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Monolith ERP and current IT-trends

Creating a step by step development model (SSDM) for existing monolith ERP system to adapt to the current IT-trends

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Perinteinen ERP järjestelmä ja nykyiset IT-trendit - Uusi kehitysmalli perinteisen ERP-järjestelmän kehittämiseksi vastaamaan nykyisiä IT-trendejä

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Toiminannohjausjärjestelmiä (ERP) on ollut saatavilla noin 25 vuoden ajan, ja järjestelmät ovat kehittyneet useiden kehityssyklien aikana. Yksikään aiemmista kehityssykleistä ei kuitenkaan ole saanut niin kovia paineita tai tarjonnut niin suuria mahdollisuuksia järjestelmäkehittäjille ja järjestelmäasiakkaille, kuin nykyiseen ulkoistamis- ja pilvipalvelu-trendiin pohjautuva meneillään oleva kehityssykli. Nykyiset lisenssipohjaiset (perinteinen, monoliitti) ERP-järjestelmät ovat suuren haasteen edessä ja niiden täytyy löytää keinot mukautua pilvipalveluiden luomaan uuteen kilpailuun joko sopeuttamalla nykyisiä toimintamalleja tai muuttumalla myös itse pilvipalveluksi.

Tämän tutkimuksen tavoitteena on tutkia mahdollisuuksia, haasteita ja vaatimuksia joita perinteinen ERP järjestelmä kohtaa nykyisten IT-trendien ohjaamassa liiketoimintaympäristössä. Toinen tutkimuksen tavoite on selvittää onko pilvipalveluiden tarjoaminen ainoa vaihtoehto ERP-toimittajalle pysyä kilpailukykyisenä.

Tutkimus on toteutettu suunnittelututkimuksena. Suunnittelututkimus keskittyy luomaan uusia innovatiivisia artefakteja, jotka ratkaisevat todellisia ongelmia organisaatioissa. Tutkimus koostuu kirjallisuuskatsauksesta, jonka tarkoituksena on luoda kattava tietopohja, jonka avulla rakennetaan kehitysmalli (artefakti) ERP-järjestelmän sopeuttamiseksi nykyisten IT-trendien mukaiseen toimintaympäristöön. Malli luodaan tutkimalla kirjallisuudesta kerättyjä vaihtoehtoja ja haasteita ja johtamalla niiden pohjalta parhaat vaihtoehdot ja ratkaisut kehitysmalliin (kehityspolkuun). Valinnan suorittavat CGI:n ERP asiantuntijat. Asiantuntijaryhmän koostumus on esitetty liitteessä 1. Tapaustutkimuksen kohteena on CGI:n V10 ERP.

Tuloksena tämä tutkimus esittelee kehitysmallin (artefakti), jota voidaan käyttää ohjeena perinteisen ERP järjestelmän nykytrendien vaatimassa sopeuttamis- ja kehityssuunnitelmassa. Tutkimuksessa käsiteltiin myös pilvipalveluiden vaikutusta ja tarpeellisuutta ERP. Tuloksena päädyttiin siihen, että ERP pilvipalvelu ei ainakaan tällä hetkellä ole ehdottoman tarpeellinen, ja tarjolla on vaihtoehtoisia toimintamalleja, joiden avulla voi saavuttaa samoja etuja kuin pilvipalvelun avulla – niin toimittajan, kuin asiakkaankin näkykulmasta.

Avainsanat: Toiminnanohjausjärjestelmä, pilvipalvelut, pilvi ERP, ERP kehitys,

ERP toimitusmallit, IT-trendit

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ABSTRACT

ERP systems have been around for 25 years and have gone through evolution phases. None of the previous phases have however imposed so big a challenge and opportunities for the ERP producers / vendors as current outsourcing and cloud computing trends. Current traditional on-premises (monolith) ERP systems are put under pressure to cope with the demands imposed by cloud computing and other IT-trends (such as mobility). Traditional ERP systems have to adapt or face a risk of becoming obsolete.

This research aims to study the options and requirements for a traditional (monolith) on-premises model ERP system to adapt with the new trends affecting the enterprise computing. Another key component of the research was to find out if cloud computing is the only viable solution for the ERP system in the future.

The research is conducted with Design science research method. The main focus of design science research is to create new and innovative artefacts that solve actual problems in organizations. The research is done as a literature review on the ERP and current IT trends with main focus on cloud computing to build a knowledge base that could be used to create a development model (or route). The model was created by studying possibilities and challenges current ERP systems have and then choosing (by ERP expert group) and using the best alternatives and solutions to gain benefits and solve challenges. The case study was done by with CGI V10 ERP.

As a result this research introduces a step by step development model (SSDM) that can be used to guide development of existing system step by step to the new computing environment. The need for cloud computing solution for ERP was also studied and the result is that pure cloud solution might not at least for now be the first choice for a monolith ERP to adapt to the discussed IS trends. There are also other alternatives such as modified on-premises solutions or vendor hosted ERP solutions available that can compete with cloud computing with significant benefits and competitive overall value to the both customer and vendor.

Keywords: ERP, Cloud ERP, ERP delivery methods, ERP development, IT trends

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1 INTRODUCTION

ERP systems and the current IT trends – is Cloud/SaaS the only option?

This research aims to study the options and requirements for traditional (monolith) on-premises ERP systems to adapt with the new trends affecting the enterprise computing. The feedback from client companies we have been communicating with and also all the latest market research show that monolith ERP system is not necessarily the most considered solution anymore. Different SaaS (Software as a service) and cloud offerings have been gaining popularity on most of other business systems outside of full scale ERP systems (Csaplar, 2013). Now the trends are clearly starting to affect ERP system demand too, and there is a growing interest towards non-monolith ERP alternatives (Castellina, 2013). Late financial development has also affected the willingness to invest upfront capital to extensive implementation projects and system licences. It is getting clear that companies are nowadays much more keen to search for solutions that offer lighter implementation process and lower upfront payments. This drives the focus of interest into the ERP solutions easier implement, and easier to fund.

This trend has been clearly seen in ERP business as the full scale monolith system implementations are exceedingly hard to sell and potential customers demand more benefits for less investment. Ongoing challenging financial situation is one of the key drivers on this development, but it is not only one. ERP systems have been around for about 25 years now and much has been learned during this time about the implementation and benefits of the systems. There has not been a major game changing generation change in ERP systems on the whole time of their existence. Now alternative delivery methods such as cloud computing are setting a trend for all the business applications and these trends result in demand of alternative ERP solutions.

1.1 Background

Subject of the research is closely connected to my work, as I currently work as a director of an ERP unit at CGI. Our unit has developed a full scale ERP solution known as CGI V10, which is one of the most used ERP systems in Finland. V10 has been fully developed and is maintained in Finland in the past 20 years.

At this moment V10 ERP is offered as a traditional on-premises model where customer buys the software licences and implementation project. ERP system is generally installed to customers own servers or servers of third party service provider chosen by customer. This operating model has shown to be quite demanding especially for the companies on the low-mid tear of the SME sector (companies under 100 employees). Bigger organizations can usually meet the demands of an ERP implementation process, but even they have lately expressed interest in ways to ease implementation process both financially and on the project work itself (which makes up a large part of financial aspect of the project). The demands we have heard from several customers on many occasions are pretty much same: "We do not have time or money to proceed with a full scale ERP implementation. We need an easier implementation process and ERP model that saves money and time, and adds value to the business". As of now most full scale ERP systems are out of reach for smaller tier of the SME sector. This sector is however a significant part of the Finnish organizational structure and according to Finnish Tilastokeskus SME companies add to 99.8% of companies in Finland, and the micro and small ones take a lion share of that 99.8%. While full scale ERP system might not be ever possible or even needed for the smaller companies, even affordable parts of it might provide great benefits - especially if connected to the systems of bigger organizations they co-operate with.

We assume that producing a pre-configured industry specialized ERP vertical system based on known best practices combined with well-planned and lighter implementation process will open numerous possibilities to reach new customer sectors and further secure our position on our already strong sectors. This combined with some of the essential cloud properties such as external integrations to suppliers, subcontractors and customers is assumed to provide completely new

innovative business models such as ERP world has never seen before. We drive to find ways to implement ERP systems with lower upfront financial investment and lower amount of customer human resources needed while addressing the known critical issues affecting success of ERP implementations and keeping up with the current ICT trends. The purpose of this research is to create a model to achieve such an ERP system and implementation process.

We feel that this research will contribute a new angle to the knowledgebase of ERP system research as it is made from vendor / produced point of view. ERP research done from the vendor / produced point of view is quite scarce at this moment, and professional literature on the subject is even harder to come by. The knowledgebase built in this research will also be a valuable asset to me and CGI ERP business.

General applicability of this research should be on a good level, as it is based on extensive study on existing knowledgebase on ERP systems and their existing challenges and the challenges brought by new trends of IS development. This research is aiming to create an ERP system model that copes with the challenges of the ERP traditional implementations and prepares the system to meet the demands of the new IS trends from the vendor point of view, and this also positions the research on a less studied field. This research should also give quite a good view on ERP systems for organizations considering implementing one.

Background questions

Is SaaS / Cloud absolutely necessary step in ERP system development?

What are the main benefits and drivers of cloud computing and what are the main challenges cloud computing present for ERP systems?

What are the key points customers see as challenges in current and future ERP system implementation models.

1.2 Research process / Research structure

Research method used is design science research method (DSRM) and more specifically its adaptation to information system (IS) research. The main focus of design science research is to create new and innovative artefacts that solve problems in organizations (Hevner, March, Park, & Ram, 2004)

The research is divided in two main parts. First main part is an extensive literature review that builds a knowledgebase of ERP, current situation of ERP systems (monolith systems), and outsourcing trends affecting ERP systems and possible alternatives for the outsourcing and more specifically cloud computing that is now trending. Then knowledge base is then used to create a model (artefact) that can be used as an upgrade plan for a monolith ERP system operating model.

Main parts of the ERP system landscape are studied and analysed to recognize and find solutions to the problematic critical factors affecting current and upcoming ERP systems and their implementation success. Second main part is empirical part of the development project using the development model created in the part 1

1.3 Abbreviations and short definitions

For company sizes we use European comission's recommendations (Commission, European union, 2003)

Definition	Class	Explanation
Enterprise resource planning (**ERP**) system	class definition: IS system	See chapter 2.1 ERP definition
Information system **(IS)**	General abbreviations	Common definition for all information systems and industry / research field

Critical success factor **(CSF)**	General abbreviations	Known and supposed factors having effect on ERP implementation success
Information technology **(IT)**	General abbreviations	Common abbreviation used to describe to whole information technology concept
Micro enterprises (**ME**)	class definition: **SME**, Small and medium-sized enterprises	Enterprise with up to 10 employees
Small enterprises (**SE**)	class definition: **SME**, Small and medium-sized enterprises	Enterprise with up to 50 employees
Medium sized enterprises (**ME**)	class definition: **SME**, Small and medium-sized enterprises	Enterprise with up to 250 employees
Large enterprise (**LE**)	class definition: **LE** Large enterprises,	Enterprise with over 250 employees
Return of investment (**ROI**)	General abbreviations	A financial meter to determine how invested funds generate profit
User interface (**UI**)	General abbreviations	Interface that is used to control applications by users.
Software as a service (**SaaS**)	class definition: Cloud service type	Software delivered as a service

Table 1. Abbreviations

2 KNOWLEDGE BASE / LITERATURE REVIEW

2.1 ERP

In this chapter the concept of ERP is researched and defined. This chapter builds the base for the rest of the research as the concept of ERP is the centre point and the integrating factor of everything else in this research. First establish a definition and common characteristics ERP system. Then to understand ERP systems and their evolution better the history of the ERP-systems and their meaning and impact to organisations is described. Once this is done the challenges and company risks related to ERP are studied.

2.1.1 Definition of an ERP (ERP system)

ERP-system as a concept has nowadays quite a solid establishment, and most researchers agree on what ERP-system is and what it is supposed to do in following are listed a few common definitions of ERP system as direct paraphrases from previous researchers. This is done to show that ERP-system has quite a clear common definition and characteristics among researchers - thou there are some differences too.

Addo-Tenkorang & Helo (2011) definition of an ERP: The Enterprise Resource Planning (ERP) system is an enterprise information system designed to integrate and optimize the business processes and transactions in a corporation. The ERP is an industry-driven concept and systems, and is universally accepted by businesses and organizational industries as a practical solution to achieve an integrated enterprise information system solution.

Klaus, Rosemann, & Gable (2000) definition of an ERP: The ERP concept can be viewed from a variety of perspectives. First, and most obviously, ERP is a commodity, a product in the form of computer software. Second, and fundamentally, ERP can be seen as a development objective of mapping all processes and data of

an enterprise into a comprehensive integrative structure. Third, ERP can be seen as the key element of an infrastructure that delivers a solution to business.

And then again in short form:

Klaus et al. (2000): Usually called Enterprise Resource Planning systems (ERP), these comprehensive, packaged software solutions seek to integrate the complete range of a business's processes and functions in order to present a holistic view of the business from a single information and IT architecture.

Al-Mashari, Al-Mudimigh, & Zairi (2003) define than an ERP-system is usually built upon a single database and application with a unified interface across the entire enterprise and it enables the entire organization to operate under one application standard that firmly integrates human resources, accounting, sales, manufacturing, distribution and supply chain management.

Klaus et al. (2000) have also state that ERP is highly configurable software, as it needs to accommodate the diverse needs of most customers across the most sectors of economy. According to Klaus et al. (2000) all ERP systems are however not presented in same form, and can differ according to how much configuration they allow (or require) before they can be used. Different levels are described as follows:

(a) In its most comprehensive form, the software is generic, targets a range of industries, and must be configured before it can be used;
(b) Packaged, pre-configured templates have been derived from the comprehensive software. These templates are tailored towards specific industry sectors (e.g. automotive, retail) or companies of a certain size (SME).
(c) For most users, ERP-software presents itself as the operational installation after the generic or pre-configured package has been individualised according to the particular firm's requirements

Lee, Siau, & Hong (2003) define ERP as an organization wide software system that aims to streamline information flows between different parts of an organiza-

tion. They also describe ERP systems as enablers for organization wide integration, as the ERP systems provide means to combine all the organization's data in a one common place. Integration is also considered the main characteristic of an ERP by Saini, Khanna, & Kumar (2012) who state that ERP systems help companies manage and streamline all business processes smoothly through integration and provide an access to real time information.

Older research data defines ERP system usually as a software product, and while ERP essentially is always product in a sense that it is a software application, it is necessary to take note that nowadays ERP can also present itself as a service from Customers' point of view: With software as a service, a customer contracts to use an application, such as ERP or CRM, hosted by a third party, rather than buying a software license and installing the application on its own machines (Dubey & Wagle, 2007).

While SaaS-model for ERP is not a completely different type of ERP-system, it clearly has an impact on how ERP can be defined especially from the customers' perspective. Traditionally the ERP-systems have been delivered "on premises" as products for customers to buy, install and control as they wish. In a SaaS-model software is not sold to customer, but is rather rented by a service provider who also provides the infrastructure for the customer to be accessed over internet. (Dubey & Wagle, 2007).

From these definitions we can conclude that ERP system by definition is:

1. ERP is a system that integrates a complete range of business processes and data in a single instance to create a holistic view of the organisation.
2. ERP is a single information- and IT architecture product (that may be offered as a service) that has a unified interface across the organization.

And it has some defining characters:

1. ERP can have different forms from highly configurable solutions to industry specific pre-configured templates.
2. These different forms of ERP system include a varying amount of common industry best practices and standards to optimize and direct the business processes.
3. ERP can be offered to a customer in various manners (product, service)

2.1.2 History of ERP

ERP has evolved and advanced from their predecessors, material planning systems (MRP) and manufacturing planning systems (MRPII). The main difference between these is that ERP system covers whole organization and all its business function processes while MRP and MRPII were used only for materials and production processes.(Elragal & Haddara, 2012). MRP was first introduced on late 1960's and was mainly focused on planning and managing material flows for manufacturing. MRPII was introduced at 1980's as the MRP systems business requirements had extended after the focus of manufacturing business changed from material flow optimization to manufacturing process control and planning with emphasis on overhead cost reduction and manufacturing quality. (Robert Jacobs & "Ted" Weston, 2007)

The term enterprise planning system (ERP) was introduced first at 1990's by Gartner Group, and their definition included criteria that the ERP software had to be actually integrated across and within functional silos (business processes). At that point MRPII systems had already evolved to include a wide array of business processes that ERP systems nowadays have, but the integration between business functions was not yet there. The breakthrough of the ERP systems on wider scale can be linked to 2000's and Y2K was the major factor forcing organisations to upgrade their legacy (MRPII) systems to Y2K compliant systems that were now matured ERP-systems with organization wide integrations between business processes. (Robert Jacobs & "Ted" Weston, 2007).

As seen here, MRP, MRPII and ERP are all built on each other in cycles of evolution. It is interesting to notice that while looking at the functionalities of the most common ERP systems (SAP, Oracle, Ms AX and even our own V10) they still have the core functionalities of MRP and MRPII inside of them. Those functionalities are now off course fully integrated with all other business processes of the organization. Also the next evolution cycle of the ERP systems will probably follow the same principles and build upon existing ERP systems or at least on their established business logic and databases.

2.1.3 Value and impact on organizations

Research has been made on the impact of ERP-systems on organizations, and it is commonly accepted that a successful ERP implementation provides significant business benefits to a company. The whole concept of accessible and integrated real time business data through every process of a company enables so many business benefits that Davenport (1998) qualified enterprise resource planning (ERP) systems as the most important development in enterprises' use of information technology (IT). He further states that ERP systems streamline organizations data flows and provide a wealth of real time operating information for management and this has translated to dramatic gains in speed and productivity for many companies. According to Helo, Anussornnitisarn, & Phusavat (2008) information system such as ERP is considered a fundamental tool for competitive organization or industry.

According to Piccoli and Ives (2005) Implementing ERP system can have direct operational benefits but it can also facilitate business growth indirectly by stimulating innovations. This could lead to value creation and opportunities for differential long term benefits to company. Addo-Tenkorang & Helo (2011) also emphasis ERP systems value on system stating that ERP system may create enormous and versatile benefits including operational benefits, financial benefits, investor benefits and user satisfaction. They also say that ERP systems value can be seen by observing market reactions while pronouncing a new ERP project. In

some cases an announcement of an ERP system project is enough to raise company market value.

ERP system can also be used to change organizational culture. Some companies have used ERP as a tool to create more disciplined culture on their organization by using it as a lever for exerting more managerial control on highly enterpreunial cultures. While enabling higher managerial control, ERP's abilities of real time data access and streamlined processes can also be used to create more transparent, flexible and democratic organization with flatter hierarchical structure. Davenport (1998).

In figure 1 are results of the perceived benefits from the research of Helo et al. (2008). From the figure it is easy to conclude that the ERP seems to provide its clearly seen benefits on business process management. The percentages represent leaders who stated that they have noticed certain benefit of an ERP system in their organization.

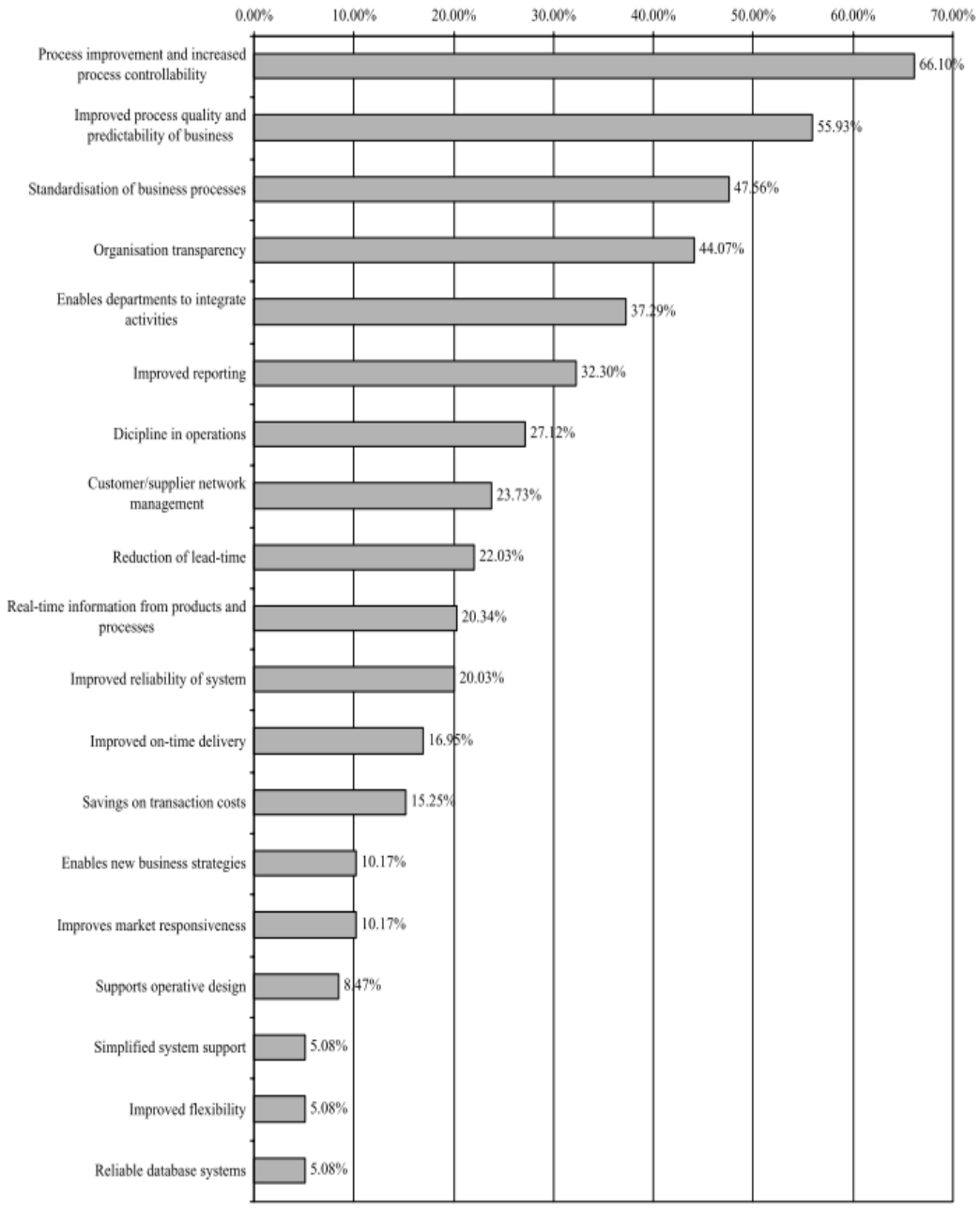

Figure 1 The benefits of an ERP system. (Helo, Anussornnitisarn, & Phusavat, 2008b)

While the easiest benefits to perceive are related to business process coordination, improvement and quality, ERP systems also provide more intangible benefits that are harder to measure accurately. One of the more intangible beneficial functionalities of an ERP is the role of a decision support system (DSS) for management by providing a better view of the real time data of the company functions. Holsapple & Sena (2005) concluded in their research that ERP systems offer substantial decision-support benefits by enhancing coordination and communications

within multi-participant decision makers. Enterprise systems in overall provide valuable company wide information to improve decision making of the management. This information can be used to analyse profitability, cost structures and performance (Laudon, K.C. & Laudon P.L. 2006). In their study off ERP and DSS in SME (Small and medium enterprises) Beneki & Papastathopoulos (2009) also came to conclusion that using ERP and DSS is related positively on company's profit making ability, and companies that made a limited use off these systems were less profitable than those with extensive use. They also describe ERP systems being in a category of systems that is closely associated to company's performance.

Table 2 shows a categorization and summary of benefits of ERP implementation collected by Ibrahim A. (2010). Benefits have been divided into five different categories by their impact on company. The table gives a good reference on how wide and deep the impact ERP system can have in company. It is safe to assume that every company implementing ERP system won't probably be able to achieve all the benefits in the summary. However when examining the benefits listed here with business development and company success in mind, it seems clear that even alone many of the benefits can make a decisive difference. For example strategic benefit "build business flexibility for current and future changes" can be recognized as a key factor of a company's sustained competitive success in ever changing business environment even outside the information system research (Ahmed, Hardaker, & Carpenter, 1996), (Das & Elango, 1995).

Type	Benefits of ERP	Literature support
Strategic Benefits	Support business alliance	(Shang and Seddon, 2000; and Shanks *et al*., 2003).
	Building external linkages	(Shang and Seddon, 2000; Shanks *et al*., 2003; Mabert *et al*., 2003; and Yen *et al*., 2004).
	Build business flexibility for current and future changes	(Shang and Seddon, 2000; and Shanks *et al*., 2003).
Operational Benefits	Suppliers and customers can be online communication	(Gupta, 2000; Shang and Seddon, 2000; Shanks *et al*., 2003; Mabert *et al*., 2003; Hawking *et al*., 2004; and Gupta *et al*., 2004).
	Integration of business operations and processes	(Ahmed *et al*., 2002; Spathis and Constantinides, 2003; and Yen *et al*., 2004).
	Improve the labor productivity	(Shang and Seddon, 2000; Mabert *et al*., 2003).
	Quality of information	(Ahmed *et al*., 2002; Shanks *et al*., 2003; and Spathis and Constantinides, 2003).
	Improved delivery times	(Gupta, 2000; Shang and Seddon, 2000; Ahmed *et al*., 2002; Spathis and Constantinides, 2003; Gupta *et al*., 2004; and Hawking *et al*., 2004).
	Reduction of total operation and administration costs	(Gupta, 2000; Shang and Seddon, 2000; Ahmed *et al*., 2002; Spathis and Constantinides, 2003; Shanks *et al*., 2003; Mabert *et al*., 2003; and Shehab *et al*, 2004).
	Reduction of stock levels	(Tudawe, 1999; Spathis and Constantinides, 2003; and Gupta *et al*., 2004).
	Reduction of real-time information	(Spathis and Constantinides, 2003; Mabert *et al*., 2003; Gupta *et al*., 2004; and Shehab *et al*, 2004).
Organizational Benefits	Support organisational changes	(Shang and Seddon, 2000; and Shanks *et al*., 2003).
	Improved co-ordination between departments	(Spathis and Constantinides, 2003).
	Replace legacy systems	(Mabert *et al*., 2003).
Managerial Benefits	Improved decision making	(Gupta, 2000; Shang and Seddon, 2000; Ahmed *et al*., 2002; Shanks *et al*., 2003; Spathis and Constantinides, 2003; Gupta *et al*., 2004; Shehab *et al*, 2004; and Hawking *et al*., 2004).
	Improve financial management	(Spathis and Constantinides, 2003; and Hawking *et al*., 2004).
	Faster and more accurate transactions	(Spathis and Constantinides, 2003; and Hawking *et al*., 2004).
	Reducing the requirements of manpower	(Gupta *et al*., 2004).
	Improved inventory/asset mgt	(Gupta, 2000; Hawking *et al*., 2004).
Technical Benefits	IT costs reduction	(Shang and Seddon, 2000; and Shanks *et al*., 2003).
	Increased flexibility in information generation	(Tudawe, 1999; Shang and Seddon, 2000; Ahmed *et al*., 2002; Shanks *et al*., 2003; Spathis and Constantinides, 2003; and Hawking *et al*., 2004).
	Increased IT infrastructure capability	(Shang and Seddon, 2000; and Shanks *et al*., 2003).

Table 2. Benefits on ERP system with original literature references.(Ibrahim, 2010)

ERP implementation can have a huge impact on company on several different organizational layers as seen above. The value created by ERP is multifaceted and some benefits are hard or impossible to measure accurately except on the whole

profitability increase or total value of the business. Accurate ROI (return of investment) calculations have been notoriously hard to make on ERP implementations, and most companies accept that on assumption that there are several intangible benefits on ERP systems that can't be accurately measured. Kale, Banwait, & Laroiya (2010) found out in their survey that 38% of the companies who had implemented ERP fairly agreed that ERP system had more intangible benefits than tangible benefits. Only 2% agreed that tangible benefits were greater than intangible benefits.

2.1.4 Conclusions

ERP systems can be argued as the most complicated organizational IT systems and they can have a great impact on organizations performance as ERP system undeniably provides significant benefits for an organization that manages to successfully implement the system. As a whole there seems to be no research data at all implying that a successfully implemented ERP system would not significantly benefit company. There however lies the biggest challenge and risk for companies, as the successful implementation of an extensive ERP system is extremely demanding task for a company of any size.

2.2 On-premises operating model (traditional model, monolith ERP/model)

Until recent years ERP systems have been almost exclusively implemented with on-premises model since the beginning of the ERP life cycle. All the data provided in earlier chapters is based on research done on on-premises ERP and on-premises implementations.

As IT megatrends are now changing to internet based solutions, the traditional on-premises ERP is getting competition from different types SaaS and Cloud solutions that most ERP vendors are already providing or preparing in some form. On-premises ERP is implemented through an implementation project that combines

usually IT and organization development projects together and can be extremely demanding for an organization of any size taking on the challenge. The constant message CGI V10 unit is getting from customers is that there is a need for ERP system solution that does not require so high upfront payment in form of licence fees and resource heavy implementation project.

2.2.1 Definition

On premises model stands for an installation that is done into the customers own IT infrastructure and software is licenced to customer to use on particular computer, or by other criteria such as number of users. Licences are either on a term basis or perpetual and are usually treaded as a capital expense in organizations. (Castellina, 2011).

2.2.2 On-premises operating model and implementation projects

The operating model of an on-premises (also called monolith) ERP implementation is a traditional IT-development project and licence purchase; Customer pays for the licences and for an implementation project that usually includes a combination of system and business consulting, training, configuration work, technical work, and project management. The ERP implementation is usually sold as a package with licences and project work. The licence fees and project work demand an upfront investment while benefits of the ERP system implemented will follow only after successful implementation project which can take even years to complete. Because of just this one reason, it is not wonder why many organizations are nowadays very hesitant to take the risk of implementing a new ERP system offered in traditional on-premises basis while there are other options to consider. This is confirmed by Castellina (2011,2012), showing a steady growing interest on alternative ERP solutions year by year while most important reason for this sift is financial benefit from alternative system.

The on-premises ERP implementation project itself can be divided in different stages or phases that all have significant impact on outcome. General model of project phases that is widely accepted in literature is a five states ERP implementation model. (José Esteves, 2001), (Ehie & Madsen, 2005), (Sun, Ni, & Lam, 2015).

Sun et al. (2015) description of the stages is in table 3. It is important to notice that the ERP project is quite different from customer point of view compared to vendor's standing point. Quite often the vendor is contacted first time at the Stage 2, and the real job for vendor starts at stage 3.

Stage 1: ERP organisational readiness	This stage involves the readiness assessment of the focal enterprise in resources and management before selecting a candidate ERP solution. A steering committee first defines the CSFs and KPIs (key performance indicators) of organisational readiness, and then conducts a gap analysis by assessing the KPIs. This allows the organisation to address any performance gaps detected to accommodate the requirements for ERP implementation.
Stage 2: ERP selection	At this stage, a company starts the well-rounded process of selecting an appropriate ERP package and implementation partner. A working committee is set up to identify all of the business requirements across focal enterprise, customers and partners. Information about system functionality, reference sites, product roadmaps, ERP vendors, implementation partners and

	partners' local support capabilities are identified and screened. A short list of potential ERP packages and implementation partners is compiled. An in-depth evaluation process is conducted for the potential packages and partners, followed by a negotiation process, in which contractual terms are worked out, and a final recommendation is made and confirmed by the board of directors
Stage 3: ERP implementation	This stage covers the determination of the project scope to the system installation and cut-over. In this stage, members of the project team are selected and the project's standards and procedures are established. Customers' requirements are incorporated into the definitions of the business blueprint and the business process is redesigned to meet requirements. Furthermore, system configuration, testing, user training and installation are conducted and completed.
Stage 4: ERP final preparation	The final preparation stage is important to ensure that the system, process, management and users are prepared for the ERP live-run. The final preparation stage should cover the following major tasks: integration and stress tests to confirm hardware capabilities, a disaster recovery test to determine system availability and recoverability during

	and after unexpected incidents, user acceptance evaluation to confirm user acceptance of system functionalities, complete user training and a cutover plan to move to the production environment and live-run.
Stage 5: ERP live-run	At this stage, system performance is assessed through performance monitoring and customer feedback. Performance should be measured every six months during the ERP live-run. To improve system performance, this stage includes system repair issues and extension and transformation that encapsulate the continuous improvement concept. This stage also involves two other possible activities when conducting periodic reviews: a system upgrade that allows additional capabilities to be built into the system to obtain preferable benefits, and system retirement, in which the old ERP is replaced by a more suitable one to meet the organisational needs of the moment.

Table 3. Five steps of ERP implementation (Sun et al., 2015)

The 5 steps process of Ehie & Madsen (2005) is also presented figure 2 for comparison. It describes also the processes of change management and business development alongside of five ERP project stages. The stage names vary a bit from model to model, but basically stages include the same actions and key points as five steps of ERP implementation by Sun et al (2015. Both models also take in account the development need of the ERP system after initial implementation phase and live run start up.

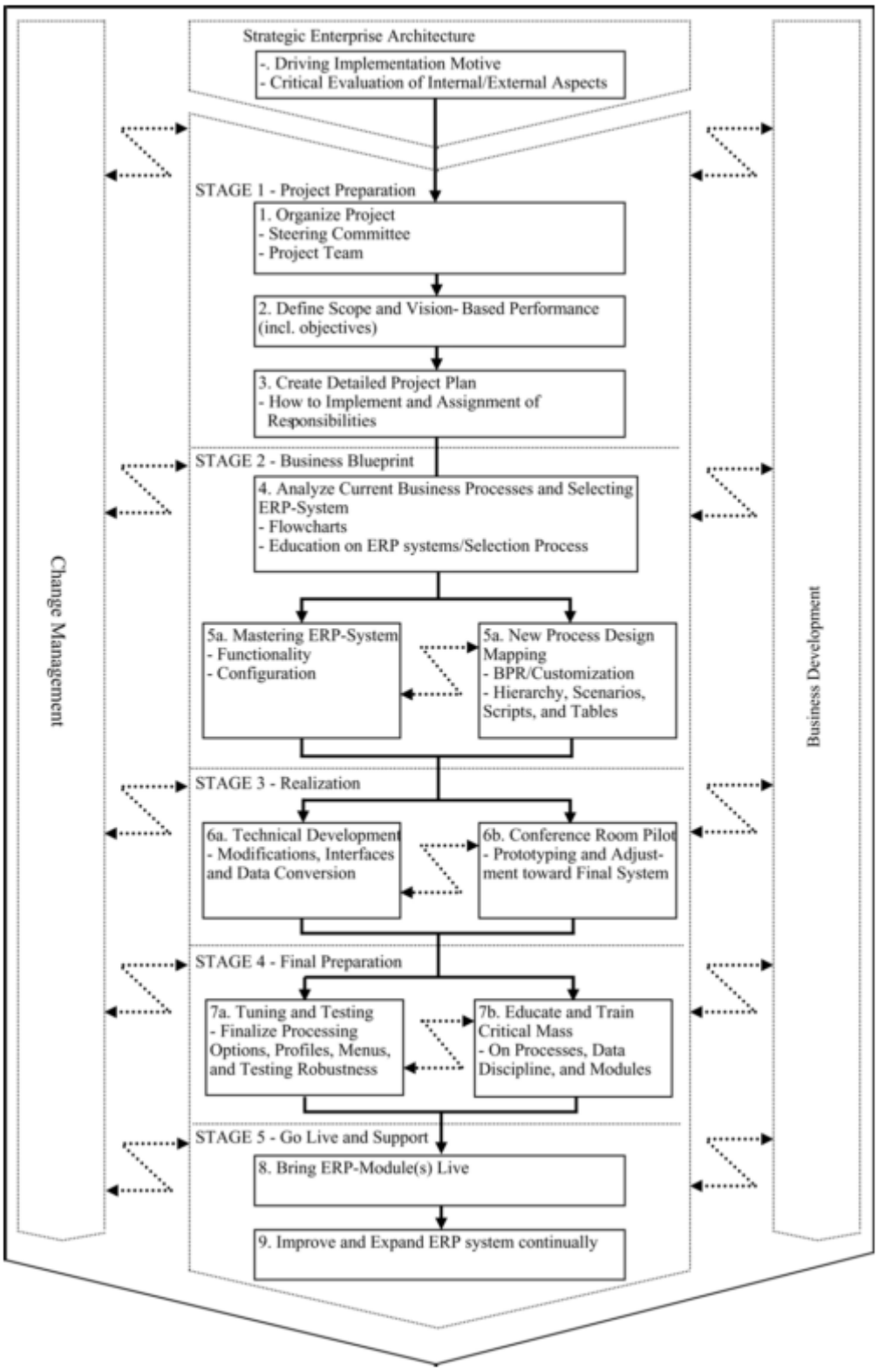

Figure 2. 5 stages of ERP implementation project (Ehie & Madsen, 2005)

As described earlier, this same model is basically used on most common ERP implementation projects and its stages from two to four are pretty much same with

vendors of SAP, Microsoft AX, Oracle etc. The terminology may vary a bit from product to product, but the main components are the same. The difference on different product projects comes from inside the stages.

2.2.3 ERP system implementation challenges and risks

ERP system implementation is in many cases the biggest development project that will ever undertake, and its successful completion will be a demanding and consuming process. Successful implementation is the key to competitive advantages ERP systems are expected to offer and on the other hand failed implementation projects are known to even cause bankruptcy in some cases.

Figure 3 by (Helo et al., 2008a) shows difficulties perceived by ERP vendors and consultants in ERP implementations. Difficulties under “Others” are

Figure 3. Disadvantages / challenges of the ERP implementation (Helo et al., 2008a)

Due to extensive impact on the whole organization ERP systems implementations pose various challenges. Implementing ERP systems usually require a huge

amount of money, time and human resources. ERP implementation can also lead into a confusion of organizational culture and results can be seen even on as a short term decrease in customer satisfaction. (Hanafizadeh, Gholami, Dadbin, & Standage, 2010). It cannot be over emphasized that ERP project it not just an IT project, but a strategic organization development project and should be approached as such (Aloini, Dulmin, & Mininno, 2007).

ERP system implementation and operating risks vary by organization size. Relatively high cost of implementing and operating ERP system compared to company size is a major problem for SMEs (Small and medium-sized enterprises). Large enterprises however can more readily accept the high cost and carry the risk of failure in ERP implementation. High cost of implementation accompanied by failure to implement a beneficial system to a SME can drive a healthy business to financial problems or even to a bankruptcy (Saini et al., 2012)

A risk of not gaining the benefits from ERP system due to various possible reasons in implementation and post implementation phases imposes a significant risk to all organization sizes. ERP system has to be implemented successfully to gain the expected value from the system. Successful implementation is however much more complicated process than successful installation of the system. The strategic use of the tool and complete application in all areas of the company are required to gain competitive advantage from ERP system (Hanafizadeh et al., 2010).

The biggest risk for a company is that ERP system implementation project itself can itself end in a failure. Aloini et al. (2007) have classified ERP implementation project failures in four different categories according to their reasons and effects:

(a) Process failure, when the project is not completed within the time and budget.
(b) Expectation failure, when the IT systems do not match user expectations.
(c) Interaction failure, when users' attitudes towards IT are negative.
(d) Correspondence failure, when there is no match between IT systems and the planned objectives.

These failure types are not all equal considering benefits company can gain from the implemented ERP system even if the implementation project itself can be seen as a failure. For example class a, "process failure" in ERP implementation can still produce a perfect system that yields significant benefits to a company, if the company can carry the higher than anticipated price or schedule delay. However the class d, "correspondence failure" can be devastating outcome for a company, as the system does not serve the needs of the company and in worst cases a system like this can severely handicap a company.

Reasons leading to ERP system implementation project failure are discussed in several studies. Aloini et al. (2007) have gathered an comprehensive list of ERP implementation risk effects as follows: budged exceed, time exceed, project stop, poor business performances, inadequate system reliability and stability, low organizational process fitting, low user friendliness, low degree of integration and flexibility, low strategic goals fitting and bad financial/economic performances.

Aloini et al. (2007) have also gathered 19 of the most common risk factors that cause problems on ERP implementation projects and can cause afore mentioned implementation risk effects and project failures on different levels. Risk factors and effects are gathered in table 2 where Aloini et al. (2007) study is used as a comprehensive list of risk factors and other sources are studied to confirm their observations. Risk factors can be compared to their corresponding critical success factors (CSF) that many researchers have discussed (Fui-Hoon Nah, Lee-Shang Lau, & Kuang, 2001), (Kronbichler, Ostermann, & Staudinger, 2009), (Al-Mashari et al., 2003), (Umble, Haft, & Umble, 2003), (Ram, Corkindale, & Wu, 2013; Ram, Wu, & Tagg, 2014). In table 4 risk factors are linked to corresponding critical success factors. In "Own comments and application possibilities" column there are listed possible solutions and improvements to our own operating model and product to address the risk factors and critical success factors.

Risk Factors (Aloini et al., 2007) unless noted otherwise on a cell.	**Corresponding critical success factors (CSF)**
Inadequate selection (of system /	**Correct architecture / systems choices** (

project)	Shehab , Sharp , Supramaniam , & Spedding , 2004; Ibrahim, 2010; Sathe, 2014; Somers & Nelson, 2001; Wei & Wang, 2004)
Poor project team skills	**ERP teamwork** . (Fui-Hoon Nah et al., 2001)
Low top management involvement	**Top management support** (Al-Mashari et al., 2003; Fui-Hoon Nah et al., 2001; Sarker & Lee, 2003; Umble et al., 2003)
Ineffective communication system	**Communication** (Fui-Hoon Nah et al., 2001)
Low key user involvement	**User Involvement** (Joan Esteves, Pastor, & Casanovas, 2003; Jarrar, Al-Mudimigh, & Zairi, 2000; L. Zhang, Lee, Zhang, & Banerjee, 2003)
Inadequate training and instruction	**Training** (Corkindale & Ram, 2014; Fui-Hoon Nah et al., 2001; Ram et al., 2014)
Complex architecture and high number of implementation modules	**Correct architecture choices**. (Somers & Nelson, 2001)
Inadequate BPR (Business process redesign) resulting excessive customisation (Momoh, Roy, & Shehab, 2010)	**Business process redesign (and minimum ERP customisation)** (Al-fawaz, Evaluation, Al-salti, & Eldabi, 2008; Fui-Hoon Nah et al., 2001)
Bad managerial conduct	**Top management support, Business plan and vision** (Fui-Hoon Nah et al., 2001; Sumner, 1999)
Ineffective project management techniques	**Project management** (Ram et al., 2014)

Inadequate change management	**Change management** (Fui-Hoon Nah et al., 2001):
Inadequate legacy system management	**Efficiently integrating internal and external systems** (Ram et al., 2014)
Ineffective consulting services	**Partnership, Implementation team composition** (Saravanan, 2005; L. Zhang et al., 2003).
Poor leadership	**Top management support, project management: Leadership** (Sarker & Lee, 2003)
Inadequate IT system issue	**Correct architecture choices** (Somers & Nelson, 2001)
Inadequate IT system maintainability	**Ongoing vendor support** (Somers & Nelson, 2001)
Inadequate IT supplier stability and performances	**Partnership** (Saravanan, 2005)
Ineffective strategic thinking and planning	**Strategic planning and vision** (Loh & Koh *, 2004; Nah & Delgado, 2006; Ranzhe & Xun, 2007; Zaitar, 2012)
Inadequate financial management	For some reason this is not included in any of the main studies in the area although it can clearly be seen as a major risk and also a CSF. Financial aspect of the ERP implementation is noted by researchers (Al-Mashari et al., 2003), but for some reason it is not included in CSF research and does not appear on CFS list compiled by researchers.
Labour shortage (Loh & Koh *, 2004)	**Top management support, Implementation team composition.** (Nah & Delgado, 2006)

Table 4. Risk factors and corresponding critical success factors

ERP risk factors and critical success factors are discussed in length here because they provide a great insight where to focus attention while designing a new ERP implementation models. The challenges of ERP system implementation can be also better understood if we study known critical factors for ERP implementations and match them to corresponding risk factors.

2.2.4 Critical success factors (CSF)

Critical success factors are one of the most studied subjects on all ERP research field. That is no doubt due to the need to find most important factors that can make or break the ERP implementation project so that efforts on implementation can be directed towards the known validated key areas. Some of the corresponding critical factors were already presented in Critical risk factors section. In this chapter we aim to deepen the knowledge on CSF's and to create a collection most important CSFs to consider while implementing ERP systems, and most importantly when developing better ways to implement ERP systems. It is also important to understand that certain critical success factors have effect on implementation project outcomes and others business outcomes. These outcomes and CSF's affecting them are linked to each other, but for example succeeding in certain aspects of implementation project do not necessarily have direct impact on business outcomes. (Ram et al., 2014). It is very important to understand these CSF's and relations between them while designing ERP system and business models around the ERP as the choices made for the business model generation should be based on both those that ensure the implementation success and those that enhance chances of acquiring business benefits from the system.

For the ERP upgrade model we will pick those CSFs that can be efficiently affected by ERP vendor to ensure clients implementation success. Then we study how we can take in account those CSF's in the new model developed.

CSF: Top management support

Top management support commonly accepted as one of the most important CSF's by most researchers (Al-Mashari et al., 2003; Nah & Delgado, 2006; Sarker & Lee, 2003; Sathe, 2014; Umble et al., 2003)

Most important critical factors include top manager support (Fui-Hoon Nah et al., 2001). Strong and committed leadership is essential for implementation success (in all phases of project) (Sarker & Lee, 2003) and top management support must provide guidance to teams for implementation and monitoring of project progress (Al-Mashari et al., 2003; Umble et al., 2003). Same conclusion was also made by also by Aloini et al. (2007) stating that participation and support of top management is expected and experienced as very important asset for success in implementation project. Top management support can be linked to most other CSF's as Top management is controlling the assets and decision of a company and is providing the organization's vision and strategy that are needed to set the goals for a successful implementation project (Loh & Koh *, 2004; Ranzhe & Xun, 2007; Zaitar, 2012).

Top management support CSF: Strong leadership

Also strong leadership through the organization and project team is counted as CSF and it has roots in top management support and example they are giving (Sarker & Lee, 2003). If project managers and steering committee do not show leadership and commit solving problems and providing direction, the risk of failure in implementation is greater. (Aloini et al., 2007)

Top management support CSF: Strategic planning and vision

"*Organization must decide why and ERP system needs to be implemented and what business goals system should address. To do this organization must identify the business goals and strategic business issues. The strategic planning of system is essential for ERP implementation success Alignment of Business strategy and IT strategy should be enabled with senior executive support. A system implemen-*

tation without a clear vision can turn into a total failure of implementation." (Aloini et al., 2007)

A clear vision and business plan should be driving force behind the ERP implementation project. They give guidance to which direction they project should be steered to meet the ultimate business goals. Process starts with conceptualizing the business goals and finding ways to reach the goals.
(Fui-Hoon Nah et al., 2001; Loh & Koh *, 2004; Ranzhe & Xun, 2007; Zaitar, 2012).

In our own business we have ran into situations where client organization does not actually know why they are implementing the ERP system, or the reason is "because everyone has one". These provide a very challenging environment to succeed and please the customer as they do not really have idea why they are doing this and what they are actually trying to accomplish.

Top management support CSF: Project champion

Project should have high level executive sponsor and a project leader who can campaign for the project and takes responsibility and gives business perspective for the whole implementation success (Sumner, 1999).

In our own projects we have noticed that if project champion is missing there is a risk that no one really takes responsibility for the whole project and there "drive" needed to successfully complete the implementation is lacking. Therefore it is important to find the right sponsor or champion for the project and make sure that he understands what is required from him.

CSF: Business process re-design and avoiding excessive modification

"*ERP as a packaged software is often incompatible with existing business processes and needs. The effect is either customisation of the software which is expensive and adds to maintenance cost, or business process redesign to align business processes with the system implemented."*(Aloini et al., 2007)

Organization's willingness to do business process modification to align business processes to pre-configured best practice processes of ERP system is considered a key CSF. This willingness if often reduced by resistance to change. The resistance to change can lead to often misguided efforts to duplicate the old system and its processes to a new system to be implemented and therefore driving over-customisation of ERP system. Rothenberger & Srite (2009) came to same conclusions in their research on ERP system customisation. Unwillingness to do business process re-design is inversely proportional to the amount of system customisation needed: To neglect BPR is a risk in ERP implementation project; either it will cause extra system costs or poor fit off a system.(Aloini et al., 2007)

Many organizations have made unnecessary and complex customisations because people doing implementation did not understand business processes of the organization well enough to re-design them. New business model and re-engineering driving the technology project is a key factor affecting ERP implementation success (Al-fawaz et al., 2008; Fui-Hoon Nah et al., 2001)

One of the most important and usually one of the most expensive actions of the whole ERP implementation project is the modification done to system. More specifically customisation and configuration work that is done to the ERP system to meet the business needs. This is first done during stage three of the ERP implementation project. Customisations are initially planned on stage 2 while planning the ERP system realization / implementation stage. However customisations and configuration changes can be and quite often are made during the realization stage of the project, as the plan starts to meet reality and gaps between business and ERP processes are found. The modifications are also quite often continued after the go-live of the project to optimize the system and adapt it to changing business environment. (Sudhaman & Daneva, 2014; Zach, 2012)

ERP system configuration is done by choosing ERP systems modules and by doing table configuration, meaning using switches of the system to turn on and off options and their properties. This is a standard procedure in most implementation

projects, and should be done to match the ERP systems functions to organizations business process needs within the limits of the ESP system.

If the configuration capabilities of ERP system are not seen as flexible or extensive enough to meet organization's needs, system customisations can be made. Customisation is done by producing system changes to the product. This can be done by modifying the existing program code or producing entirely new code. Customisation level of an ERP system is a critical point in implementation of the ERP system and has long lasting effects on system maintenance and upgradeability. (Aloini et al., 2007; Momoh et al., 2010; Sumner, 1999)

Over- and under-customisation can both be very dangerous to the outcome of the implementation project. (Rothenberger & Srite, 2009; Sudhaman & Daneva, 2014). Over-customisation can lead to reduced degree of functional integration and can reduce the benefits of the packaged software. (Tiwana & Keil, 2006). Under-customisation can lead to a system that is not flexible and does not meet the business requirements of the organization. (Seethamraju & Krishna Sundar, 2013; Zach, 2012). To be able to make solid decisions on level of customisations the ERP implementation team must evaluate and research the different choices of customisation options that can be produced by combinations of configuration and customisation (Eckartz, Katsma, & Daneva, 2012; Rothenberger & Srite, 2009). Figure 4 (Rothenberger & Srite, 2009) shows a widely used ERP implementation framework for modifications. The framework is divided in two main parts of modifications made during ERP implementation: Business process modifications and ERP system modifications.

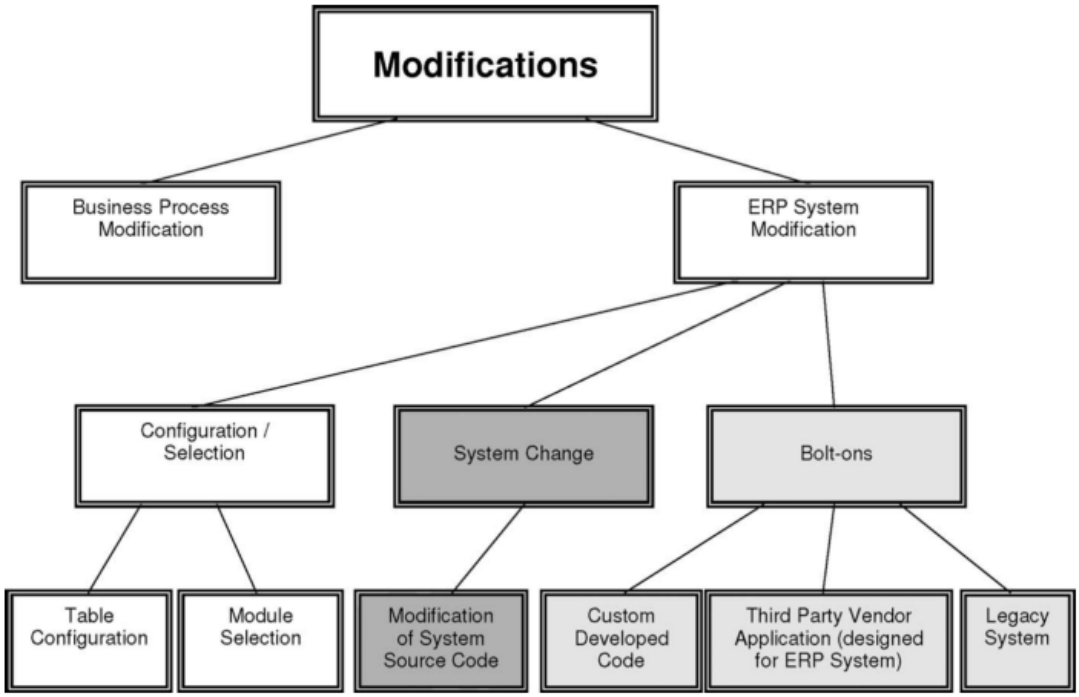

Figure 4. ERP implementation modification framework (Rothenberger & Srite, 2009)

In our own CGI V10 ERP business we have concluded after several completed projects that the selection of a correct system for the organization is the key factor on how extensive modifications are needed. The generic systems usually need an extensive configuration and customisation to meet the particular demands of a certain industry. Pre-configured systems can be implemented much more efficiently if their pre-configuration is based on best practices for a particular industry. These pre-configured systems are called vertical solutions, and are usually based on generic system that is customised and configured according to known best practices of a certain industry. Pre-configured systems can also be re-configured or customised to meet the special needs of organizations if needed. Even in these cases we have noticed in several completed projects that the resources needed to customise industry specific pre-configured system are much smaller than they would be when using a generic system.

CSF: Change management

Change management is considered a major CSF as implementation of ERP system modifies how the organization operates and inadequate change management may result in project failure. Generally one of the main obstacles facing ERP imple-

mentations is resistance to change and inadequate efforts in change management (Aloini et al., 2007; Bhatti, 2005)

Change management can be also linked tightly to top management support, as an organizational culture where the employees share common values and goals and are receptive to change is most likely to succeed in ERP implementation – and this cannot genuinely be achieved without active role of top management (Fui-Hoon Nah et al., 2001)

Change management in ERP projects is multi layered process. First layer we have observed is the change management of the implementation project itself. It is crucial to have solid change management process in place to address all the change and modification needs to the implementation project itself during the implementation project. Without a solid project change management process the project scope, budget and schedule are very likely to spin out of control

Second layer of change management is the layer of controlling and driving change in the whole client business environment. This is also tightly tied to the top management support to project as top management should be driving force behind organizational change as big as ERP system implementation.

CSF: Correct system and architecture selection

"Implementation of an incorrect system / project can cause the whole project to fail or severely affect the benefits of the system for the company. The better the ERP selection process is, the greater the chance for successful implementation project. Technical software capabilities must be studied before implementation matters and their impact on business processes assessed; questions such as these are pivotal for ERP success. Technical aspects that are essential are: all necessary functionality, user friendliness, portability, scalability, modularity, versioning management, simple upgradeability, flexibility, security, presence of a complete guide, a procedure manual to help users, and data accuracy. Because of the integrated nature of ERP software, if some of these elements are absent or ineffec-

tive there can be a negative effects throughout the enterprise." (Aloini et al., 2007)

Correct system and architecture selection is the most important CSF in project initiation phase. Correct choice of system and platform builds a base for successful implementation project. (Somers & Nelson, 2001). Failing to make the correct choice will lead to over-customisation or underperforming system at best. At worst it can cause the whole project to fail. The process of selecting a system can be very hard and long process, but needs to be done with great attention. To make implementation successful and easy as possible, it is important to find a system that has as close fit as possible to most of the organizations current business processes (Everdingen, Hillergersberg, & Waarts, 2000). Also the choosing the right amount and modules to be implemented will have effect on the project, as the number of modules implemented increases the complexity of whole project. (Aloini et al., 2007)

CSF: user training and key user involvement

User training and instruction should be available and highly encouraged, as it has been proven to have significant effect on implementation success (Fui-Hoon Nah et al., 2001). Also providing effective training and education is vital to achieving differential benefits from ERP implementation (Ram et al., 2014) Lack of proper user training and resulted users' lack of understanding how the system affects the organizations processes are key factors in many ERP implementation problems and can even result in implementation failure (Aloini et al., 2007)

Low key user involvement can have serious impact on project outcome, as without user involvement it is very hard for implemented system to meet the users' expectations. Implementing ERP system into organization and into everyday work results a vast learning curve and also behavioural changes for employees and users of the system. It is critical that this is taken into account while doing implementation project to ensure successful go-live-phase (Jarrar et al., 2000) Key users also have to be convinced on the system utility and confident enough with its use and benefits to be able to champion the system and train and support

end users. Lack of user training and understanding failure of how enterprise applications change business processes are key factors in many ERP implementation problems and failures. (Aloini et al., 2007)
User participation is one of the most critical factors of success in ERP projects, their involvement increases their satisfaction and acceptance of ERP tool (Joan Esteves et al., 2003; L. Zhang et al., 2003)

CSF: Project management

Successful project management is essential for implementation project success. The implementation project is a very complex set of great amount of task of different size and importance, and solid project management strategy and expertise is needed to ensure success. (L. Zhang et al., 2003). Project management itself consist many aspects and skills needed, task management, resource management, financials, project change management, risk management, leadership skills and many others. Ineffective project management significantly affect the project success. Project risk management in particular is a key factor in project success. (Aloini et al., 2007) There has been debate on the project management being very high on CSF importance ratings, as it has been noted that good project management does not itself guarantee competitive advantage as a benefit to organization. (Ram et al., 2014). It is however clear that inadequate project management will most likely ruin most chances of getting desired benefits from the system – or at least they will be delayed or overpriced.

CSF: ERP team composition and teamwork

"*Team composition & teamwork includes the CSFs Project Team competence, dedicated resources, use of consultants, ERP teamwork and composition*". (Saravanan, 2005).

Teamwork and composition in the ERP implementer-vendor-consultant partnership is a key factor influencing ERP implementation success. (Fui-Hoon Nah et al., 2001) Also the project team's business and technological competence will

greatly contribute to the success or failure of an ERP implementation. (Aloini et al., 2007) Also the sharing of information and interpersonal skills are important assets for the project team members. The effective implementation team must build trust between it's members and across organization borders (Loh & Koh *, 2004). A good partnership between client organization and vendor doing the implementation is very important for the success of the implementation project and successful use after the project (Saravanan, 2005)

It is also very important that vendors staff has solid expertise on ERP system functions and also on business processes. Also consultants need good interpersonal skills to be. Vendors team setup is crucial to implementation success (Aloini et al., 2007; L. Zhang et al., 2003)

Labour shortage is one critical risk for the successful implementation and top management should ensure that chosen project team has time and resources to succesfully get the necessary things done. (Nah & Delgado, 2006)
ERP implementation usually needs more manpower and resources for test run, analysis and evaluation of the possible effect on the production plans and business goals, than those previously expected. Therefore, it is wise to plan for slack or build in contingency and have the test run when there is slack between the processes. Usually, this should not be done at the busiest time. (Loh & Koh *, 2004

CSF: Partnership and ongoing support

A good partnership between client organization and vendor doing the implementation is very important for the success of the implementation project and successful use after the project (Saravanan, 2005)

ERP system choices can be very long lasting, and good vendor support is essential: *"Vendor support represents an important factor with any packaged software including extended technical assistance, emergency maintenance, updates, and special user training*" (Somers & Nelson, 2001). Aloini et al. (2007) Confirms the same importance of ongoing vendor support. They also draw attention to gen-

eral maintainability of the system as a part of partnership and ongoing vendor support. A system without a proper vendor support and update possibilities will very soon be an operational and security hazard to organization.

CSF: Communication.

"*Communication is necessity in an ERP implementation project. It provides appropriate link and success to data for all actors"* (Aloini et al., 2007)

Importance of communication is also confirmed by Fui-Hoon Nah et al. (2001) stating that effective communication between all parties involved in implementation or affected by it. Communication is also an essential part of the change management and project management and teamwork.

CSF: integrations and legacy system management

"*ERP system's main purpose is to integrate processes of the organization, and people should be able to work within the system, not around it (in legacy systems). The transition phase from legacy systems to new ERP system is a critical period in ERP implementation success."* (Aloini et al., 2007)

Efficiently integrating internal and external systems to ERP is vital to achieve differential benefits from ERP implementation (Ram et al., 2014)

Not CSF: Financial management

"ERP system implementation is costly, and poorly managed financials can run organization to financial problems." (Aloini et al., 2007)

For some reason this is not included in any of the main studies in the area although it can clearly be seen as a major risk and also a CSF. Financial aspect of the ERP implementation is noted by researchers (Al-Mashari et al., 2003), but for

some reason it is not included in CSF research and does not appear on CFS list compiled by researchers.

2.2.5 Future and opportunities for on-premises ERP systems

As general we see opportunities on industry specific on premises solutions providing cutting edge innovations tailored to solve known challenges of certain industries while same time providing a solid easy to use and implement industry best practices based core system with possibility to do customisations if needed. Even though Cloud models are now rising in trend, we see that traditional monolith system still has it's place in the ERP field. While there are certain modifications needed for the monolith system and business models to be desirable for current market, they certainly can be seen to have place in the ERP offerings. The latest research by Castellina (2013) also gives a hint that cloud trend is starting to even out. The cloud trend and it's effect on ERP systems will be discussed in the later chapter.

2.2.6 Conclusions

Factors that have effect on ERP implementation success and failure have been studied widely and there has been established a common understanding on what is important and what is not. It is safe to assume that CSFs discussed in this chapter are essential for project success and should be addressed in development of the new model and in the implementation process that new model produces. The implications for the model have been discussed after each of the CSF discussions and are therefore not repeated here. As conclusion we see that we have means to take in account (on varying degrees) all these CSFs in the new model and therefore raise significantly the likelihood of most successful and smooth ERP system implementations.

2.3 IS trends and ERP

IS systems have been under change for as long as they have existed. From mainframes to personal computers and to recent mobile applications available platforms and the connectivity to other platforms have been driving force of IS system development. Since internet was first introduced they IS development has been in ever accelerating speed on trying to connect everything and everyone one to the world wide data network. Organizations have been enjoying advantages of data integration for as long as it has been available. Traditionally organizations have however owned their own servers and applications, and internal integration of on-premises systems has been the go-to solution for most companies. The speed and reliability of today's internet connections has however opened new possibilities for companies to outsource their servers and use applications over internet. Lately the biggest question for many organizations has been whether to own their own applications or could it be possible to pay only for the use of IS system that they do not really own. Even company data can be stored in IS service provider's servers to be used through internet anywhere organization needs access to it.

Other trend to consider is mobility but that is also covered by the cloud trend. Another significant trend could be identified as extensive integration trend, as the IT-systems are integrated beyond organization limits to reach out suppliers, customers and partners. Also at the same time internet of things is gaining momentum and machinery is getting integrated into the network and to IS systems at accelerating speed. Integration reaches also people, as social media is gaining foothold also in the working environment and organization as starting to find benefits on building integration between social communication and organizational systems to enable better collaboration and communication.

For the new model the most significant factor is the outsourcing and cloud trend that is profoundly changing the way organizations acquire their IT-systems.

2.3.1 Outsourcing trends

Further outsourcing is also producing a major change to traditional business models of the software companies, as products are turned into a serve, or at least ser-

vice is a significant part of the product. Revenues are shifting from upfront licence payments to subscription and maintenance fees, and cash flows of the companies are affected accordingly. For software companies this means a challenge where they have to find out what products they can produce services or which services they could add services to gain financial of competitive benefits. They also need to find out how to turn products to services or find out how they can create services to add value to their products. Third challenge is to "productize" these services so that they can be produced cost efficiently and with desired quality. (Cusumano, 2008).

Castellina of Abereen research (Castellina, 2011, 2012, 2013) has been doing a yearly research on ERP trends and has clear evidence to show that SaaS and Cloud models are getting more and more consideration from organizations while on-premise model considerations are steadily going down. However latest research shows that evening out of the solution alternatives is starting to happen. This trend evening out is giving a hint that even if cloud or SaaS models have demand, they might not be only considered solution in the future. Research shows also that interest on vendor hosted ERP has gone up a bit from last years. This might be due to the growing understanding on solution alternatives and realization that SaaS or Cloud is not always the best or even viable solutions. Figure 5 shows the trend towards SaaS and cloud growing between 2009 and 2013 and starting to even out in the year 2013.

In our own customer feedback we have received several inquiries on SaaS or Cloud ERP, but many of those demanding these new services do not really have clear understanding what they are really after (except cost savings). In our observation however Cloud and SaaS alternatives are challenging traditional ERP systems with easier implementations and low up-front payments. Even if the offerings of the SaaS and Cloud ERP's might not be even close to the traditional ERP systems offering and adaptability, the effect can been seen in how customers respond to the traditional ERP systems implementation and licence costs. They are still compared to new comers with considerable simpler offerings, and seen to be on heavy side on costs and implementation work needed. While we are usually talking of systems of whole different scale on functionality and adaptability, there

resource comparison is still there and affecting the decision making. Castellina's yearly research (Castellina, 2011, 2012, 2013) gives now however a hint that customers are starting to understand the highs and also the lows of the SaaS and Cloud models and this is seen as evening out of the slide to the SaaS and Cloud side on the ERP considerations of organizations.

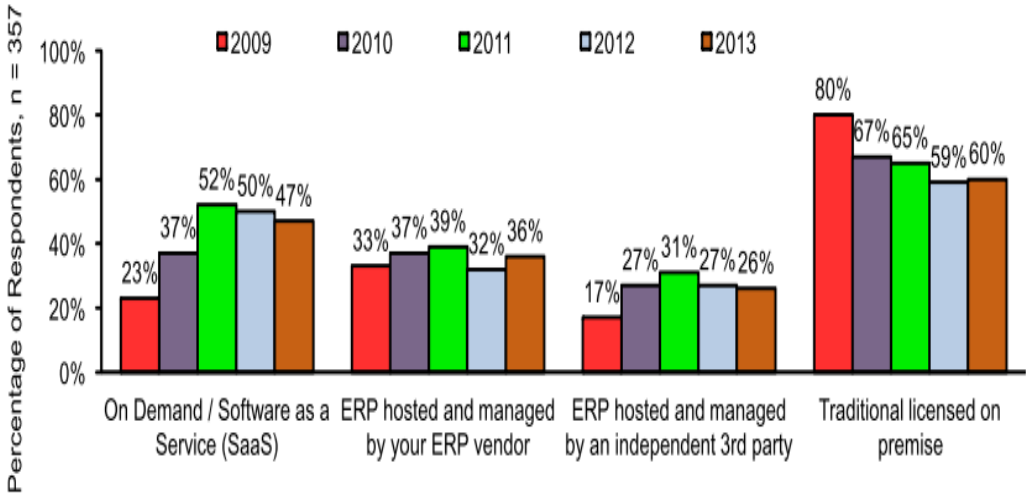

Figure 5. ERP solution / operating model trends 2009-2013 (Castellina, 2013)

Another good way to examine IS trends and evaluate their effect on companies using ERP systems is to compare existing ERP installations to the earlier trends on ERP considerations. In Figure 6 are shown current ERP solution models used by organizations. Results are categorized by organization size.

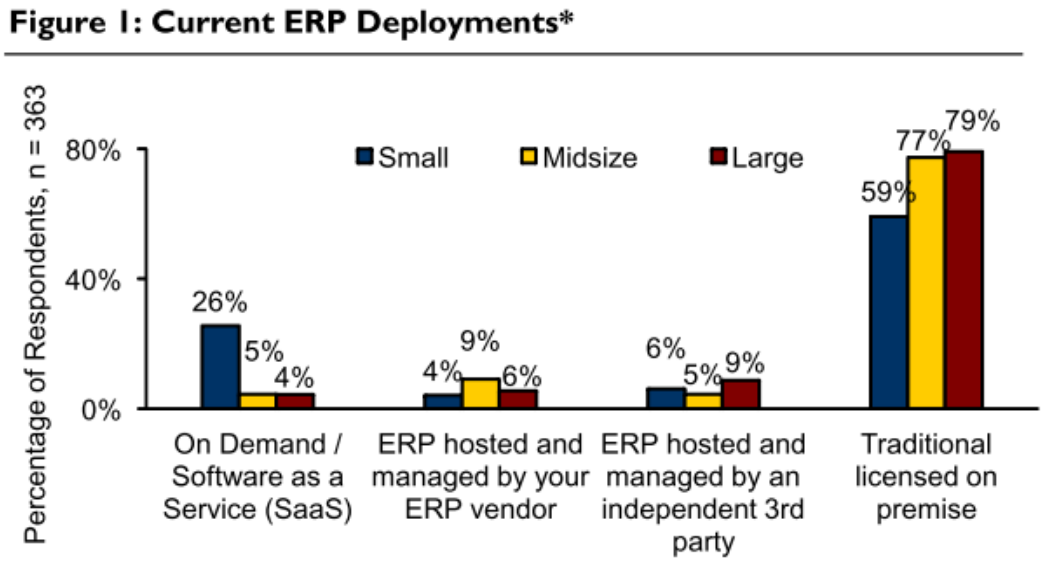

Figure 6. Existing ERP installations 2012 (Castellina, 2012).

As we can see from the figure 6, major part of the companies are still using traditional on-premises ERP's Comparing this to the ERP consideration figure we can see that ERP installations are sifting to the SaaS or hosted services side, but not really that dramatically. Many organizations state that they are considering various options, but the amount of traditional on-premises ERP considerations is still not dramatically lower than existing installations. This gives a signal that SaaS models are not the only chance for ERP systems to be viable in the future. SaaS or hosted models cannot be ignored though, as they total to a considerable part of the total future ERP considerations.

Main drivers in cloud ERP considerations are cost savings. Both upfront cost savings and total cost of ownership savings including savings in upgrades as shown in the Figure 7 by Castellina (2012) . It is also notable that 42% of the customers are looking for a best fit solution regardless of the delivery method.

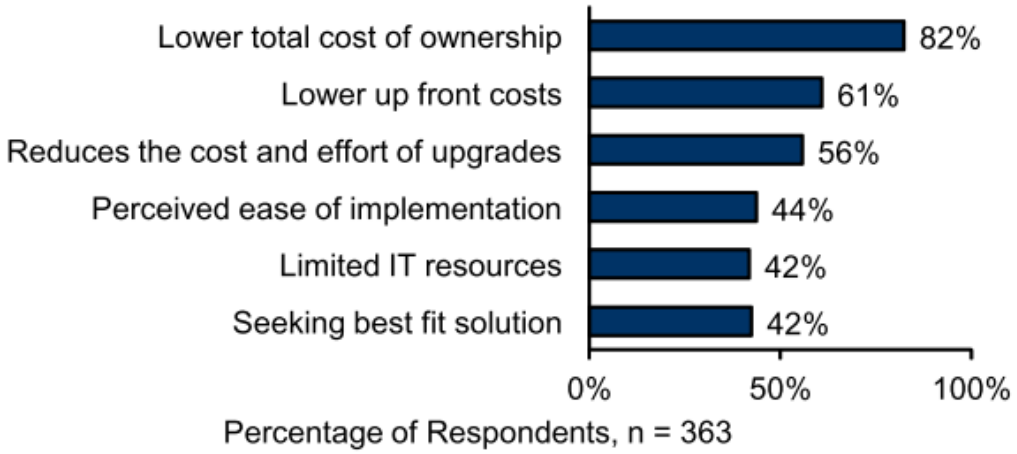

Figure 7. Drivers of Cloud ERP considerations Castellina (2012)

Although there has been some reconsideration whether cloud ERP really gives cost savings when calculating the whole ERP lifecycle (Marketvisio, 2013), Castellina & Krensky (2012) show that initial return of investment is returned faster with Cloud ERP. Comparison with creative scaling choices is shown in Figure 8. However this does not give any indication that total cost of ownership during the lifecycle of an ERP system would be lower for Cloud solutions, as it is

natural that ROI time is shorter due to cost structure differences of the cloud and on-premise models. On-premise model demands higher upfront payments caused by licences and usually more cost demanding implementation. However the maintenance costs are usually much lower than continuous service costs of the cloud ERP so the winner in total cost of ownership might not be so clear after all. This area would be great for later research as there seems to be no current research done at subject.

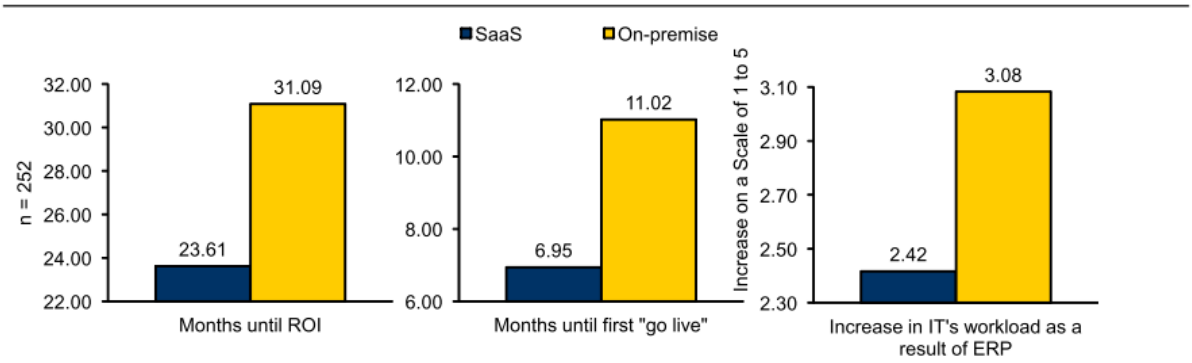

Figure 8. Cloud / On-premise ROI comparison (Castellina & Krensky, 2012)

2.3.2 Different delivery models – Cloud (SaaS) ERP

Cloud computing is the latest trend on outsourcing and cloud computing has it's roots in an ongoing megatrend of IT outsourcing. The IT outsourcing and IT field generally is currently going through critical changes as many organizations are seeking and beginning to increasingly use cloud services to acquire needed applications for business use. (Armbrust et al., 2010; Weinhardt et al., 2009; Q. Zhang, Cheng, & Boutaba, 2010)

"IT outsourcing is an act of delegating or transferring some or all of the information technology related decision making rights, business processes, internal activities, and services to external providers, who develop, manage, and adminis-

ter these activities in accordance with agreed upon deliverables, performance standards and outputs, as set forth in the contractual agreement" (Dhar, 2012)

Cloud computing and SaaS are terms that are both used to describe a software that is offered as a service through internet connection, or local area network connection in some cases. In many cases they also mean pretty much same thing, although there are also some differences. Nowadays both SaaS and Cloud are often bundled together under a term of cloud computing. Cloud computing refers to both applications and hardware and system software in data centers running the applications delivered through the internet. The data center software and hardware together is what we can call cloud. (Armbrust et al., 2010). Cloud systems can be further categorized in different classes according to their use and availability

Exact definition made by Armbrust et al. (2010)

"Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the datacenters that provide those services. The services themselves have long been referred to as Software as a Service (SaaS). The datacenter hardware and software is what we will call a Cloud. When a Cloud is made available in a pay-as-you-go manner to the general public, we call it a Public Cloud; the service being sold is Utility Computing. We use the term Private Cloud to refer to internal datacenters of a business or other organization, not made available to the general public. Thus, Cloud Computing is the sum of SaaS and Utility Computing, but does not include Private Clouds."

Thus by Armbrust et al. (2010) definition we have two different basic cloud deployment types of which only first one is counted as cloud computing.

1. Public cloud: Cloud is made available to general public as pay-as-you-go manner and the service being sold is utility computing
2. Private cloud: Internal datacenters of a business or organization not made available to the general public.

There is also a third option that is a mix between both of these cloud types. It is called hybrid cloud and it is a combination of public and private clouds. Thus we have third cloud type. (Marston, Li, & Bandyopadhyay, 2011)

3. Hybrid cloud: A combination of public and private clouds. Usually non-critical information is outsourced to the public cloud and, while business-critical services and data are kept inside the organization's own datacenters.

NIST (National Institute for Standards and Technology, U.S Department of Commerce) (Mell & Grance, 2011) also recognized these same three cloud deployment models, and introduces a fourth one called community cloud.

4. Community cloud: A cloud where several organizations with common concerns share a cloud.

NIST (Mell & Grance, 2011) also provides a list of essential characters for cloud computing. Characters are shown in table 5.

On-demand self-service.	A consumer can provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service's provider.
Broad network access.	Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, laptops, and personal digital assistants (PDAs).
Resource pooling.	Cloud computing pools a provider's computing resources to serve multiple consumers using a multi-tenant model,

	with different physical and virtual resources assigned and reassigned according to consumer demand. Cloud computing provides a sense of location independence. Customers generally have no control or knowledge of the exact location of the resources. But, they may be able to specify location at a higher level of abstraction (e.g., country, state, or data center). Examples of resources include storage, processing, memory, network bandwidth, and virtual machines.
Rapid elasticity	Resources can be rapidly and elastically provisioned, sometimes automatically, to scale out quickly, and rapidly released to scale in quickly. To consumers, the resources often appear to be unlimited and can be purchased in any quantity at any time.
Measured Service.	Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction suitable to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Providers and consumers can monitor, control, and report on services with transparency

Table 5. Essential characters of cloud computing (Mell & Grance, 2011)

It is clear that some of these pure cloud service characters are not easy to apply to extensive IT systems such as ERP system. ERP systems generally require quite an effort to be implemented and adapted to the organizations business processes. This generally requires expertise on ERP systems and thus requires ERP system consultants to implement the system. Due to these ERP system characters a full self-service cloud hosting a full ERP system is quite a farfetched idea. We see that Cloud could however work as an ERP system deployment platform and be quite self-serviceable after the initial implementation has been successfully completed with help of the experts.

Broad network access is something that ERP systems can be adapted to, so this essential character could be met. However most monolith systems will need upgrades in user interfaces to adapt to the heterogeneous platforms such as tablets or even mobile phones. It is also possible and worth considering upgrading only certain processes to heterogeneous platform, and keep some of the processes client based (but still available through network access through for example Citrix or other such virtualization services).

Resource pooling fits quite well on ERP systems characters, as multitenancy is already in use for example in our V10 system to accommodate different companies of same corporations. This is easily adapted as a non-corporation multi company environment. As ERP systems store critical company data, the data security and storing location are considered critical factors while considering cloud ERP. Organizations considering ERP systems have expressed their will to keep their data inside the borders of their home country to gain more security. Several countries also require ERP data to be also has to be accessible by local authorities for auditing and review. (Armbrust et al., 2010; Marston et al., 2011).

Rapid elasticity character also fits well in ERP system use. ERP systems can put a huge stress on systems on peak use times, and on low use times they can be run on much lower computing resources. Rapid elasticity helps ERP systems to perform well on those peak times by adding computing resources as much as needed, and releasing resources as soon as they are not needed anymore (Armbrust et al., 2010).

Measured service – character also fits well on business critical systems such as ERP system. The ability to measure and monitor service can be used to prevent capacity problems and to easily identify performance issues on systems.

NIST also defines three cloud service models. This definition includes SaaS as a one of the cloud computing service models. The service models are shown in table 6.

Cloud Software as a Service (SaaS)	The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure, typically through a pay-per-use business model. The applications are accessible from various client devices through a thin client interface such as a web browser (e.g., web-based email). The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings.
Cloud Platform as a Service (PaaS)	The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but

	has control over the deployed applications and possibly application hosting environment configurations.
Cloud Infrastructure as a Service (IaaS)	The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, deployed applications, and possibly limited control of select networking components (e.g., host firewalls)

Table 6. Cloud service models (Mell & Grance, 2011)

The SaaS model is the one used for ERP systems. ERP cloud system can be built on PaaS service model provided by the ERP vendor itself or by thirds party cloud service provider.

2.3.2.1 Meaning

Outsourcing IT services through any means has been ongoing trend and with cloud services will enter to another accelerated phase as organizations seek to gain benefits from new type of service provided. The lowering of IT costs has been a major driver of IT outsourcing generally, and still is the main driving force of cloud computing. Outsourcing vendor can achieve lower costs of developing and managing the IT solutions compared to the customer company by focusing on scaling the systems, managing excess capacity and pooling together knowledge and experience on different industries and IT applications. Outsourcing simply reduces costs. The performance and quality assurance is also a great asset of IT

outsourcing. Service provider can provide a high level of performance and availability of the service and Service level agreements are usually made to further guarantee the agreed levels of service availability. Also on global operations outsourcing vendors can often provide professional support around the clock on diverse locations. (Dhar, 2012)

Cloud computing's relentless upward trend poses a challenge to existing application vendors. Monolith system vendors face the situation where they need to either adapt to cloud computing environment by providing cloud services themselves or find other ways to keep their products and services competitive in the more competitive global environment. However cloud computing and adapting to it can also be seen as a great chance to reach new customer sectors or industry areas they can make a successful transition from traditional application services to cloud computing service.

The main benefits from cloud service to vendor can be reached through multi-tenancy. In multi-tenancy environment a single instance of an application running on a server can provide service to several customers. This multi-tenant structure include separated and secured databases or database areas (tenants) for different customers to store their data safely and so that despite of the same server and database structure other users do not have access to it. For vendor this means cost savings in server capacity and also in software maintenance work thus driving profit margin or making it possible to price more competitively. (Dhar, 2012; Weinhardt et al., 2009)

2.3.2.2 Cloud challenges

Cloud computing still has some challenges that affect the service and their desirability among customers.

The biggest concern is the security, privacy and integrity of the organizations data stored in the Cloud service. When data is out of the organizations hands and is stored in outsourced environment without direct access from customer organiza-

tion, there has to be absolutely no doubts that the these issues are taken care off by cloud service provider with extreme care and high quality. (Lanois, 2010; Martin, 2011; Soma, Nichols, Mosley Gates, & Gutierrez, 2011).

Business continuity is a clear risk of any system that is used over internet connection that adds one important link to the system that can be compromised by internal or external factors. Business continuity issues can also rise from the performance of the cloud provider servers and network. Non-interrupted availability of business critical systems is main concern of many IT departments. (Turner, 2013; Yigitbasioglu, 2013). Turner (2013) also argues that mission critical applications cloud could be a hybrid cloud model where the critical parts of the application and data are stored locally and can be accessed without external internet connection. External threats could be even in from of denial of service attacks by outlaws or even by foreign governments in some cases. (Shukla, Agarwal, & Shukla, 2012)

So called Data lock is another risk with cloud computing. Customer organization can find it's data locked in vendors system in a system specific format thus making transition to another vendor and system hard, costly or even impossible. (Martin, 2011)

Access to data and Auditability of the data is also a concern for organizations. Many organizations hold data that is required by law to be auditable by the local authorities. There are also laws in several countries prohibiting certain data to be stored outside the country. Cloud providers use multiple data centres across multiple jurisdictions and this can impose problems to organization data regulations (Lanois, 2010; Martin, 2011). Many cloud providers have however started to offer services with fixed data locations to satisfy the data regulation needs.

Customisation of the services or applications can also be an issue if organization needs specific customised applications to fill the need of their business processes, cloud services might not provide enough modification possibilities, and pure cloud services (on demand, ready to use cloud services) do not allow any kind of coding based customisation of the services that many organizations have come to

expect as it has usually been possible on their on-premise systems. (Dillon, Wu, & Chang, 2010)

2.3.2.3 Cloud ERP challenges

Due to novelty of the subject the research in the area is still quite scarce. Mijač, Picek, & Stapić (2013) completed a literature review based research on cloud ERP challenges and also came to conclusion that there is still lack of scientific coverage on the area.

All the general cloud challenges are also present with cloud ERP adaptions. Lack of customisation possibilities may be the biggest challenge for many organizations to adopt pure cloud ERP systems that are based on multi-tenancy and therefore have one core source code for all organizations using the service. (Dillon et al., 2010; Kim, Kim, Lee, & Lee, 2009) Mijač et al. (2013) argue that lack of customisation possibilities might be the biggest negative side of the cloud ERP.

ERP systems are also usually extremely business critical, so availability is extremely important aspect when choosing ERP system delivery method. (Dillon et al., 2010; Kim et al., 2009)

As established earlier, ERP systems are generally deeply integrated systems internally and externally. Cloud environment brings another level of integrations and integration challenges with is, as there are now integration requirements between other clouds, public and private. There can also be integration needs to legacy systems and other company systems not in cloud environment at all. If organization wants to buy separate ERP modules from different cloud or on-premise vendors there is a challenge to integrate the systems and manage the master data between systems. (Dillon et al., 2010; Kim et al., 2009)

For ERP vendors transfer to cloud can demand a huge investment on new technology and product enhancements, as the old monolith ERP systems are either discarded or adopted to the cloud platforms.

2.3.2.4 Cloud and ERP possibilities

Cloud provides a new ERP platform that can drive innovation and new business ideas. New applications and services that have not been possible for traditional ERP systems can be created by innovative vendors. (Marston et al., 2011)Already tapped innovations include high portability and mobile applications. (Saeed, Gustaf, & Uppström, 2011).

Even though service security and performance are major concerns for organizations considering cloud ERP, it can be argued that cloud vendors can provide very high service and performance on lower costs that organization could do it by themselves (Saeed et al., 2011)

As established in earlier chapters, ERP systems can be extremely expensive and resource heavy to implement. Cloud ERP provides new perspective by removing most of the upfront capital and usually providing faster and simpler implementation process. (Saeed et al., 2011) Leaner implementation process on ERP system perspective however often means that organization has to do even more business process re-design to adapt to the cloud ERP process setup.

2.3.2.5 Conclusion and Applications to the development of the new model

While considering ERP systems by delivery method, one could argue that the delivery method does not necessary have effect on the actual work needed to reach the same functionality between systems. Rather is seems that with cloud delivery method companies are much more willing to adapt to the pre-configured system that what is the case with on-premises system that has wide customization capabilities. This in our opinion as an ERP vendor is one of the key points in debate over on-premises and cloud ERP systems. Is there actually a significant difference in on-premise and cloud offerings functionality and usability or is there just different attitude towards different delivery methods that result in leaner implementation projects for cloud based systems. Also it is worth considering it the cloud

offerings implementation methods are much more effective than those of on-premises model. No earlier research could be found on the subject, so it provides an interesting follow up research topic.

Also the total cost of ownership is in our point of view pretty even with both models.

It is however true that cloud environment seems to offer room and even incentives for innovation both from vendor and customer point of view.

As ERP systems seem to gradually extend their integrations outside organization to connect to the supply chain, partners, government officials etc. the cloud would seem to provide very good platform for inter-organizational integration (White, 2014). We also see that the whole ERP does not necessarily need to be totally built as a cloud service to provide benefits of the cloud. It would be possible to build semi-cloud systems that would have back-office tools provided to customers through vendor-hosted ERP-delivery method and with remote desktop / virtualization use. Then on the other hand all the applications and processes that would benefit from mobility and web-usability could be provided from cloud-service connected to the vendor hosted core system and database. This would also clear out some of the data location, security and integrity issues and also give access to customizations. This service off course could not be provided with as low cost as pure pre-configured cloud ERP without customization possibilities, but benefits of the semi-cloud solution might be enough to justify higher price.

2.3.3 Other solutions / demands from IS trends

As established earlier, the main driving force behind cloud computing are cost savings and easier and faster implementation. It is therefore wise to also consider if there are alternative options than cloud for monolith ERP to stay competitive. The mobility and integration trends demands could be also met with semi-cloud setting or by adding mobile modules even to the existing monolith ERP system implementations.

2.3.4 Conclusion and Applications to the development of the new model

As for new model cloud and all other delivery methods have clear implications, so it is important to consider these while designing a new model for ERP system.

We have considered different routes for the ERP system to continue developing and expert panel has concluded that at least partial cloud service for chosen business processes and mobile applications is necessary and gives a great chance for new business innovation. Cloud option also is estimated to extend the customer potential of our product / service by providing lower cost entry to ERP system. Providing cloud services however is considered to require a focus on certain industry areas so that fitting pre-configurations can be made to the systems chosen processes and services delivered from cloud.

From vendor perspective it seems that cost savings and faster implementation could be reached by modifying the monolith ERP implementation model and core system. This could be done by making industry specific pre-configurations, cutting down the customization options (at least for the initial implementation project) and building a lean quick implementation project model based on the pre-configured system and providing pre-made training materials (possibly video), and advanced tools for data gathering and importing.

If customer is after carefree environment and IT taskforce reductions same solution could be delivered as a vendor hosted service. This would also allow customization if customer would so choose to do.

The total cost of this solution might be as low as “of-the-self-cloud ERP”, but the options provided and the use of a full scale ERP system instead of stripped down cloud ERP would by our estimation justify the higher cost. This model would also remove most of the Cloud ERP challenges, although the availability through internet connection is still an issue here.

This vendor hosted pre-configured ERP with semi-cloud abilities would provide a solid step toward pure cloud systems. At this moment however pure cloud ERP seems not to be worth the significant investment needed to convert whole existing ERP user interfaces to the web based solution the cloud needs. However semi-cloud solution with chosen processes that require integration of several organizations or mobility and monolith back office would seem to fulfill the most significant requirements of the current ERP trends.

3 RESEACH CONTEXT AND RESEARCH METHODS

3.1 Goals, scope and theoretical framework of the research

The goal of the research is to study how the new trends of the IS development affect the ERP systems and find an ideal model how to adapt an existing monolith ERP system to meet the evolving demands. The case study of the research is CGI's V10 ERP system. In the empirical part of this study a development plan is made for the V10 system adaption. The development plan is based on the adaption model. The adaption model is based on the research of the existing knowledge base and expert evaluations of the possible solutions. The model is evaluated based on business value criteria.

Criteria for evaluating the created model solution

- Solution must be technologically viable: It can be created with our available tools and solutions.
- Solution must be economically viable: The investment must proportional to evaluated financial potential. ROI must me on acceptable level.
- Solution must address the current known issues of our chosen industries / Customer segment and possibly open new customer segments.
- Solution must comply with known critical success factors (CSF) of ERP implementations to enhance implementation success.

The actual development project is not part of this research.

Research questions:

What is the future of the ERP systems and how to adapt an existing monolith ERP system to the latest IT trends?

What kind of model can be used to develop an existing monolith ERP system to meet the demands of latest IT trends?

3.2 Research strategy

Research method used is design science research method (DSRM) and more specifically its adaptation to information system (IS) research. The main focus of design science research is to create new and innovative artefacts that solve problems in organizations (Hevner et al., 2004)

Research is done by building a sufficient knowledgebase on ERP systems and IS trends and then building a model to create a model how to create a future proof ERP system. The new model is based on the information in the collected knowledgebase and expert opinions on how to proceed with different alternatives knowledgebase suggests.

Research method used is Design science research method (DSRM) and more specifically its adaptation to information system (IS) research. The main focus of design science research is to create new and innovative artefacts that solve problems in organizations (Hevner et al., 2004)
Methodology used is problem centred discipline introduced by Hevner, March, Park, & Ram (2004). Problem centred discipline introduced by Peffers et al (2007) defines framework and process model for the DSRM in information system research. The discipline is commonly accepted as a preferred methodology for DSRM research in IS. In their adaption of DSRM in IS research Peffers et al (2007) define six principle for DSRM in IS research that include the seven commonly accepted guide lines for DSRM in IS research introduced earlier by Hevner et al. (2004). These principles guide the research so that it is focused on creating and evaluating artefacts that solve known problems in organizations.

Compared to traditional behavioural science research method also used in IS research that studies IS systems reactively, DSRM takes a proactive approach to problems. As behavioural research paradigm aims to explain and foresee managing, using, obtaining or acting with research subjects (IS systems or equivalent),

DSRM approaches IS research from the angle of solving existing problems within organizations with new innovative artefacts that it creates. Hevner et al. (2004)

Hevner et al. (2004) states that goal of DSRM is to find solutions to organizations problems by using technology and combining human resources, organization and technology. They also explain that DSRM process is a creative and iterative process that goes in cycles developing solutions and evaluating them in cycles while closing to a best available solution. The problem is defined as a gap between current situation and desired situations in organization. The solution to this problem can be a process which closes the gap between current and desired situation party or entirely.

First part of the DSRM research is to obtain a sufficient knowledgebase from which back ground information, and different solution possibilities to problems can be studied and evaluated. Knowledgebase is built by doing an extensive literature review of existing research material on ERP systems, ERP implementations, ERP and IS trends such as cloud computing and their effects on whole ERP industry. The collected knowledgebase is then used to define known issues and best practices for ERP systems and use them as a guide line to create a model to develop a future proof ERP system from traditional monolith ERP.

Operating models and development alternatives are collected and evaluated against each other with business critical (economically viable solutions) and product critical (solutions that are available for the current organization) point of view to create the most suitable model for making a future proof ERP.
The evaluation is made by expert evaluations at CGI ERP organization by introducing the alternative solutions collected from knowledgebase to the experts and using their expertise to choose the best alternatives for the model.

When best alternatives are found and evaluated and chosen by experts, they are compiled into a single model (artefact) that will be a base for a development plan for the ERP system and operating model development strategy. The process is shown in figure 9.

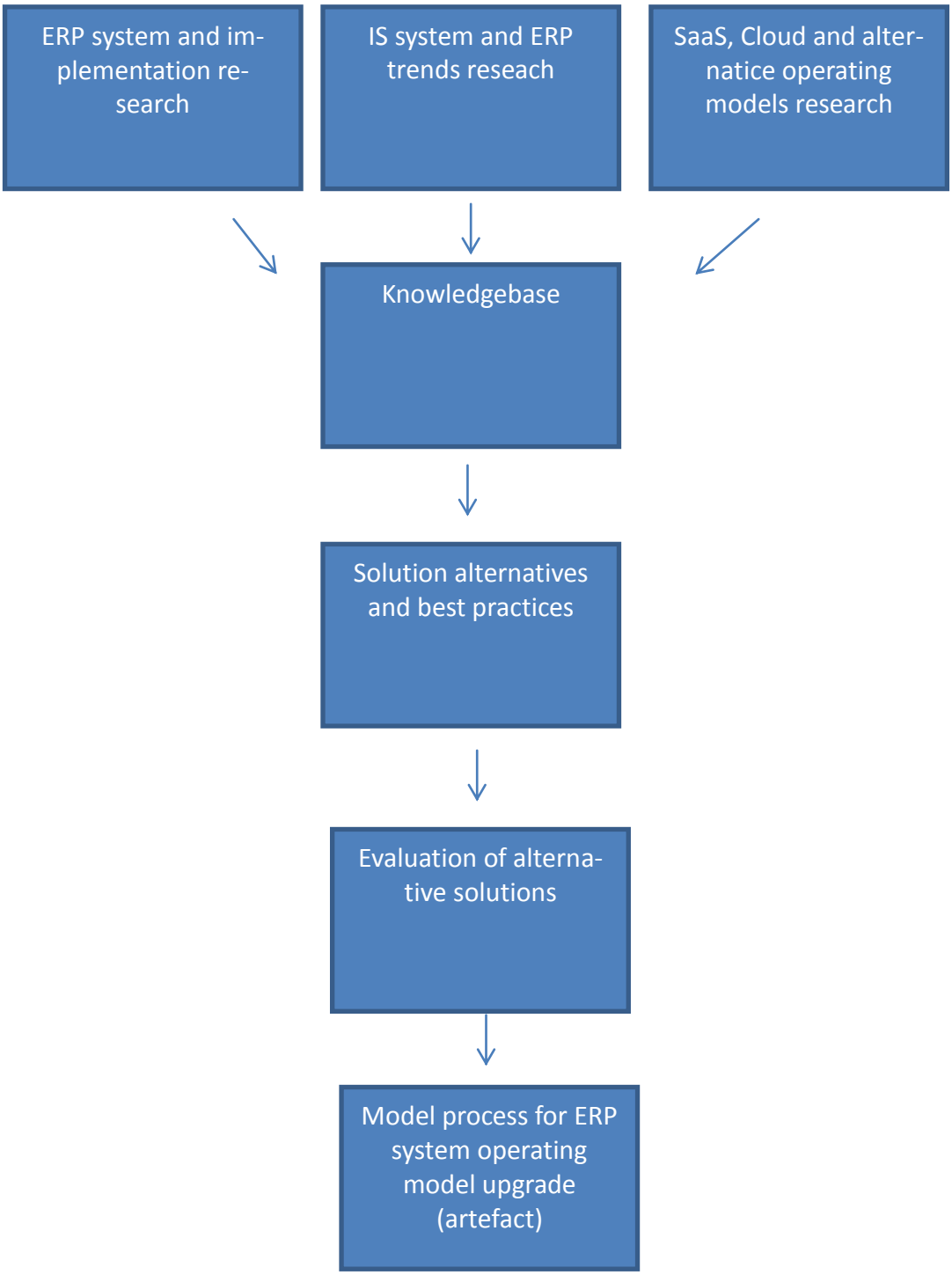

Figure 9 Research process

3.3 Case: CGI V10

CGI is one of the world's biggest IT consulting companies with over 70.000 employees and 10.5 billion $CAD revenue. CGI has strong local presence in Europe and in Finland CGI employs around 3000 employees. CGI values its own intellectual property (software products) and distributes and develops numerous different systems including a wide array of ERP solutions. Case ERP here is CGI V10, Finland based full scale ERP system that includes all the basic ERP functions (sales, purchasing, shipping etc.), project management functions, manufacturing functions, full financial module also payroll and HR-modules. CGI V10 has been developed in Finland during the last 20 years and has gone through several major upgrades on the way. At its current state the product is a mature ERP system and in the beginning of another major upgrade cycle to address the demands of the current IT-trends.

CGI V10 employs 50 experts that work solely with V10 ERP. As V10 is CGI's own product the product development is done in-house by V10 architects, consultants and programmers. The researcher acts as a director in the V10 business.

V10 is one of the most used full ERP solutions in Finland with over 150 active customer organizations and.

Currently the business model almost solely based on-premises-model with some added on mobile functionality usable through web. V10 is based on Progress OpenEdge (OE) database technology. Lately Progress OE has improved it's web and SaaS capabilities and it gives interesting new opportunities for the OE based products.

The upgrade model created in this research will be the guideline for the development of the CGI V10 ERP in the next years as it is adapted to the requirements of the ongoing significant IS trends.

While doing this research the first part of the development project has been started according to the model with system improvements and delivery process improve-

ments. Project scope and goals can be found in attachment 2 (Business critical, removed from published version).

4 THE DEVELOPMENT MODEL FOR AN EXISTING MONOLITH ERP

This model is mainly aimed for the case company and product, CGI V10, and development activities, needs and requirements are compared to the current state of the CGI V10 and its possibilities. Model should however be generalizable also to other monolith ERP systems in the similiar situations

4.1 Platform and delivery method comparisons

We have concluded that there are six basic possible delivery methods for monolith ERP which are:

Monolith model (current model)
Modified monolith (Industry specific pre-configured system)
Vendor hosted ERP
Monolith/hosted ERP enhanced with separate mobile components
Semi-cloud
Cloud

Monolith ERP short description:

- Basic ERP system with on-premise model.
- Full customizability and modifiability
- Customer purchases licences
- Installed on customers hardware
- Traditional extensive implementation project

Modified monolith ERP short description:

- ERP system that is pre-configured to fit certain industry
- Full customizability and modifiability
- Customer purchases licences

- Installed on customers hardware
- Lean implementation project with added value from change management and CSFs

Vendor hosted ERP (as service) short description:

- Either or the previous ERP models
- Full customizability and modifiability
- Delivered form ERP vendors hardware through internet (not with web-usability, but with virtual desktop such as Citrix)
- Customer pays monthly fee for the service (binding contract for 2-5 years)
- Customer usually pays start-up fee (much lower than licence fees)
- Needs an implementation project depending on the ERP model used.

Monolith/hosted ERP enhanced with separate mobile components:

- Added mobile functionality to the previous ERP solutions.
- Needed to satisfy customer demands before more extensive mobile/web usability
- Usually html5 or native code based
- Separate applications and parts of modules that are programmed separately from the ERP platform.
- ERP client and mobile User interfaces (UI) both are needed so this solution doubles the UI work.

Semi-cloud

- ERP solution that provides chosen full web-usable processes as a service for customers from the cloud that is connected to the vendor hosted back-office client based ERP.
- Web UI can replace client UI
- Significant part of the ERP is still provided as vendor hosted service and is used as back office tools while web based processes are used as mobile tools and for external integration and communication tools (supply chain management, customer service, sales etc.)
- Multi-tenancy is used
- Customer pays monthly fee for the service (binding contract for 2-5 years)

- Customer usually pays start-up fee (much lower than licence fees)
- Needs a small lean implementation project depending on what processes are implemented.
- Provides extensive customizability and modifiability

Cloud

- On demand solution
- Customer pays monthly fee for the service
- Very fast implementation process
- Multi-tenancy is used
- Full web usability through the whole ERP system.
- No possibilities for customization

4.1.1 Simulated total cost of ownership (TOC) comparison between main delivery methods

As established total cost of ownership (TOC) is the main driver of cloud solutions. Therefore it is important to understand how different models compare on TOC. However there was no research data yet available. In this chapter we have created a simulation of TOC calculation between on-premise and cloud ERP solutions. Calculation based on current on-premise and cloud pricing models with current ERP prices and implementation work estimations, for a company with 100 full time ERP users. This calculation while not based on actual experience on TOC can be used as a guideline how different delivery methods compare with each other in TOC.

Calculation takes in account:

- On-premise
    - On-premise initial investment of 500 000€ for implementation project (200 000€ licence fee, 300 000€ implementation work)
    - Funding for initial investment with 1.3% annual interest (current standard) and 5 years payback time.

    - Cost of client own infra for basic ERP servers 2.000€/year (workforce excluded)
    - 24% of original licence yearly maintenance and support costs
    - Version upgrade every second year (7% of the whole initial investment)
- Cloud / Vendor hosted as a service
    - 125€/month/user service fee, no start-up cost. Includes support, maintenance and version upgrades
- Industry standard on-premise with lean implementation
    - On-premise initial investment of 350 000€ for implementation project (200 000€ licence fee, 150 000€ implementation work)
    - Funding for initial investment with 1.3% annual interest (current standard) and 5 years payback time.
    - Cost of client own infra for basic ERP servers 2.000€/year (workforce excluded)
    - 24% of original licence yearly maintenance and support costs
    - Version upgrade every second year (7% of the whole initial investment)
- Calculation here does not take account customers own resource use

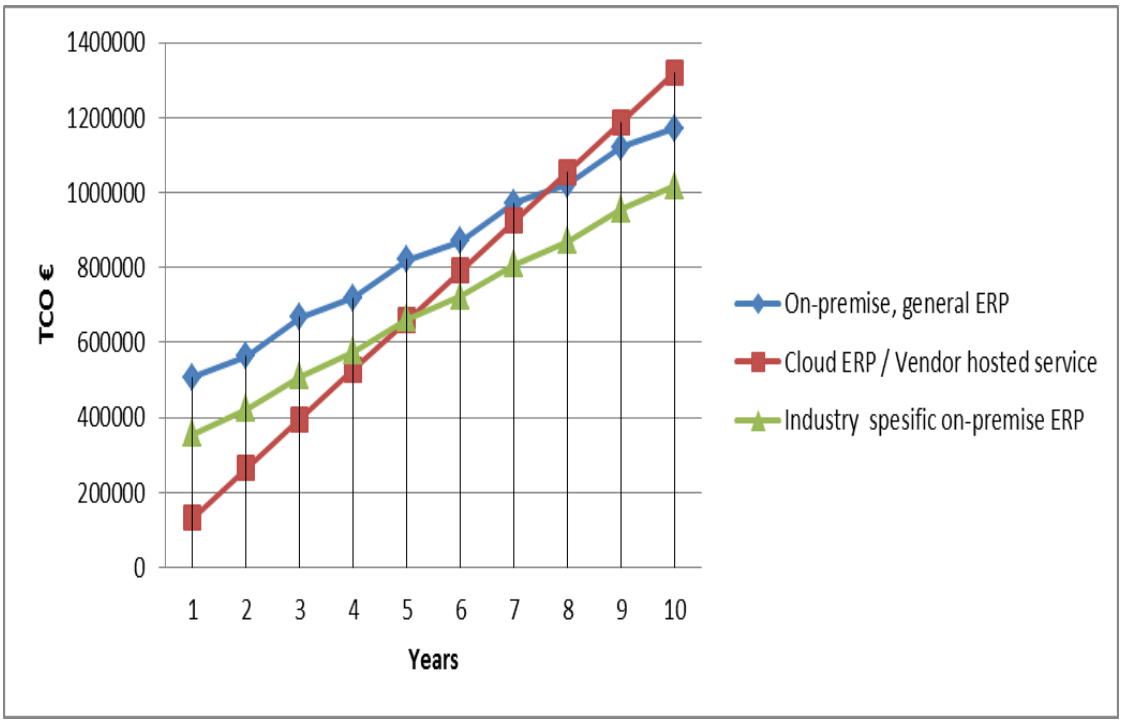

Figure 10. Comparison between on-premise and cloud/vendors hosted SaaS and Industry specific on-premise external TCO

From this calculation we can see that external TCO (TCO without clients own workforce costs) for ERP system is lower for cloud for 7.5 years. Industry specific could however reach savings compared to cloud at around 5 years. This is much due to the relatively small implementation work needed to get industry specific ERP system running. Comparing this figure to our own average customer ERP age of over 10 years with n=150 customers, average customer would be better off with on premises-system when comparing external TCO.

On the vendor point of view the cloud would give biggest turnover the longer clients use the service, turning points being 5 years for the Industry specific ERP and 7.5 years for general ERP.

4.1.2 Comparison tables between delivery models

In following graphs is presented the value comparison between the ERP delivery methods presented earlier. Comparison is done after discussion with CGI's expert group assessing the advantages and disadvantages and the giving solutions points

from 1 to 5 to customer value aspects and 1-10 to vendor value aspects. Points were given in general consensus during and after discussions rather than doing it one by one with every expert for average points or by voting etc. Points on TOC were given according to simulation in previous chapter. It is worth taking a note that in many aspects these evaluations are based on subjective assesments of ERP experts and have strong correlation to the current CGI V10 situation. Generizability on other ERP systems is dependent on the situation of the ERP system and results should be read as such. The evaluation method however gives a good tool for other ERP system providers to make their own assessment based on their own situation.

Figure 11 describes the customer value presented by different delivery methods. Higher points are the more value this delivery method provides to customer towards presented attributes. Attributes are mostly collected from the information presented in knowledgebase although some attributes were added by product strategy board (customer interest/brand factor and added services value to customer).

Interesting point here is that semi cloud provides the best customer value by this comparison and vendor hosted and mobile added vendor hosted still provide same or better value than pure cloud solution. Also modified monolith model is actually quite high in points even as on-premise model. When we add vendor value to the comparison it is clear that there is a clear winner. Vendor values are introduced in figure 12and combined values in figure 13. At the current state where vendor with monolith ERP is, the direct transform to cloud ERP vendor does not seem to offer best business value, as the production costs will run very high if vendor decides to create a full cloud solution as full cloud solution for existing monolith (client technology based) ERP demands a full user interface, platform and distribution model remakes. As the vendor value and total value graphs show, by this comparison the cloud solution provides less value than even the industry-specific on-premises model. This is mostly due to relatively low cost of making the industry specific ERP solution and fast ROI gained from it.

As a whole it is also worth noticing that all the delivery methods build upon each other and can be seen as steps towards the cloud. Even if we see all these methods as steps towards the cloud ERP it does not mean that lower steps would become obsolete. They still offer some benefits and alternatives when compared to upper steps of semi cloud and cloud. From vendor point of view it should present no problem to offer ERP with all these delivery methods at once, as they are all built on each other and system maintenance and development for all the delivery methods can be unified.

The higher you go on the cloud-steps the more standardized and pre-configured system is needed, and this also means that more system improvement work has to be made with each step towards the cloud.

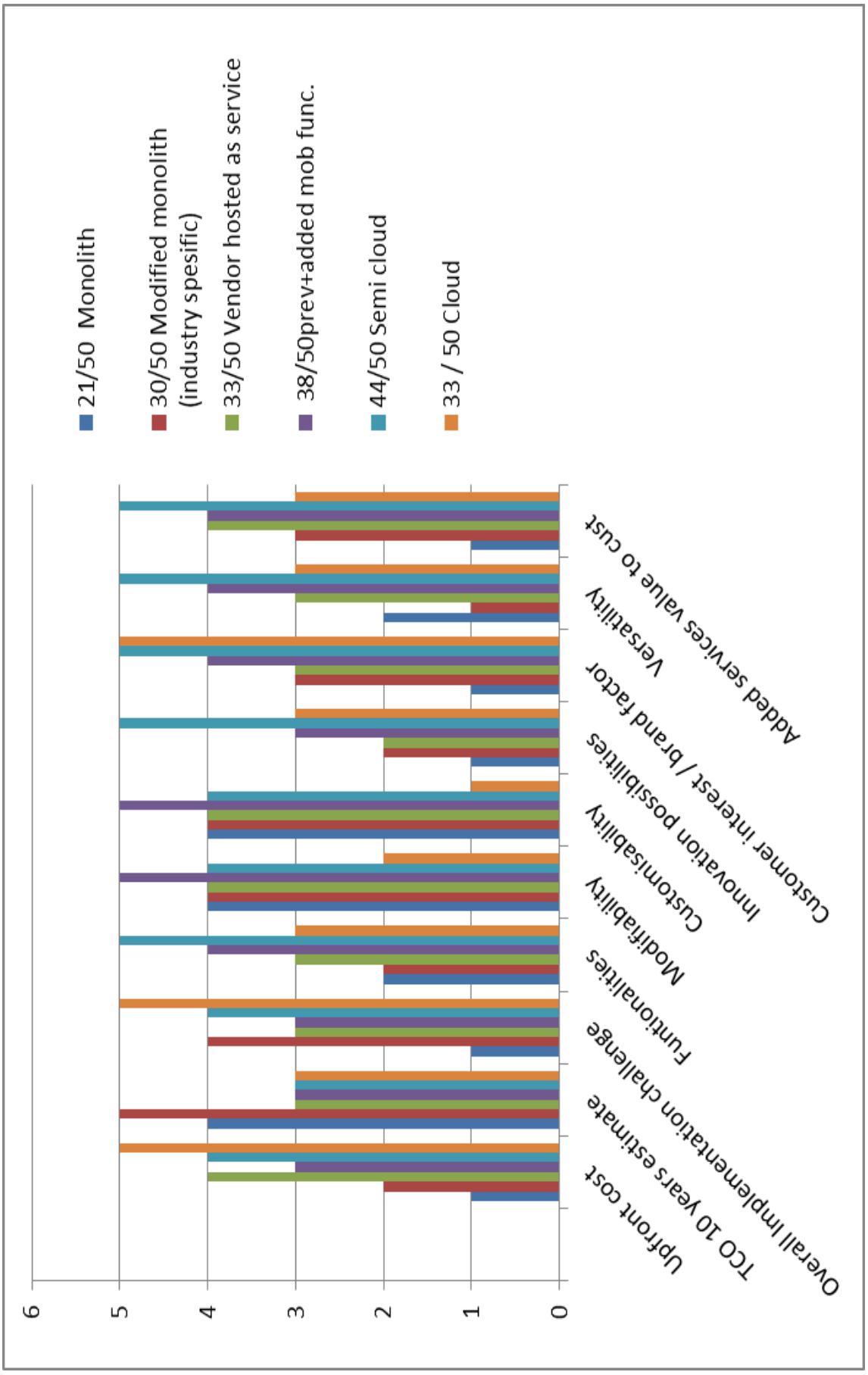

Figure 11. ERP delivery method customer values (higher = better)

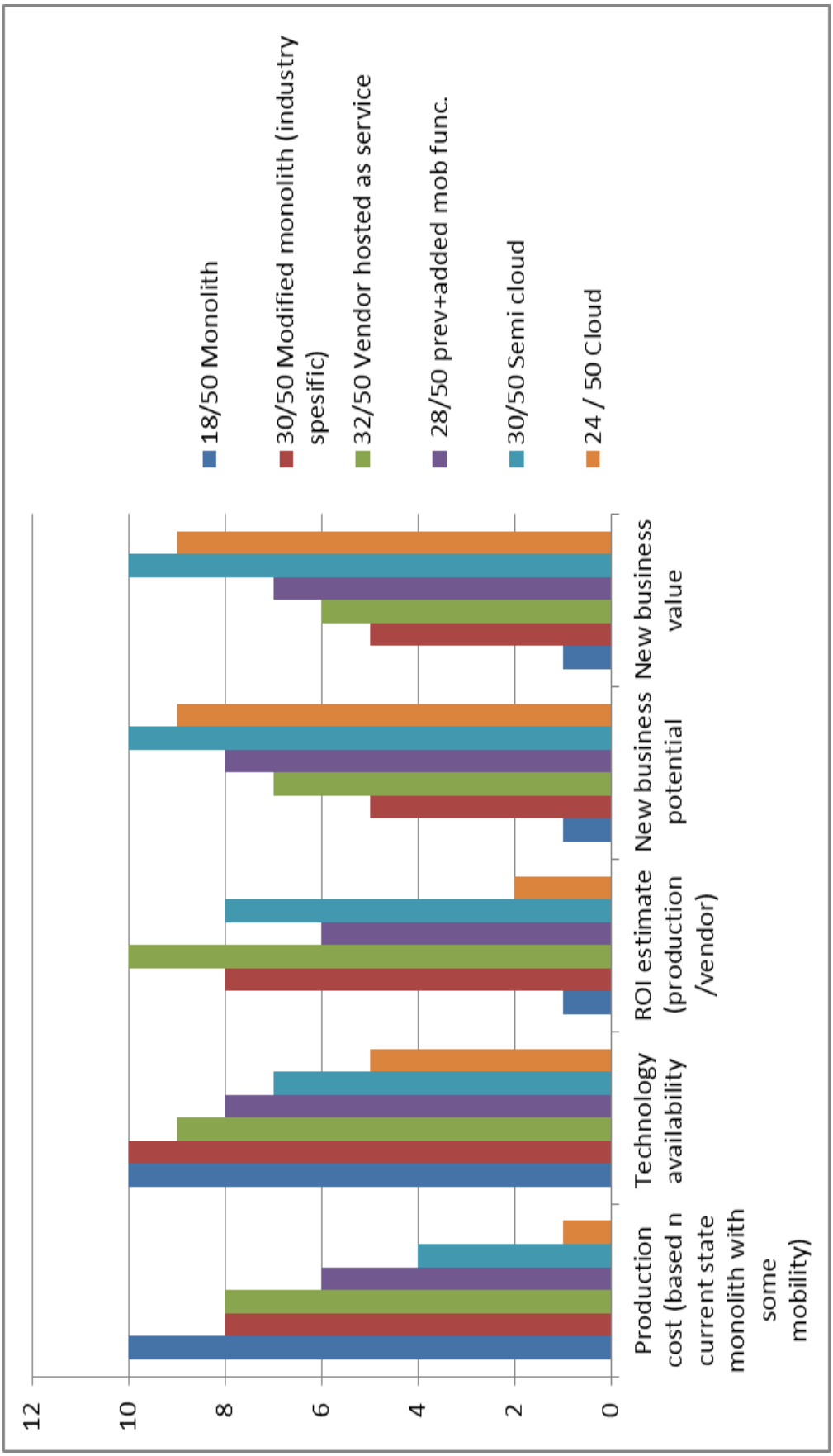

Figure 12. ERP delivery method vendor values (higher = better)

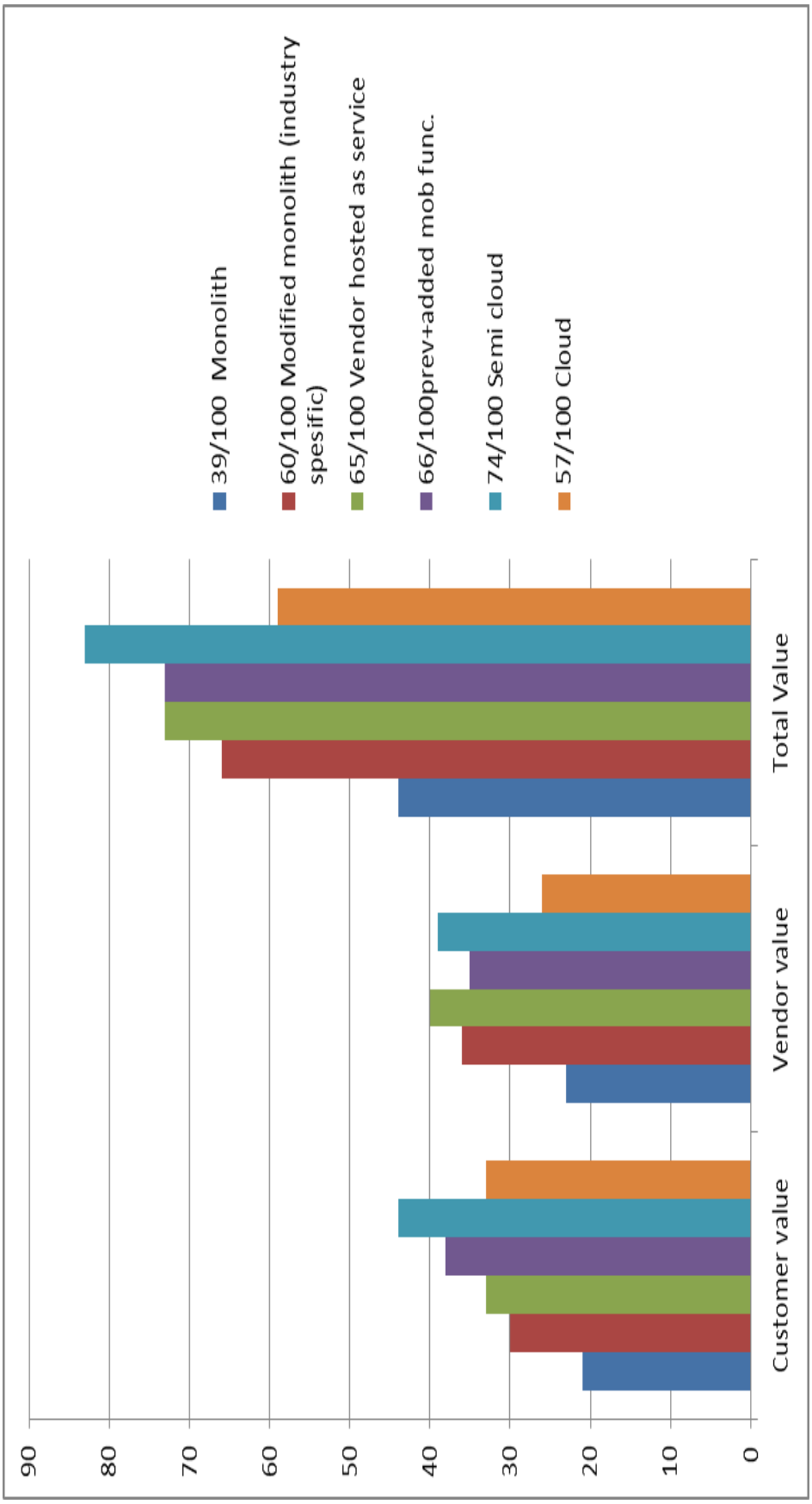

Figure 13. ERP delivery method total values (higher = better)

4.2 Delivery process improvement

To develop more efficient delivery process resource use and quality wise the best place to start searching for ideas are the critical success factors, as they provide a comprehensive knowledgebase for all the important aspects considering ERP implementations and they key points.

We go through the most important CSFs here and find ways to take them into account while developing a better ERP delivery process. The solutions and ideas provided here are a collection from V10 product strategy group and expert group design sessions and discussions.

Top management support CSF: Strong leadership

ERP vendor could provide a built in support process in project implementation for customer top management. ERP vendor can offer consulting services in change management for the whole client organization, instead just for the ERP implementation project as we currently do. A set of easy to use tools for change management (communication plan, stakeholder analysis for example) and guidance how to use them can also be provided. It is also possible to take in a change management consultant for the whole duration of the project to handle the change management daily tasks.

Also ERP vendor could provide consulting help to clear and align organizations vision and strategy with the ERP system implementation. ERP system implementation without link to organization strategy is in our experience often aimless and lacks direction and purpose which makes the work for project team very hard and risks the whole outcome of the project.

CSF: Business process re-design and avoiding excessive modification

ERP vendor could provide expertise to consult and support customer organizations BPR. This type of consulting could be added optional part to the implementation process. Also ERP vendor could make it mandatory (or highly recommended) for customers to at least review their basic business processes before the implementation with our without our help. It is also important to make sure that customer has knowledge on BPR demands in ERP implementation, and training material and education could be provided by us.

It is also important to have right people doing the ERP implementation so that they have clear vision of the organizations business processes and re-design needs. By providing knowledge of the BPR needs to the client organization we can have an effect on the chance of getting the right people into the project team.

As CGI V10 ERP vendor it is clear that we need to consider if it is possible to create pre-configured vertical solutions of our product to more easily meet the needs of certain industries that we focus on. We have strong experience and high level expertise on certain industries that we have been working with for a long time and we could use that knowledge and partnerships we have to create well planned industry best practices based pre-configurations for our system. This would make it easier for the client organizations to align their processes to the system and lessen the need to do any kind of modification, which would inevitably run down the size of the basic implementation project done without customisations and thus could significantly lower the initial cost of the implementation. This would make it possible for smaller companies to implement our ERP system and therefore would effectively enlarge our market potential.

CSF: Change management

ERP vendor could offer our expertise in change management to consult and support organizational change. ERP vendor could build change management packages that include top management consultancy and outline a basic change management process for management to follow. ERP vendor could also provide materials needed to really drive the change and communicate it effectively to the organization in the right way and with the right schedule. These can be added as options to

the implementation project. ERP research done in Finland by Marketvisio (Marketvisio, 2013) concluded that 67% of the interviewed organizations saw change management as the greatest issue needing development in their ERP and ICT projects. Same research also shows that almost all the companies found driving change through organization as the most interesting topic on ERP discussion and development.

CSF: Correct system and architecture selection

ERP vendor should provide a clear description of our ERP capabilities and implementation packages contents. Well planned pre-configured packages with chosen essential modules to meet expected customer needs at chosen industries would be beneficial to easily find out if the product has a close enough match with customers' business processes.

ERP vendor could also provide consulting service, or questionnaire templates for analysing customer's processes compared to our ERP solution as a part of project initiation. If there is need to evaluate and re-design customers business processes altogether before an ERP system selection can even begin, this consulting and analysis can be combined with this function. We have however noticed that it is sometimes hard for customers to see ERP vendor a business process consultant before the implementation project has started. This is especially hard with new customers, but can be more easily done with existing customers that have come to know and trust our consulting experience both in system consulting and in business process consulting. Pro-active marketing and good communication network are needed to reach potential new customers early enough in ERP investment processes.

CSF: user training and key user involvement

ERP vendor should have clear training plans and materials matching their iplmenentation project. It is necessary to make a separation between implementation training and user training. Implementation training for key users is an important part of the implementation project to ensure success of the project and the user

training is extremely important factor to ensure the benefits after the implementation phase.

At CGI V10 we can review and renew our training plans and materials as necessary. We could also implement new tools to training. For example we could start producing video material so that customers can view the training material as needed after trainers have done their job. We also generally train only key users as part of their super user training and they train the end users them self. We could add more solid support for super users on planning and executing the end user trainings to ensure that end user trainings are done on proper time and are based on adequate knowledge.

As for key user involvement, ERP vendor can further educate customers before and during the project on importance of key user involvement and also end user involvement on appropriate level. Generally the most important key users are already in our project teams by project design. They perform various tasks such as data collecting, business process design or walk troughs to our consultants, and they also quite often are educated during the project enough to be trainers for the end users of the system.

CSF: Project management

Solid project management is a key to successful project outcome as an implementation project, but does not guarantee business outcomes. However failed project management is a sure way to sabotage changes for successful business outcome.

ERP vendor must have a solid expertise in project management. It is however not enough to have competent project management on vendor side, but client side project management has at least equal impact on project outcome.

ERP vendor could offer project management expertise to clients not only as project managers, but as project management consultants and trainers to ensure client side project management is up to the challenge of an ERP implementation.

CSF: ERP team composition and teamwork

In our implementation projects have come across organizations that do not have adequate project skills to complete a successful implementation project. The implementation project is always dependant on both parties involvement and skills, both in business side, but also on project work side. If project working and management is not at all familiar to client organization's key users and named project manager we could provide project work and project training for customer project team to ensure they have adequate skills to successfully do their part in implementation project.

It is extremely important for an ERP vendor to have trained professionals with industry specific expertise to implement the ERP system. Consultants with solid industry expertise combined with well-planned industry specific pre-configurations would seem to be ideal solution to provide best value to customer and implementation success. Industry experts (even non-IT professionals) can also be used to create industry specific pre-configurations to make sure they meet the industry demands.

Labour shortage on client side is by our estimation the biggest factor delaying implementation projects. To improve clients understanding of work ahead we can provide even more detailed work plans with resource estimations for the project team, and create clear responsibility matrixes that leave no discussion or doubt who will be needed to perform tasks and when.

CSF: Partnership and ongoing support

As CGI we can assure that we provide a stable partnership to customers of any size or location being one of the world's biggest consulting and IT companies with over 70 000 employees and long successful history on this industry. CGI also has very high standards of operation which are audited constantly. Compared to many smaller vendors this solidly guarantees that we can provide a worthy partnership through the whole life cycle of a system.

CSF: Communication.

ERP vendor could offer support for building a communication strategy and help implement in client organization as a part of change management consulting.

CSF: integrations and legacy system management

Integrations required by ERP system implementation are very diverse. They range from one time data import integrations to permanent multi system integration networks that can include dozens of different systems. Master data management is also important factor on multi system environment and also in system transition phases. ERP vendor could offer master data management expertise from consulting to full outsourcing to our clients as needed.

ERP vendor could also offer our expertise on legacy systems integrations, data conversions and parallel system integrations as needed. At CGI V10 over 90% of systems we have implemented are integrated to some other systems, so integrations management during implementation is very important factor that can have effect on budget, schedule and benefits gained from the system. To help clients to move data from legacy systems, we can also build highly automated import functions to our system that allow secure and fast data migration from legacy systems.

Not CSF: Financial management

Although not much information was found on existing literature, we have noticed importance of successful financial management of client organization during implementation project. To help our customers we can provide support for clients financial planning during project. Through industry expertise and well planned pre-configuration and client business process re-design support it is possible produce an ERP system and implementation model that has a clear plan and well defined scope to stay within projects internal budget (vendor budget) and it is possible to help client organization to plan and work according to clients whole ERP implementation budget (Client budget).

CSF conclusions and application to a model as whole

All of these CSFs can be influenced by ERP vendor if vendor's delivery process is designed with the CSFs in mind. Some of these CFSs can be affected with just minor improvements or quality updates to standard process, but some need more work and new expertise to be included in to the delivery process. For example including change management support and consulting to support top management of the client organization we need to build a change management service package and have change management consultants to deliver the service within implementation project. At CGI this is however no problem, as we currently have several capable change management experts already and just need to link them to right ERP projects.

Discussed improvements are based on traditional ERP-implementation model seen as an IT-project. Improvements on this area are mainly focused on delivery process improvement rather than system improvement. A sum of these factors addressed in an ERP implementation process model can add up to much easier implementation project while generating additional revenue to the vendor from additional implementation services such as top management consulting or change management consulting.

4.3 Artefact: a Step by Step Development Model (SSDM) for an existing monolith ERP

To create a model for upgrading an existing monolith ERP to meet the current requirements of the IT trends we need first to analyse what are the current main prohibits for the ERP system implementations for the organizations – whether they are on-premise or cloud. Then we need to understand whether they are truly linked to the delivery methods such as on-premise or cloud, or are their root causes elsewhere. As we have found out earlier these prohibits include missing functionalities, usability issues, too risky implementations, too high upfront costs, too

high TCO costs or even IT trend mismatches (in-premises vs. cloud has been somewhat hype-issue lately).

When making decisions to how to develop an existing system, it is extremely important to really understand the root causes for the customer demands and aim the development resources to address those issues rather than just go with the IT trends. Following trends too eagerly can turn out to be rather costly and offer no real added value to the product. For example Cloud is mostly used for cost savings and service quality assurance (Dhar, 2012), and if another solution can provide same or close to these benefits and exclude some of the cloud challenges, it might be preferred over cloud.

ERP systems are most complicated and extensive business systems there are, and upgrade costs of such a systems are high. Return of investment (ROI) calculations should be made and development actions should be aligned where the best ROI can be found, even if that means dropping out from the latest trends.

Cloud ERP has been around for a very short time, and cloud ERP considerations of organizations seem to be is already evening out after the biggest cloud hype has been settled down and evidence is starting to build up on usability and true cost savings.

However as it has been studied earlier cloud can give significant benefits to both client and vendor organizations, and therefore we see that moving towards cloud technology is reasonable thing to do. With model presented here it is possible to align system and process development of an ERP system so that every development step done is a step closer to cloud ability, but also gives enhancements the existing delivery methods to compete with other potential cloud ERP solutions and deliver same kind of benefits that cloud ERP does - without having to take in all the known challenges that cloud ERP also still has.

It is also important to understand that development of an ERP system like this is never just a product development project, but has to include the delivery process aspect as well. Also the whole business model of the ERP vendor could go under

change while taking significant development steps on delivery methods. We have studied factors affecting the implementation success and introduced several improvements to the standard (current) delivery process and delivery process improvement project addressing introduced CSF with solutions provided is needed alongside the system development project.

As for the ERP development model we suggest a two dimensional approach where we take in account the delivery process development, industry standards pre-configurations and system development as a whole considering all the possible delivery methods introduced here. For different delivery methods we suggest separate platform and UI development phases according to the needs of a target delivery method.

The artefact (Step by step development model, SSDM) is presented in figure 14. In figure 15 is presented the same model with indicative development cost accumulation graph in orange.

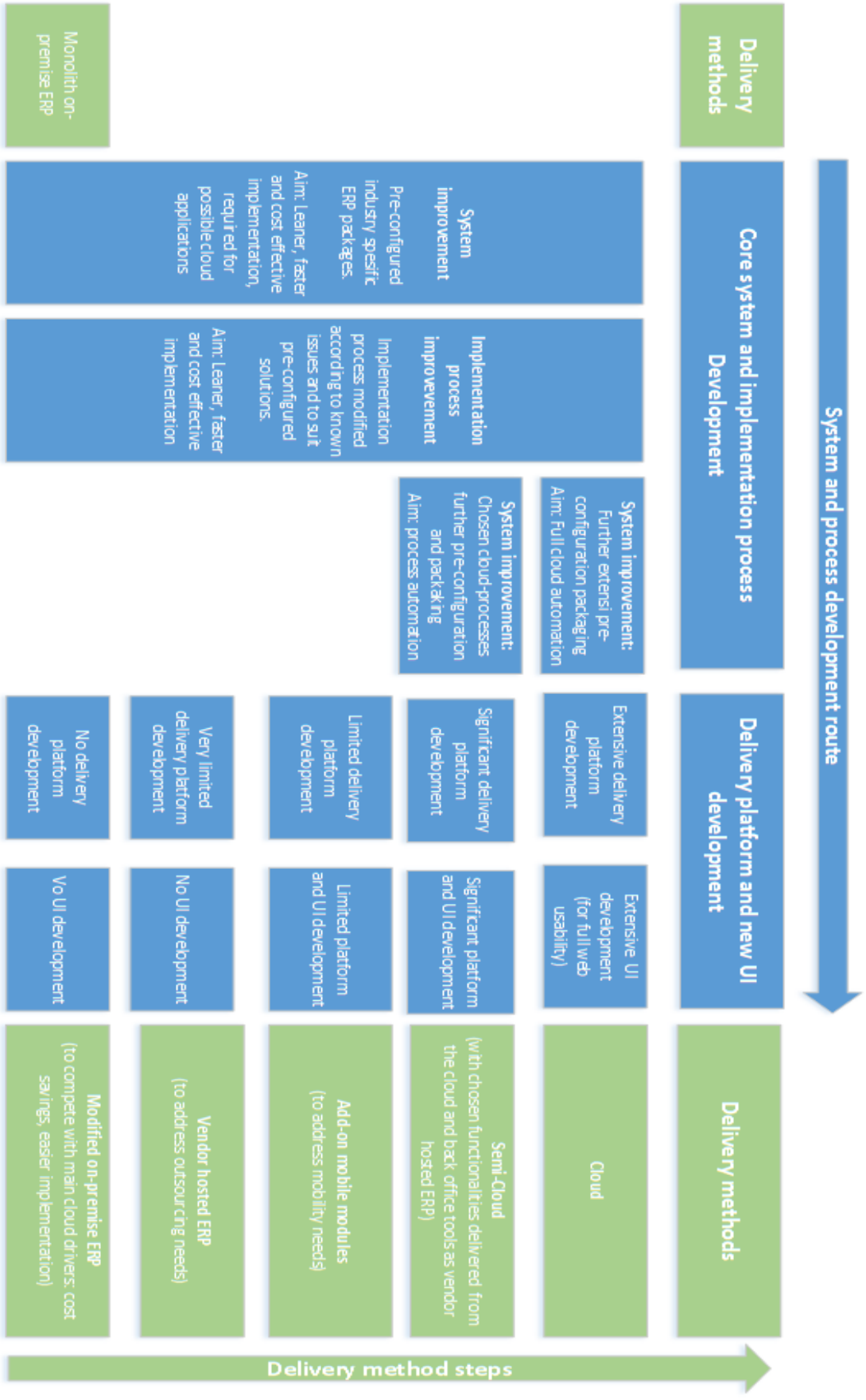

Figure 14. Artefact, Step by Step Development Model (SSDM) for an existing monolith ERP

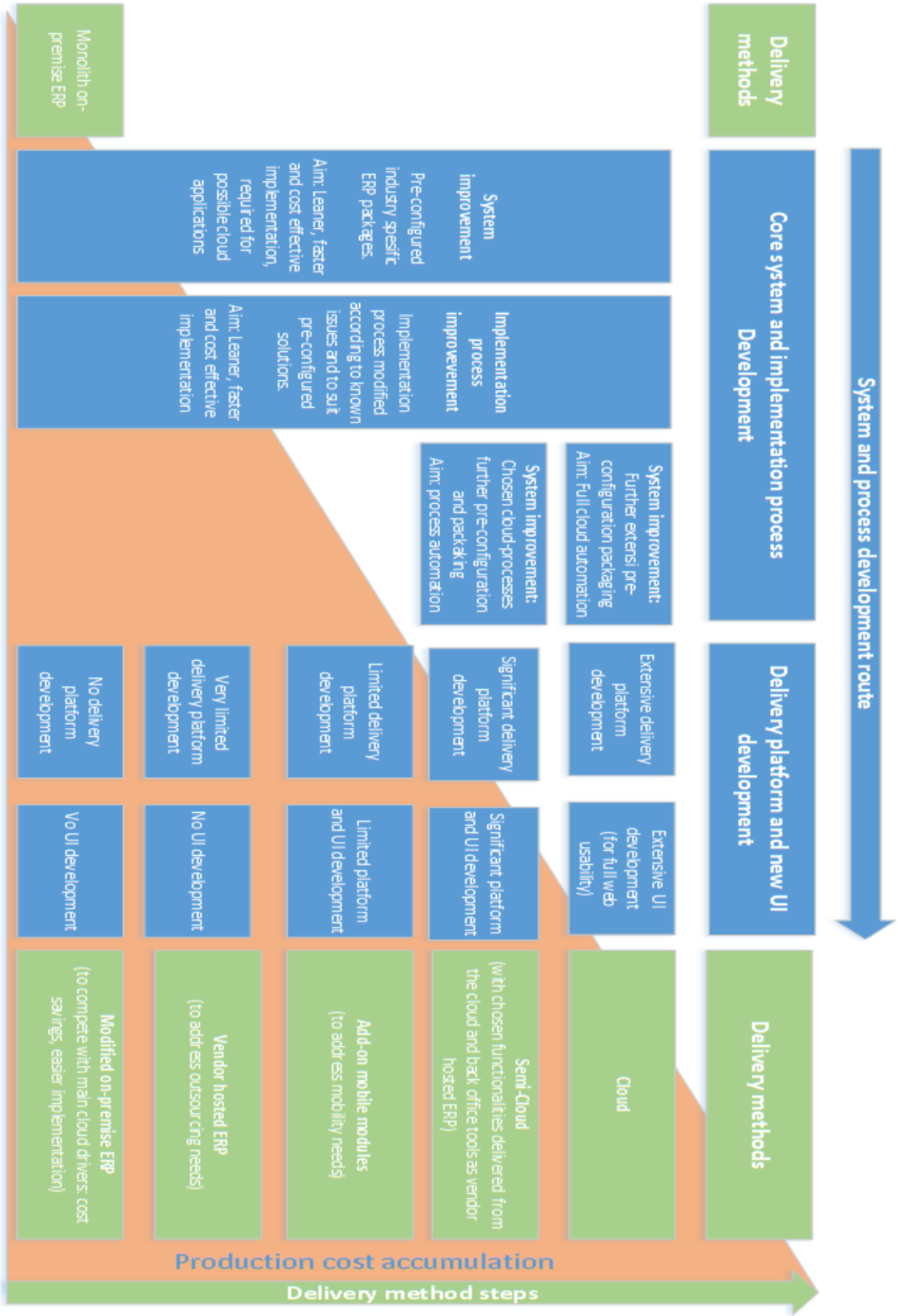

Figure 15. Artefact, Step by Step Development Model (SSDM) for an existing monolith ERP with indicative cost accumulation graph

4.4 Evaluation of the artefact

At research context we decided on criteria for evaluating the artefact i.e. created model. The evaluation towards criteria it is provided in this chapter.

- *Solution must be technologically viable: It can be created with our available tools and solutions.*
- Evaluation: While the model itself does not take in account specific technical tools or solutions, it builds on existing tools and solutions already available and takes in account new platform and UI development needs.

- *Solution must be economically viable: The investment must proportional to evaluated financial potential. ROI must me on acceptable level.*
- Evaluation: The model provides a step-by-step route from monolith to ERP and leaves the economic decision to the user of the model. Comparison of production cost levels and ROI levels of different delivery methods are provided within the supporting data for the model.

- *Solution must address the current known issues of our chosen industries / Customer segment and possibly open new customer segments.*
- The model takes in account industry specific pre-configuration needs and supporting data provides guidelines for industry specific system considerations. Each step towards the cloud requires more pre-configuration and automation on the system and model takes that in account. With the model it is possible to reach new innovation possibilities through evolving delivery methods and platforms they require. Even the modified monolith ERP with lean implementation and pre-configured industry specific solution (both affecting initial cost and TCO) will open new possibilities for the smaller customers and combined with Vendor hosting and mobile add-ons it is possible to address mobility needs and open new customer segments.

- *Solution must comply with known critical success factors (CSF) of ERP implementations to enhance implementation success.*

- The model takes in account delivery process development and supporting data provides guidelines how ERP vendor can provide solutions and value to customers and to vendor by addressing CSFs in their delivery process.

The actual evaluation of the model will take place in the future as it is used to guide the actual ERP delivery method and delivery process development (of CGI V10 ERP).

5 CONCLUSIONS AND DISCUSSION

Answering the research questions

What is the future of the ERP systems and how to adapt an existing monolith ERP system to the latest IT trends?

What kind of model can be used to develop an existing monolith ERP system to meet the demands of latest IT trends?

Questions have been answered with the development model (SSDM) created and for the future aspect we can conclude that the current trend is towards the cloud, but the trend seems to be slowing down at least for now, as the initial hype has somewhat burned down and organizations are starting get real data from the benefits and challenges of the Cloud ERP systems. Cloud ERP can definitely be an asset for an ERP vendor, but the road from monolith to cloud is not easy and definitely not a cheap one. All the positive and negative sides and financial factors need to be carefully analysed before the decisions for the desired solution platform or delivery method can be made.

In light of the research here it is safe to assume that at least for the close future the monolith on-premises ERP will have its sizeable market share. However the competition will be different with other delivery method ERP systems in the market and customers are more likely to pay close attention to the implementation overall challenge and implementation cost, and this is where monolith ERP vendors need to make improvements and adapt theirs systems and delivery methods for the leaner implementation processes demanded by customers.

Model introduced in this study will build on steps over steps and aims to offer benefits for every delivery method on the way as they can be considered as foundations for the next delivery methods in the road towards the pure cloud ERP. Whether the pure cloud ERP is the best solution for a monolith ERP provider such CGI and V10 business is up to the vendor to decide. Guidelines and insight for the

decision are provided within this study. Following this model ERP vendor can improve (or at least retain) his competitiveness in the current changing IT-environment while taking steps towards the cloud ERP without having to take a head first dive in to the cloud computing at once.

5.1 Facilitation guidelines

The model here is mainly directed towards CGI V10 but can be used with any monolith ERP in similar state. The model goes all the way to the pure cloud ERP, but it is upto the ERP vendor to make an assessment where the best business value can be reached and aim to that delivery method while also keeping the other delivery methods competitive with continuous improvement they receive from the delivery method development.

5.2 Future research ideas

- Actual TCO comparisons with different delivery method ERP systems.
- Financial management factors during ERP implementation
- Further development of the ERP upgrade model created in this research
- Actual testing of the model created in this research

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ATTACHMENTS

Attachment 1: CGI V10 development groups

Product strategy group:

Led by Director (researcher)

System architect

Solution architect (industry expertise & marketing)

Product maintenance lead

Product manager

Sales lead

Project delivery lead / Project delivery process owner

Average 15 years of experience of ERP systems development and business models.

Expert group

Led by

Product manager & project delivery lead (reporting to the Director)

ERP head consultants:

- Purchasing and operative financials
- Sales and shipping
- Projects and resource management
- Offer calculations, CRM and document management
- Manufacturing

Payroll head consultant

Financials head consultant

Mobile applications manager

System development manager

Attachment 2 (removed from published work), Delivery process and pre-configured industry specific ERP development project plan in Finnish (strickly confidential, property of CGI Group inc.)