed punctuated pattern.

The PSIC process model indicated that the comparison between on-premise owned data center solution and cloud-based solution is somewhat outdated. All the companies had already outsourced their IT, at least partly. The public cloud move did not lead to dramatic changes, as the earlier outsourcings had already changed organizations. Now these cloud solution acquisitions could be described to be an extension of outsourcing and getting access to resources in a more flexible manner. This study also suggests that the business model commercialization through business models is definitely a provider level issue. The providers had commercialized the new technology or operational model and these case study companies were enjoying the benefits of these actions.

The thesis results were in many respects in line with previous literature, but there were also some differences. Phaphoom (2013) and Linthicum (2009) argued that green values had been a driver or benefit when moving to cloud, but that was not the case in this study. The green values were felt important, but not as a driver or important benefit.

The contribution of this study to practise could be summarized in a way that the companies are not ready to move their production workloads on public cloud mainly for reasons that concern the lack of control who can access their data and where it is located. The service providers should be more clear and transparent of who can access the data and it should be technically possible to limit the persons who can access the specific customer machines and data. It should be also possible at any moment to specify where the customer devices are and where the data is stored. Also the international regulators should have more consensuses on their policies. Also the pricing model is not automatically suitable for continues services and workloads. It goes without saying that everything cannot be put into public cloud. Those systems that cannot be on public cloud could leverage the benefits of hybrid clouds. It is strongly believed that there exists many opportunities, which could be transferred on cloud after mitigating these doubts that possible customers still might have.

The contribution of this study to research could be summarized in a way that the cloud drivers and benefits are somewhat saturated. These findings stood in line with the previous literature. There was used this new PSIC ap-

proach for studying cloud deployments and is an interesting option also for the future, but it is strongly suggested to use it only for one case study at time based on the experiences of this study. Also this study managed to point out that at least these case study companies had already outsourced their IT before moving to cloud solutions. It is somewhat hard to imagine a situation where companies turn their own data center on public cloud. This study also contributes by linking cloud computing to business model literature and explored the nature of the change in cloud infrastructure or platform deployment context, which was seen rather punctuated and multi-level. Companies acquiring IaaS or PaaS services seem to experience only internal changes as the service providers experience external changes as well.

The PSIC model has been proven to work also on new circumstances and it strengthens previous findings from literature, even it has to be stated that it is somewhat complicated method, which is agreed by Lyytinen & Newman (2008). The model demonstrated that cloud has been able to pass the hype-stage, but it is still immature topic and has not been institutionalized on these enterprises, which suggests that the same situation is rampant on wider context. This study has been able to slightly increase the level of understanding around complex cloud computing, but it has to be stated that the sample is too small to make any hesitated further conclusions based on these results.

7.2.1 Implication 1: The core value from the cloud infrastructure acquisition is the flexibility and empowerment

In earlier cloud studies many different advantages and benefits have been found. The findings from studies of Leimeister, et al (2010), Linthicum (2009), Stadtmueller (2014), Marston, et al (2011) and Phaphoom, et al (2013) suggest that the flexibility in different ways is found to be one of the main values cloud could provide. One other main advantage was the possibility to reduce upfront IT-investments (Phaphoom, et al 2013 & Etro 2009). Linthicum's (2009) and Mazheli's & Tyrväinen's (2012) findings state that scalability is one of the main benefits of cloud computing. These are the major findings also in this study, which strongly align with the previous literature.

This study suggests the value that IaaS and PaaS users feel receiving is definitely coming from flexibility and automation. This kind of end-user organization empowerment can be seen through increased self-service possibilities, short-term contracts and different solution or configuration design options available on demand. What was found positive was that there was no longer need to invest into technology and tie capital on IT and moreover the company benefits automatically provider's most modern technologies.

The companies are expecting to receive more benefits of IaaS and PaaS solutions when they can even more automate their operations. Scaling capabilities and the chance to lessen the quantity of manual tasks are great examples. After all cloud was felt to be application layer issue and infrastructure and platform are only enabling layers. The companies are planning to design their own solutions in a way that changing the infrastructure provider and platform would be

rather easy and effortless task in the future and they would not be tied with one provider and with one technology. The acquiring companies do not want to be dependent of the provider functions; they want to be empowered and use infrastructure as commodity, when they want and where they want. The word empowerment is the key word, which was not found very often on previous literature.

7.2.2 Implication 2: Cloud computing is a trust business

Garrison, Kim & Wakefield have stated: "Trust between client organization and cloud provider is a strong predictor of successful cloud deployment". The previous statement is a good summary of the main challenge the companies felt when considering move to cloud infrastructure or doing it on larger volumes. Kaplan (2007) found in his study that major problem in adopting cloud was the fact that someone else is responsible of the organization's data. Chow, et al (2009) stated that organizations were not ready to put sensitive data into cloud and cloud solutions are tested with smaller projects. Armbrust, et al (2010) noticed that business continuity strategy is needed before migrating to cloud and Subashini & Kavitha (2011) continued that DR is needed to guarantee enterprise data security. These are the major findings also on this study, which strongly align with the previous literature.

Many of the adoption challenges that came up in this study have to do with the trust between the provider and customer. There were many uncertainties how the data is stored, where and who could access it. Companies were investigating the needs for own back-ups and many times the provider's DR capabilities were studied and questioned. Maybe more surprisingly also the availability and infrastructure's reliability were slightly doubted.

It can be argued that the cloud providers have not been able to explain their operational models and policies to gain the trust of the customers. Most of the challenges are related to the question: what data and workloads should be deployed, which remains open and is under investigation on these case study companies. Definitely there is no universal rule for this, but every company has to make these decisions internally. Not everything can be transferred on public cloud, but improved hybrid models needs to be investigated.

7.2.3 Implication 3: Cloud infrastructure is not institutionalized

Lyytinen & Newman (2008) model recognizes socio-technical changes on multiple levels of the organization: work system, building system and the organization level. Socio-technical systems (task-structure, actor-technology) during IS change are seen open and due to this, systems need to continuously adapt to the surrounding environment to maintain the system state, where the four major elements are aligned. Lyytinen, et al (2009) noted that institutionalisation is neither linear nor incremental, but it goes through sudden, non-linear disruptions. In these case study companies there were many actions taken, which tried to keep the systems on balance with the surrounding environment leading to

punctuated pattern and many ad hoc changes regarding their infrastructure solutions and information systems.

These case study cloud acquisitions have not been investments, not even the virtual private clouds. Anyhow, these private cloud models do not have as flexible payment models as public clouds. It can be argued that the cloud acquisition nature has been close to Peppard's, et al (2007) innovation based model where companies exploit business opportunities or build new organizational capabilities by working in a new way using IT. In the innovation model it is stated that the benefits are not known, the objectives and scope may change during implementation while organizations understand what can be achieved. This also strengthens the fact that the cloud trajectory has been punctuated and there is no clear defined goal. Trajectories are about continuous development, adaption and learning. These are the findings that have not been mentioned too often on earlier literature. Many times cloud IaaS and PaaS services are thought as something that can be just put on running, but the truth is more complicated than that. Of course the complexity is related to workloads or systems that are transferred.

The results suggest strongly that there is no mean to transfer everything to cloud, only the most modern and cloud suitable solutions should be deployed. With the cloud suitable solutions automation is expected to improve in a way that many tasks can be automated and human manual tasks are not needed anymore, this is expected to increase the interest on larger cloud deployments. Many of the institutionalizing challenges are related to the question what cloud is correct for each workload? The pricing models are different and some of them are suitable for short time peak load performance and some are also suitable on more stable and longer workloads. Also here the trust plays a big role, the customers of these case study companies have not shown great interest towards moving their production systems to cloud. When the end customers are ready, these case study companies could deploy IaaS and PaaS services on a greater extent and build their services on top of cloud infrastructure and platform.

There is no one single truth that can be deployed on cloud. It seems to be a case by case question and for the specific workload in question the optimal cloud place, if exists, needs to be investigated. It could be summarized that cloud-institutionalizing trajectories have started on these case study companies, but there is still plenty of learning, trials - successful and unsuccessful ones - to be done to understand the effects in outright. These trajectories have followed punctuated pattern and the adoption process is ongoing. Cloud computing has passed the hype stage, but cloud has not been institutionalised. Anyway it can be forecasted to be on its way to institutionalise its position on the companies' every day business operations, especially through hybrid cloud solutions.

7.2.4 Implication 4: Cloud infrastructure deployment leads to internal changes, external changes depend on future actions

Osterwalder and Pigneur (2010) stated that business model explains the way organization creates, delivers and captures value and that can be divided into smaller pieces, to nine basic building blocks. Berman, et al (2012) forecasted that there would be changes in the cloud value chains. Also Leimeister, et al (2010) suggested that cloud computing might experience business model changes. Like Zhang, et al (2010) described every architectural layer can be implemented as a service to the layer above it and vice versa perceived as a customer of the layer below it. This implicates that looking just changes from one point of view does not entail all the changes on business models, and in the value network. It is more complex system. The changes that had happened in value networks were still pretty small, but there are expected to occur further stronger changes. So far the future scenarios were based on guessing, and are also dependent of how much companies will transfer production workloads on public cloud.

Companies experienced business model changes that can be described as internal changes (cost structure, key activities and key resources). There were not many changes that were visible outside of the company. Cloud infrastructure providers had changed their business models compared to the previous operational models. Based on the results of this study is forecasted that the companies that acquire cloud infrastructure, but moreover start selling their solutions as SaaS will go through business model changes that can be described to have external effect (partner network, value proposition, distribution channel, customer relationships and segments, and revenue model).

It came up that if the companies were ready with their customers to move their production systems to cloud and offered the solutions as SaaS, there would be changes that could reflect further on the value network. And when the solutions of the case study companies enable cloud provider transition on the fly, it will not change the whole structure of the value network, but it definitely has huge effect on the partner relationships between infrastructure providers and customers.

After all it can be argued that cloud computing is about to maximise the benefits of the final end-users. Different organizations co-operate in the value network on different architectural layer providing and enabling flexible solutions for the next layer or other actors on the value network. The changes on the business models depend if it is studied from the transmitter (external changes) or from the receiver (internal changes) point of view.

8 SUMMARY AND CONCLUSIONS

This chapter summarises the entire work and final conclusions are presented. The work and findings from the case studies are linked to the origin of this work, the research question and the aim of this study. In this chapter are also presented the contributions and limitations of the thesis and also suggested some interesting topics for future research.

8.1 Summary of the study

The objective of this study was to reveal the reasons why organizations are deploying cloud computing, especially public IaaS and PaaS. Also the goal was to discover the factors where organizations paid attention to when deploying IaaS and or PaaS solutions. It was interesting as well to denote the reasons why organizations might feel reluctant towards moving on cloud. Furthermore this study was investigating of the change process and revealing what had change in the business of the companies and how the companies had changed itself.

The thesis was conducted as a case study (n=3) and qualitative method - semi-structured interviews (n=9) - were used as data collection method for the dataset. During the data analysis there were used PSIC-model methodologies (Straus and Corbin, 1998 microscopic technique) and affinity diagram methods (Britz, et al 2000). There was used PSIC-framework by Lyytinen & Newman (2008) to study the cloud trajectories of these three case study companies. The original PSIC-model illustrates information system changes by chronicling complex interactions between socio-technical elements (task-structure-actor-technology) in the building system, the work system, and organizational and environmental context, which together account for the institutionalization outcome (Lyytinen, et al, 2009). The framework and methodologies were chosen to create more understanding on this broad topic, testing the previous theories and possibly undercover factors that had not been discussed in previous literature by a process model that had not been used in this kind of context before.

8.2 Contribution of the study

The thesis made contribution towards increasing the understanding of cloud institutionalization status on three companies by stating that cloud has still some obstacles to climb over before it is going to be used as business as usual on enterprise production workloads. In the thesis were found out four major implications: 1) 1: the core value from the cloud infrastructure acquisition is the flexibility and empowerment, 2) cloud computing is a trust business, 3) cloud infrastructure is not institutionalized and 4) cloud infrastructure deployment leads to internal changes, external changes depend on future actions.

Kerin, et al (2013) suggested that sourcing motivations have evolved towards to meet more complex needs besides of cost savings. The research by Linthicum (2009) indicated that companies could benefit from cloud computing by cheaper cost, improved scalability and rapid set up of environments. Also Mazhelis and Tyrväinen (2012) were on the same line. Smith, et al (2011) indicated that the companies are looking other things as well as the bottom line, when considering move to cloud. Phaphoom, et al (2013) and Etro (2009) stated that important cloud favouring factor was the reason that in cloud model there were no need for big upfront investments. From the results it can be noticed that flexibility, automation capabilities and end-user empowerment were the main reasons and benefits from cloud usage. From the results it was interesting to see that data security issues were seen as one of the major stopping factor for further cloud movements, which is aligned with previous literature (Kaplan, 2007; Chow, et al 2009; Subashini & Kavitha, 2011 and Dillon, et al 2010).

The results of this study indicated that companies had deployed managed private clouds and dedicated private clouds, but only a small amount of public cloud. The latter was actually in the centre of the interest of this study as it is seen as the most sophisticated cloud option and giving the greatest empowerment for the companies using it. The different cloud deployment models were based on Ahorlu, et al (2013) study. The case study companies were talking about virtual private clouds, anyhow from the results can be further concluded that on most part companies solutions were based on dedicated single-tenant solutions and therefore the right definition would be dedicated private cloud and managed private cloud. Virtualization is normal also on managed private cloud and dedicated private cloud.

In this study were investigated how technology (cloud computing infrastructure) had changed companies' business models from the acquisition point of view. As Chesbrough (2010) stated normally new ideas and technologies are commercialized through business models. The commercialization in this study had been done by the service providers, which lead to internal changes on the acquiring companies. Anyhow, Baden-Fuller & Haefliger (2013) describe that changes in a firm's products can lead to changes in its business models. Based on these case studies further business model changes is expected to happen, if they modify their offering closer to a SaaS world. Then these companies would receive benefits from cloud infrastructure providers and further deliver the val-

ue to their customers and end-users, which might also lead on stronger changes also on the value network.

From the results on the general level can be argued that public cloud has passed the hype stage, but it has definitely not yet been institutionalised as a major infrastructure type for the enterprises. In the study has been noticed that it can be forecasted that cloud usage will surely grow in the future, but there are many issues to be solved before companies are ready to move their most sensitive data and customer production systems on cloud. Forbes (2014) article argues that Hybrid cloud is one good solution. On hybrid cloud model companies could transfer cloud agnostic systems to public cloud and keep the most sensitive systems and data on environments that are thought to be more secure. The key is to find an optimum balance to receive the maximum benefits of the hybrid cloud model and orchestrate different infrastructures or platforms together. Therefore it is argued that data security issues continue to be one of the major challenges in a cloud adoption. As a crucial central questions stand: how the providers should gain trust on public cloud and what are the right workload and price matches that should be deployed on cloud.

This study contributes to research by linking cloud computing to business model literature and PSIC-process model. The thesis contributes by providing rich empirical data collected from prominent cloud using enterprises by using different kind of approach. There were created three PSIC-diagrams based on the case studies. The diagrams were created to increase understanding around this complex and broad topic. The findings suggest that public cloud is expected to be institutionalized in the future. The findings from the thesis point out number of pragmatic issues that public cloud providers must address. In addition, the thesis covers essential concepts, architectural designs, main characteristics, and deployment models of cloud computing thus providing a deeper understanding of the phenomenon at hand.

8.3 Limitations of the study

This study was done as accurately as possible, but it is inevitable that there exist some limitations that must be recognized. This study included three different case study companies and three interviews per company. It is too little for any kind of generalization that could be publicly accepted as one single point of truth. The same PSIC-model has been earlier used for a case study, which was longitudinal (11 years) and included 63 interviews (Lyytinen, et al, 2009). That is a good comparison point when considering the micro-level change logic carriers, which were recognized during the companies' cloud trajectories. Also Lyytinen & Newman (2008) admit that the model is not the easiest to use. The cloud topic in general is complex and challenging, even the experienced participants had sometimes difficulties to discuss of it on different parts of the interviews. The topic was more complex and the companies' maturity to discuss of the theme was not as high as expected originally.

There exists a risk that the thesis writer has misinterpreted participants' opinions. There is a chance that some themes were referred more often as some other weaker stimuli themes due to the writer judgement. There was no balancing done between different themes, but all the results were presented as neutral and equal way as possible. As a limitation it has to be stated some of the participants had not been the whole cloud trajectory on the companies' services. On some topics it was seen that participants did not have necessary knowledge or experience to answer the absolute truth and therefore some answers were somewhat imagination-based. Due to this fact there were interviewed different level personnel to promote opinions from different point of views. Anyhow it can be argued that the interviewed per company in general had enough knowledge that the thesis writer was able to constitute unbiased results.

Cloud computing is definitely international matter, but this study focused on Finnish companies that had acquired IaaS / PaaS. The reason for the scope defining was the fact that the personal interviews were easier to arrange. It is hard and not even suggested to make any further generalization of the Finnish cloud status regarding the handled themes based on this small sample in the thesis.

Great parts of the analysis are based on the thesis writer capabilities of handle and interpret participants' data. This study has been one-man show and therefore the thesis writer's ability to draw conclusions subjectively cannot be scientifically exact. However, the study managed to meet its objectives and answer the research questions. There were no flaws in the empirical process. Finally this study describes cloud trajectories of the three case study companies, why they had started, what are the further obstacles and what had changed during the trajectories.

8.4 Future research possibilities

The thesis was carried out as descriptive study with the aim to create more understanding on this broad and complex cloud topic. The thesis tested as well the previous theories with a new tackle point with the PSIC-process model (Lyytinen & Newman, 2008) with an idea to uncover issues that had not yet been mentioned in the literature. One idea how this topic is that complex can be derived from Haapalainen's (2013) blog where is stated that defining cloud is hard for even IT-experts and therefore it is certainly hard for business representatives. There is for example speculated that the difference between private cloud and virtual environment is a thin red line. He continues that after all the definition is a secondary issue, but the central question is how cloud a like service solutions support business needs.

There are constantly many researches ongoing around cloud topic, but from this study can be prompted few more interesting suggestions. There are many different kind of classifiable cloud infrastructure available and it definitely seems that the future research should concentrate more strongly on hybrid models. Especially the focus should concentrate how to combine different mod-

els in the most flexible, cost efficient and secure way. If the change and cloud trajectory itself is wanted to be studied in more detailed, it is suggested to investigate an organization, which has advanced plans to institutionalize public cloud with their production workloads. This possible future case study should be concentrated only into one customer and done as longitudinal study. Moreover there should be enough representatives from different organizational level to get truly micro-level information of the change itself. It came up during the thesis that organizations in few years to come are expecting to be cloud users in many areas that they are not as of now.

It is also suggested to further study how much cloud providers could speed up the adoption process by actively interlocking with the customer and mitigating the doubts and adoption challenges they might hold. Future research is suggested to focus on the reasons what and how cloud providers should change so that enterprises could trust more of their production workloads on public cloud or how to benefit more from hybrid models. One more interesting point is how could cloud providers gain customers' trust and how could cloud solutions meet more precisely business needs. These suggested themes remain as open questions.

Also future research needs to further study the changes on organizations' business models in cases when organizations are benefitting from enabling cloud infrastructure acquisitions and when they are itself providing services on top of cloud infrastructure and further delivering the value to their end-customers through SaaS services. Many studies have been concentrated on cloud acquisitions on different levels, but it would be really interesting to see how information system provider's business models change when they change from traditional model to a SaaS world. The most interesting part is what all that change brings along. It is surely not only a change of licensing model, but it is expected to have many different changes on the organisation's operations. Here the PSIC model would be a perfect tool to use.

This thesis was done as qualitative and therefore the sample was not big enough to make a bigger picture of the cloud institutionalization status in general. Therefore it is suggested to conduct quantitative research in order to get scientific evidence to further validate the findings.

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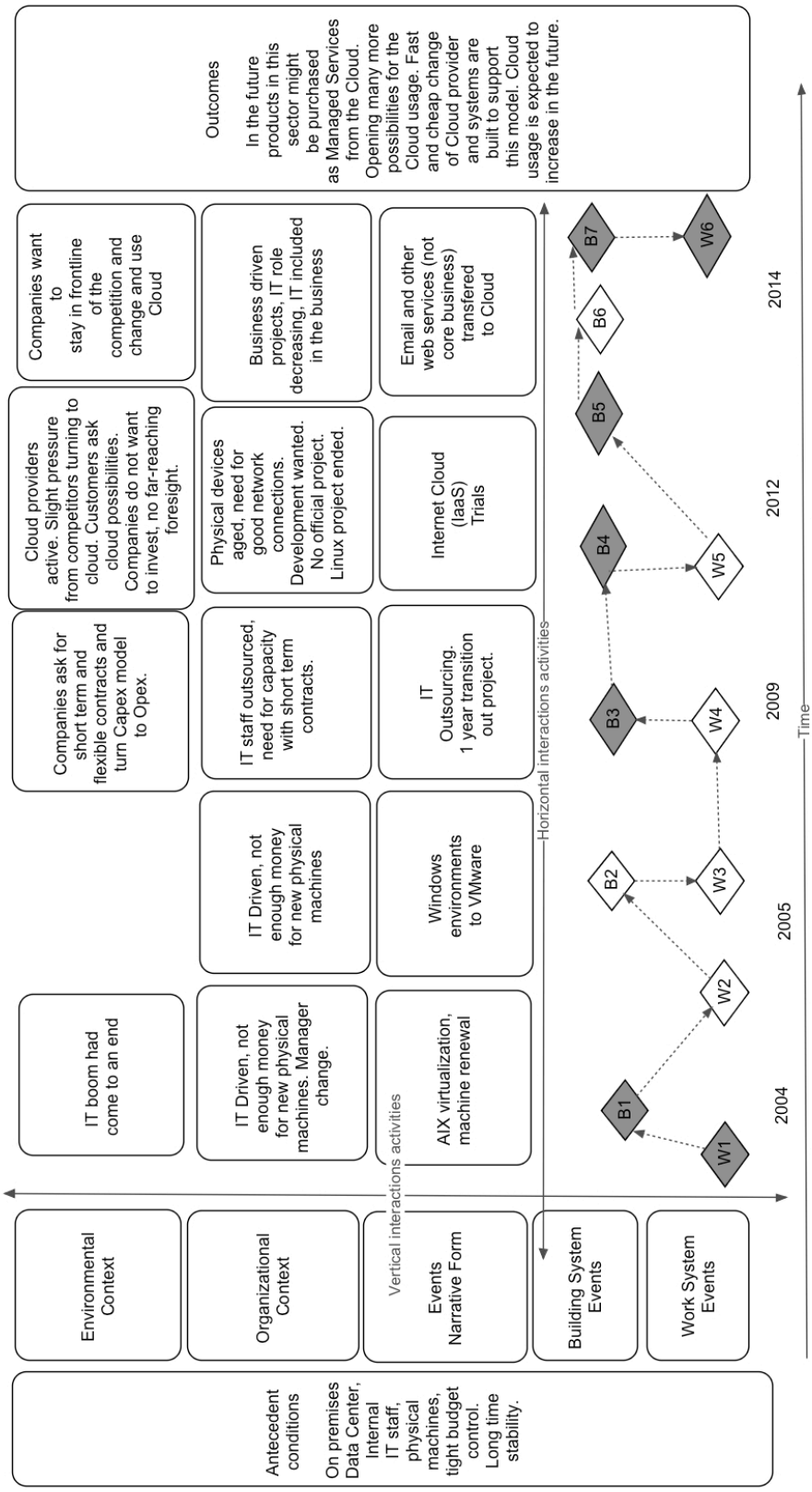
APPENDIX 1 THE PSIC MODEL OF COMPANY A



W1: There were needed more servers numerically. –> Virtualization made it possible to acquire more servers wit the same amount of money. (Technology-Task)

B1: IT-staff was not satisfied with the server performance. Change of the foreman had affect. (Actor-Technology)

W2: Stable state

B2: stable state

W3: IT-staff was transferred to outsourcing partner, IT-staff close to development stayed in-house. (Structure-Task)

B3: After outsourcing company need more upper level knowledge what to order (not technical), there were not many people in house who knew enough of the systems, but staff at outsourcing partner had many. It was hard to do wise orders. (Actor-Task)

B4: Trainers Linux project had been ongoing over a year and suddenly management notified that cloud solutions should be tried out. Linux project was frozen and trainer moved slowly from VMware environments to cloud. (Technology-Task)

W4: Actors who had VMware image ready stand against cloud, as they knew that VMware was working. After trials they changed their mind when they noticed that new versions are easy to create on cloud. (Actor-Technology)

W5: In cloud model there are needed more technical knowhow than when operating with out-sourcing partner. Increases the expertise needed of the operational level staff. (Actor-task)

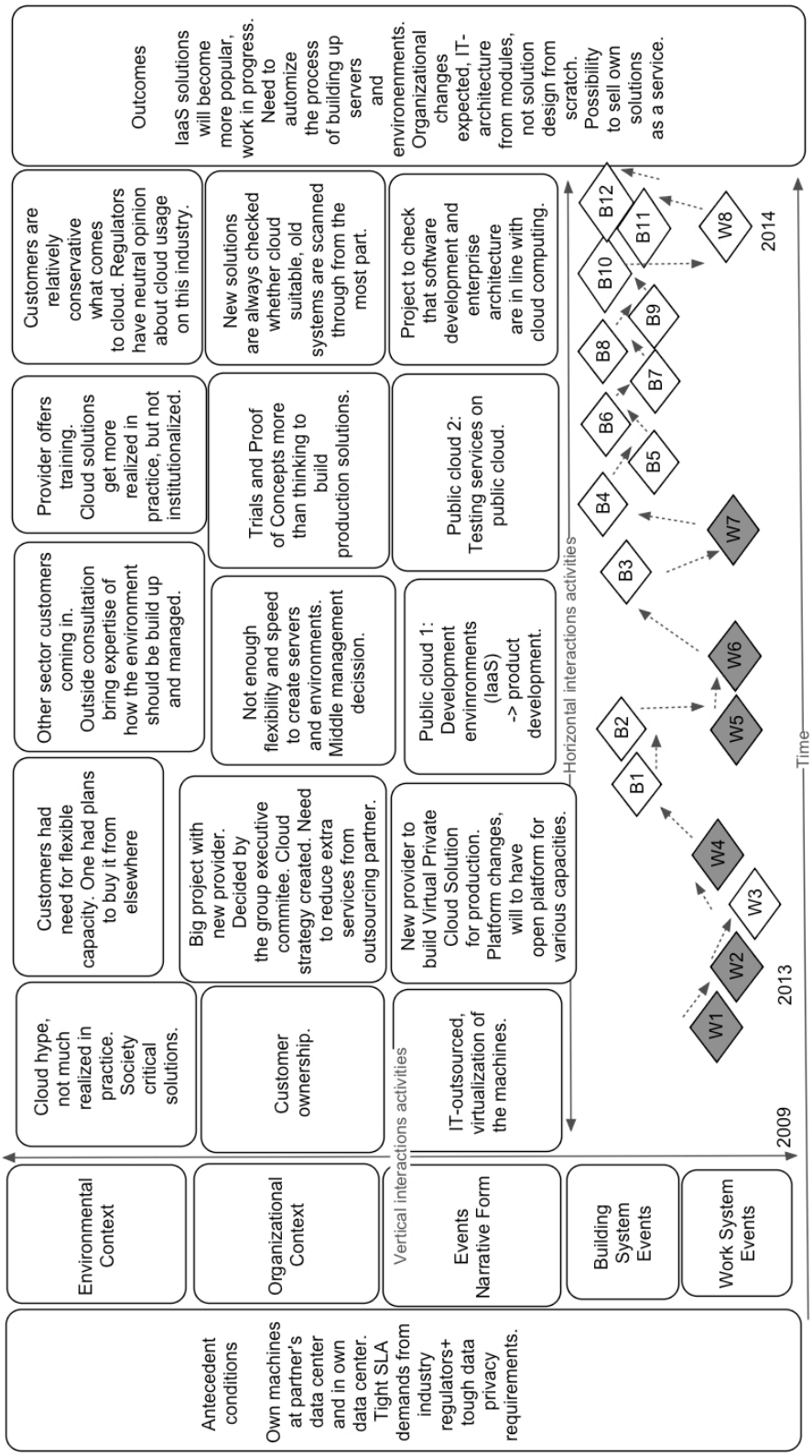
B5: Invoicing was not directed to the using department. There were too many provisions done and the machines were not de-provisioned. Then the cloud costs increased exponentially. There is continuous education needed. Company wants to keep the bureaucracy light. In the future the cloud costs are planned to allocate per real usage. The work has been started on the biggest cases. (Structure-Actor)

B6: IT-role has decreased on new server acquisitions and they are more business driven. It is expected that business function include the IT. (Structure-Task)

B7: New project to create self-service portal, from which one could order public cloud capacities inside the company's limits. Current provider user interfaces need delving into them. Staff learning is slower in the cloud in the beginning or when changing a cloud provider. Productivity is not that high as it was with traditional. (Structure-Task-Technology-Actor)

W6: New cloud technology is not always the right fit to carry out the tasks. Customers are not mature of using it. It is expected that cloud services need still additional management or system administrator partner; it cannot be avoided, as the machines need maintenance. (Technology-Task-Structure)

APPENDIX 2 THE PSIC MODEL OF COMPANY B



8.

W1: Outsourcing contract arrangements were too tight, there were too many requirements (e.g. data privacy & network infrastructure) per certain solutions and those tasks were not creating any additional value. Model was nor flexible neither cost-effective. (Structure-Task)

W2: Provider was not operating as agile as expected; it had consequences why other provider was chosen for the virtual private cloud. (Structure-Task)

W3: Virtual environments criticized a little, as they did not equal physical dedicated machines. Some users felt that there should still be a possibility for dedicated capacities, not only for virtual capacities. Sometimes I/O need is just so high that virtualization cannot follow. (Actor-Task-Technology)

W4: Company itself was too slow towards its customers. General agitation was needed. Cloud was enabler or element, which made it possible to move to a more agile world, not that it had been a intrinsic value. (Technology-Structure-Task)

B1: Cloud service comes as standard, there are not many modification possibilities. Knowhow had stayed in-house even the IT was outsourced. Staff has to accept that cloud comes as standard. Company does not want that IT-organization do system administration services, nevertheless in cloud offerings does not include all the needed managed services (such as patching). If the managed services were not acquired outside of the house, it would be against the original outsourcing strategy. (Technology-Actor-Task-Structure)

B2: Company had difficulties to decide how to solve the contradiction between security and competitive usage. Cloud strategy is created, but it does not answer all the questions the operational level has and it is expected that management will clarify the situation. For operational level the cloud strategy does not answer e.g. what is tried to achieve with cloud and why it is used. Established usage of the cloud is so far only coming. (Structure-Tasks)

W5: Services cannot be carried out fast enough, in a flexible way and as self-service, all the tasks were coming from the partner. This slowed time-to-market time. Development department got angry. Virtual private cloud was decided on the group executive level, but public cloud was internal decision of the development department. Virtual private cloud offers flexibilities, but not as much as public cloud. (Structure-Task-Technology-Actor)

W6: Company wants to build automated solutions, flexible and scalable environments; at the moment the company cannot react on peak loads fast enough. At this time there is no way to react fast enough to increase capacities. There are critical services and they are highly penalised, which makes this important theme. (Technology-Structure-Task)

B3: There are many trials ongoing. Cloud assessment model created, which checks systems cloud suitability, but is not always right, many times needed tests in practise. Cannot be said directly if something is going to work or not. Some are successful and some not. (Technology-Task)

W7: Mobility solutions does not meet the end user requirements what comes to the accessibility or reachability. Data privacy issues conflict with more open usage. There should be additional infrastructure created, which could identify and accept devices. (Technology-Task-Actor-Structure)

B4: Solutions do not always meet the data privacy requirements. Where is the data located, where is the service produced, where are back-ups and what kind of information is handled there. Data security questions arise and sometimes they exclude cloud solutions. Difficult as the service follows the sun, which leads to data security challenges. Not known what country's laws should be followed in case of data breach. (Technology-Actor-Task-Structure)

B5: New operational model in which capacities re delivered to customers. Customers use capacities on their own needs. Has created a new operational model for the organization. Challenge to solve how to follow the capacity usage. Customer feed back is behind to develop thi environment. Earlier company offered application code execution and it was customer decision to choose where the service was running. Now there is will to offer this from the new environment through the capacities. (Structure-Task-Technology)

B6: New cloud models had led to that the company has to develop and educate their staff. The company has to go through the roles and capabilities. Investigation has started. Company is investigating how to get production operations and development operations closer to each other. How should continuous integration and continuous development work is under investigation. Company has created a new integration team, but more changes are expected. (Task-Actor-Structure)

B7: There are confusions with the partner roles. Cloud systems need administration and maintenance. If production systems were deployed on cloud, a new partner would be needed. Group executives have decided that 247 system's management should be outsourced. Not yet any critical solutions on cloud. No decision so far on this topic, how should it be handled. (Task-Actor-Technology-Structure)

B8: Not sure what is going to be the new operating model with Service Level Agreements. At the moment solutions are based on SLAs with partners. Cloud contracts are standardised. There is a need to find a new operating model, as customers wants to penalise the company, but there will not exists the same kind of back-to-back model. (Structure-Task)

B9: Company has clear gap with skills. There is no understanding or knowledge what does the new things mean, what are the benefits, what is achieved or there are no technical skills of how to build up environments and how to get connection from there to the current servers. Unclear of how heavy or light it is to build integrations with cloud. (Technology-Actor-Task)

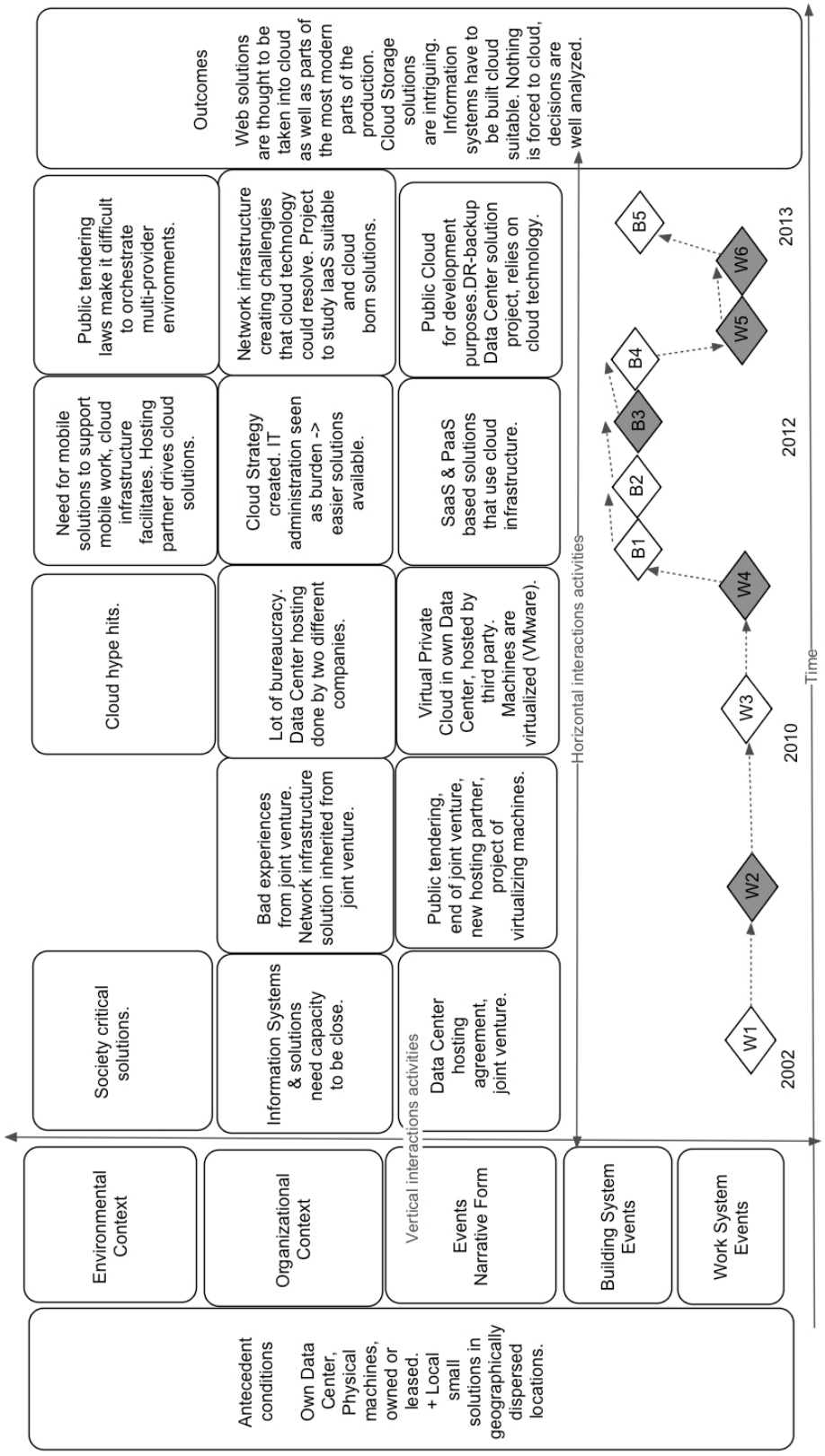
B10: What are the latencies between cloud servers and traditional data center. Many times the solutions are planned to be integrations between these two. There is a need to design the architecture in a way that network traffic does not go back and forth all the time. Not sure what would be the layer to deploy on cloud and what should be the architecture. (Technology-Task-Actor)

W8: Critical services are divided to two different providers. Due to the customers' business there are regulator's requirements that have to be fulfilled. Services should run also on a state of the emergency, therefore disaster recovery plans are important. (Technology-structure)

B11: Cloud strategy deployment is work in progress. Company has to decide how to match governance and flexibility. Should the control be transferred to one department or should each department be responsible of their capacities. It has not been clearly defined who can by cloud and from where, it seems that everyone has his or her own opinion. Risk that this is getting out of the hands of the management as business is moving forward with a great speed. There have been coming new people who have previous experiences from cloud nd they have their own opinions. Company has to study the requirements where to use cloud more deeply. (Structure-Actor-Task)

B12: Final situation, the general change is not understood, trials and studying needed and more experiences. (Technology-Task-Structure-Actor)

APPENDIX 3 THE PSIC MODEL OF COMPANY C



W1: Company has bad experiences from the joint venture partner. There was a need for new hosting service partner. With the earlier partner the service was only reactive, not proactive. (Structure-Tasks)

W2: The network solution that was build by the previous joint venture partner is causing challenges. It is a complex solution, which causes will to move towards cloud. Operative level has given plenty of feedback and IT management want to provide them the best tools. (Technology-Task-Structure)

W3: System administration was seen as burden for own IT staff. It was seen that it is easier to operate and work with ready solutions. Company saw that it is not always the best, reliable or efficient way to work to produce services by itself. The company is looking for the smartest ways of producing each service. (Task-Structure-Technology)

W4: Provision and such need plenty of bureaucracy; there are many organizations involved. It is seen that the working with cloud solutions would be easier and more automated. There is a clear will to expand this operating model. (Structure-Task-Actor)

B1: Restructuring of the departments might had some positive effect towards cloud movement. Two new workers came and they pushed the organization for more agile work styles and cloud was one part of it. There was a need to decrease manual tasks and increase automation. (Technology-Task-Structure-Actor)

B2: Cloud strategy / roadmap / documentation created. There are handled what system families and cloud opportunities there are, what are possible workloads to transfer. (Task-Technology)

B3: Unsuccessful virtual private cloud portal trial. Automation did not work and staff still had to do manual actions. In the future it is wanted that API do the provision. Now the ticket has to be rounded through sub-contractor and it is one kind of bottleneck. (Technology-Task-Actor)

B4: Web page solution, which might be deployed on cloud, has been initiated / driven by a partner company. Partner company builds up the environment and company itself does on top of the infra services and automation. (Technology-Task-Structure)

W5: There is continuously increasing need for storage space. New high technology systems and organization's information management & storage need plenty of disk space. New solutions are needed. Problem with copyrights, there is seen a higher risk if store on cloud. (Technology-Task-Structure)

W6: Even there have been enough capacities with traditional solutions; they have been on the limit most of the time. There are fewer issues to think about in public cloud if automation works fine. (Technology-Task)

B5: Green field project has been started: there is infrastructure been built with plenty of automation. The company is not tied with certain technologies, it wants have it possible to change providers on the fly. There are PoCs that are trying to create more understanding how to reduce multi-provider challenges and known bottlenecks. The idea is to start from the scratch with proto, testing and development and slowly turn the latest and greatest production solutions. (Task-Technology-Structure)