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Abstract

Organizations often consider investing in a new Enterprise Resource Planning (ERP) system as a way to enhance their business processes, as it allows integrating information used by multiple different departments into a harmonized computing system. The hope of gaining significant business benefits, such as reducing operating costs, is the key reason why organizations have decided to invest in ERP systems since 1990's. Still, all ERP projects do not end up in success, and deployment of ERP system does not necessarily guarantee the results people were waiting for.

This research studies why organizations invest in ERP, but also what downsides ERP projects currently have. Additionally Enterprise Application Integrations (EAI) as next generation's ERP solutions are studied to challenge and develop traditional ERP. The research questions are: What are the weaknesses in traditional ERP deployment in today's business? How does the proposed next generation's ERP answer to these weaknesses?

At the beginning of the thesis, as an answer to the first research question, the basics of ERP implementation are introduced with both the pros and cons of investing in ERP. Key concepts such as IS integration and EAI are also studied. Empirical section of the thesis focuses on answering the second research question from the integration approach. A qualitative research is executed by interviewing five experienced IT professionals about EAI benefits, limitations, and problems. The thematic interview and questionnaire follow the presented ERP main elements from literature.

The research shows that adopting traditional ERP includes multiple downsides, e.g. inflexibility and requiring big investments in terms of money. To avoid these critical issues, organizations could find a solution from integrations between their current IS. Based on the empirical study a new framework for the next generation's ERP is created, consisting of a model and a framework that deal with various features regarding IS adoption. With this framework organizations can assess whether they should implement EAI or ERP. The model and framework suggest that there are multiple factors IT managers needs to consider when planning their IT investments, including their current IS, role of IT in the organization, as well as new system's flexibility, investment level, and number of vendors. The framework created in the thesis encourages IT management to assess holistically their i) organization, ii) its IT, and iii) solution requirements in order to determine what kind of IS solution would suit their needs the best.

Key words	ERP, EAI, systems integration, business enhancement
Further information	





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REPLACING TRADITIONAL ERP WITH INTEGRATION SOLUTIONS

The next generation's ERP

Master's Thesis
Information Systems Science

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1 INTRODUCTION

As the competition gets tougher, organizations in all shapes and sizes around the world look for ways to enhance their business processes and keep up with the new challenges they face. There are multiple various ways to reach these goals, and investing in a new ERP system is often considered as one of them, since it allows organization to integrate information used by multiple different departments into a harmonized computing system. ERP system can help an organization to reduce operating costs, generate more accurate forecasts of demand, decrease production lifecycle times, and enhance customer satisfaction. This way ERP system can enable an organization to reach millions of dollars of savings annually. (Lv & Chen, 2010)

Within the field of IT, ERP implementation and ERP risk management are topics that have been studied a lot. It is commonly known that especially major software projects, such as ERP system deployment projects, are risky and many end up in some level of failure (Lv & Chen, 2010; Zamiri et al., 2010). Nevertheless, ERP solutions are still popular among organizations. The early concept of ERP was launched already in the 70's but during the past forty plus years ERPs have changed only little, while critical features around ERP has changed: we have moved towards more agile and flexible ways of working. (Lörincz, 2007) Thus people have started to question whether traditional ERPs can answer the needs of people and organizations today. This has inspired researchers and scientists to develop new approaches and new alternatives to traditional ERP. Still, the foothold traditional ERP has in the markets is quite firm, and this thesis continues to search for more agile alternative for traditional ERP. This has also inspired the author resulting the research questions of the thesis:

What are the weaknesses in traditional ERP deployment in today's business? How does the proposed next generation's ERP answer to these weaknesses?

This thesis studies the concept of traditional ERP and whether enterprise application integrations (EAI) could potentially challenge it. Thesis starts by introducing the concept of traditional ERP with its benefits and downsides. Next information systems integration and especially EAI are studied more deeply, and a bunch of other new suggestions to challenge and develop traditional ERP are introduced as well. Finally this leads to a new approach to traditional ERP, "the next generation's ERP" created by the author.

In the empirical section of this thesis the concept of enterprise application integrations was researched with a set of semi structured interviews. The meaning of the interviews was to study particularly integration solutions and their characteristics in order to find out how EAI implementation works in practice and could they have the potential to be a major IT solution now and in the future. All together five interviews were carried out in Turku and Helsinki during autumn 2015 with IT experts with different kinds of

backgrounds and experiences within the field of IT. Respondents represent five different sized IT and consulting companies operating in Finland: AgentIT Finland Ltd., Integration House Ltd., PricewaterhouseCoopers Ltd., Sofokus, and W3 Group Ltd. Altogether the five interviewees have 92 years of experience in working within the field of IT. All of the interviewees were offered the same set of questions without pre-given response options. The interviews had three main themes according to which the questions were categorized: i) EAI benefits, ii) limiting factors, and iii) risks and problems. During the interviews the main themes were emphasized and especially the client's perspective to EAI projects. At the end of the interview the interviewees were given a paper with a list of twenty features and they were asked to assess on a scale from 1 to 5 how well the given features apply to EAI projects. The interview results were analyzed and compared first among themselves, and after that with the thesis' theory section's results and findings.

ERP (Enterprise Resource Planning) or Enterprise System is an IT tool that integrates business processes and functions, and information used by multiple different departments of an organization into a harmonized computing system (Lv & Chen, 2010). ERPs can be described as firm wide information systems linking important business processes together so that the information can flow freely between different areas of the firm (Murthy, 2008), and an organization can have more than just one ERP system in their use (Møller, 2005). The hope of gaining significant benefits is the key reason why organizations have decided to invest in ERP systems for years and years now. However, not all ERP projects are success stories, since deployment of ERP system does not necessarily guarantee the results people were waiting for. Buying and implementing the system can require millions and millions of dollars, and, worst-case-scenario, the ERP system implementation will be abandoned. (Soh, et al., 2000)

ROI and what kind of financial expectations organizations have for the ERP system play a major role when trying to find a best ERP solution. Since the investment is so huge, organizations should carefully think about how different alternatives could help them to reach their goals set for ERP implementation. In addition, the solution that a company ends up with should have the highest match to organization's functional requirements, i.e. the new system needs to fit with current business processes. (Lv & Chen, 2010) The ERP system has to have proper functionality to cover business requirements, as the technical architecture needs to support and go together with existing applications. When doing cost analysis, costs should be treated as total costs of ownership, not only buying the ERP but other costs added, as well. (Avram, 2010)

Many organizations have various separate information systems that they use in their everyday business. Usually these information systems in one organization are developed and implemented on different platforms and have different systems for data management, as well. This contributes to a situation where the right information can be difficult

to get easily and on time, as information systems have difficulties in reacting to user requests that are focused on more than one system. In order to avoid possible shortcomings in information systems interaction, and to fulfil new business process efficiency requirements organizations might end up in integrating their information systems into one. (Tomicic-Pupek, et al., 2012) There are different types of enterprise integration projects. Enterprise Application Integration (EAI) is integration of IT systems within the organization aiming to improve business efficiency and real-time information processing. Other types of enterprise integration include B2B integration, B2C integration, and web integration. (Lam, 2004) Enterprise Application Integration is about integrating enterprise applications to form a coherent information system. For example Manouvier and Menard (2010) define EAI as “a collection of methods, tools, and services that work together to bring heterogeneous applications into communication, as part of the traditional, distributed or extended enterprise”. (Manouvier & Menard, 2010, pp. 23)

Exchange of information between applications in information system is in the core of EAI (Manouvier & Menard, 2010). EAI is based on the idea that integration between external and internal information systems brings value to the organization, and information sharing increases the value and quality of information. Organizations that wish to improve their productivity and reduce costs can find EAI to be the solution to answer this need. EAI, however, is a huge project for an organization and requires support from the very top to the very bottom of the organization. (Zhigang & Huiping, 2009)

Interview results are in line with prior literature that focuses on EAI. According to the final interview conclusions EAI solutions are a necessity in any organization doing business today. Investment level is relatively small with EAI, and they are used to decrease manual work, automate processes, and increase data integrity. The customers implementing EAI want their information system and enterprise applications to communicate and interoperate. Getting rid of vendor lock might also be a big motivation for ending up with EAI solutions. End result is flexible, however, the current information systems define the EAI project at hand: they determine the starting point and possible limitations. Technical factors were found to be most crucial limiting factors for EAI implementation.

It seems that EAI suits all kinds of organizations, but it is exceptionally good choice if the organization is happy with the current information systems they have but wish to even more out of them. However, the managers and other decision-makers pondering whether to invest in EAI or not should have a clear understanding of the role of IT within their organization. They should also realize that purchasing one major closed IS package from a single vendor is a serious lock-in factor and not a modern solution. ERP requires changes on its terms whereas EAI enables change on the customer organization's terms.

The research findings inspired the author with creating a model and a framework to support organizations in finding a proper solution that suits their situation the best when considering the development of their IT strategy and information systems. By this it is meant that next generation's ERP suggests managers to assess their current IS, what is the role of IT in the organization, how important is system flexibility to the organization, how much is the organization willing to invest in IS and what is the number of vendors managers would be happy to work with. With the model managers and other decision-makers are put to think about IT within their organization and different aspects of the solution they are looking for. More specifically, the managers ought to assess IS based on the current, objectives, and strategy: the age of current IS and the level of satisfaction with them in the organization, how flexible should the information systems be, and also investment level, number of vendors and willingness to purchase one major system. Thus the framework is a more concrete tool for managers and other decision-makers, as they are expected to assess these six different features regarding the nature of the next generation's ERP solution they should acquire.

2 WHAT IS ERP?

In this chapter and its subchapters the concept of ERP (Enterprise Resource Planning) is introduced. Topics such as what is ERP, what kind of process ERP implementation is, and the benefits and challenges in ERP implementation are discussed. In addition issues related to finding the most suitable ERP solution are examined.

ERP or Enterprise System is a commercial IT tool, which integrates business processes and functions, and information used by multiple different departments, such as accounting, human resources (HR), manufacturing and distribution, into a harmonized computing system (Lv & Chen, 2010). ERPs can be understood as firm wide information systems that link the most important business processes together in order to allow the information flow freely between different areas of the firm. Business process, in turn, can be seen a collection of activities that work together to produce a defined set of products and services. In figures 1 and 2 are illustrated both the traditional view of a system and how ERP functions as one system for multiple business functions. (Murthy, 2008) ERP is quite a comprehensive software solution that aims to improve organizations' business IT architecture (Zamiri, et al., 2010). An organization can have more than one ERP system in their use (Møller, 2005). Five major ERP vendors include SAP, Oracle, Peoplesoft, JDEdwards and Baan (Lv & Chen, 2010).

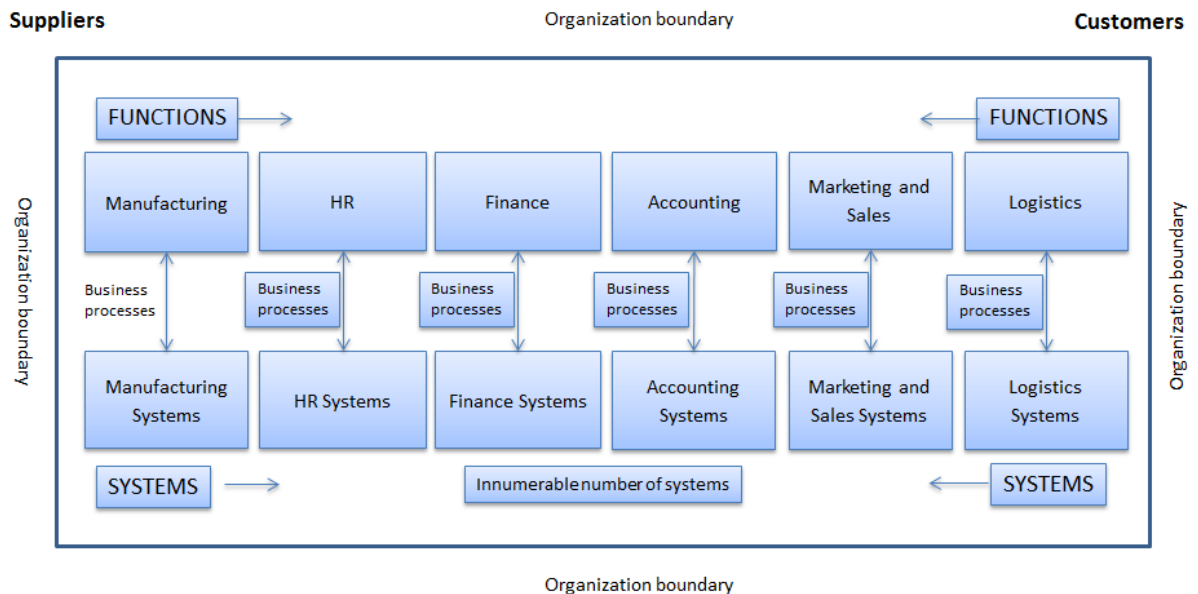


Figure 1: Traditional view of information systems (Murthy, 2008, pp.31).

ERP software packages are implemented in various organizations to manage and integrate business processes across different organizational functions and locations. They

cost millions of dollars to buy and implement, and require notable organizational changes. Some organizations gain significant improvements and benefits, whereas others have had to settle for less or even noticed that they need to abandon the ERP system implementation. (Soh, et al., 2000)

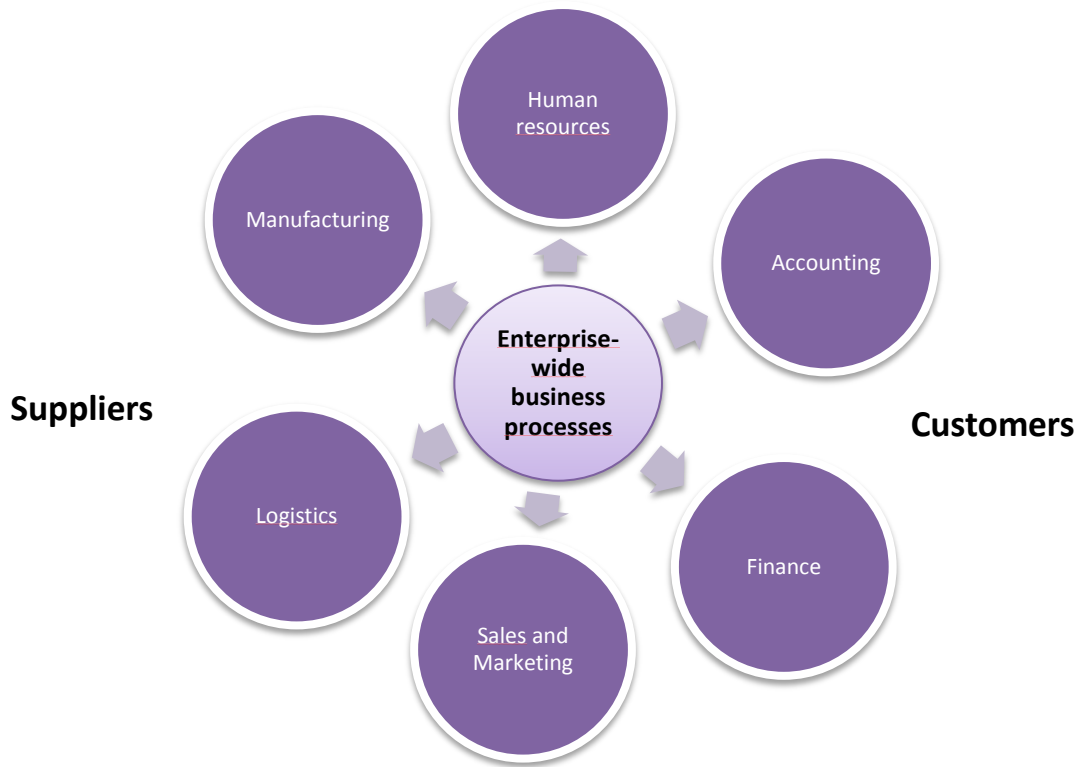


Figure 2: ERP as one system for several business functions (Murthy, 2008, pp.32).

The evolution of enterprise information systems (ES or EIS) started already in the 1960's and has been driven by both business and IT. The gap between these two has affected organizations throughout the years, as business analysts and system designers have had to face the business - IT alignment problem. Material Requirement Planning (MRP I) was the first big step towards the ERP solutions known today. MRP I integrated on data and model level inventory, engineering and demand management, and aimed to provide automated planning, building and purchasing requirement based on the current and allocated inventory and expected arrivals. Manufacturing Resource Planning (MRP II) was developed to integrate business planning, sales, distribution and supply logistics and other functions together in order them to work in harmony. As the computers became more and more common and affordable for organizations, soon each department within an organization could reach their own data and application. Finally in the beginning of 1990's, accounted-oriented information system, ERP took shape from the development process, aiming to identify and plan resources needed for example

gathering, producing and shipping customers' orders. (Lörincz, 2007) There are various potential reasons why ERP has grown into such a popular IT tool for organizations. These reasons include strong demand for systems that deal with multi; support multi lingual, multi currency, multi mode, and multi facility business requirements. In practice this means that nowadays globally operating companies need to serve their customers in many different languages, and be able to receive invoices in different currencies. Organizations also differ in things such as when the products or services are finished in relation to customer orders. (Murthy, 2008)

ERP implementation lifecycle, success and failure

ERP implementation is not an easy task and can take even years (Avram, 2010). Instead of thinking ERP implementation as a static process, ERP implementation is a continuous improvement process that is composed of both initial and post-implementation phases. There are a few different interpretations concerning the ERP implementation lifecycle, but they all have the same basic features. The number of steps can vary from three to six, and for example Zhen et al. (2009) described the ERP implementation with three steps. First step is ERP primary adaption. This is when leaders make a decision to implement the ERP system in their organization, and start to prepare the organization for the project. In the second step, ERP secondary adaption, also the employees accept the ERP system and begin to use it in their work. Final step is ERP assimilation, where the ERP system becomes routinized in the organizational work processes. (Zhen, et al., 2009) Avram (2010) suggests that ERP implementation should be done top-down, so that the entire organization cooperates completely during the implementation, cooperation starting from the very top of the organization to the bottom of it.

Within the three ERP implementation steps there are various sub-phases to go through. As the management of the organization starts to screen for ERP project, a vendor offers its packages and services to fulfil the organization's needs. First the proper methodology for ERP implementation needs to be determined. Knowing what to do on each step of the implementation is important for the project success, so a methodology that provides a tested road map can truly make a difference. The beginning includes project investigation (planning), selection of right type of ERP package (analysis), and designing the implementation process. (Murthy, 2008) Choosing ERP should be done based on analysis on various aspects, such as current business, internal processes, budgets, critical points inside the company, and strengths. Both business and technical analysis should complement each other. The new ERP should align with the current infrastructure, but most likely it is the infrastructure that must be aligned with ERP. Cost calculations ought to be done, so that the organization can compare the expected benefits with the costs, as ERP is usually implemented in order to reduce costs and save

money. Project preparation will start only after choosing the most proper ERP for the organization. This includes project planning, selecting and training project team members, kickoff, and going through technical requirements and quality check tools. (Avram, 2010) After choosing ERP system and started project preparation, issues such as gap analysis (company needs versus ERP functionality), re-engineering business processes, configuration, testing, and end user training are covered (Murthy, 2008). When reached the realization phase of the project, all business and process requirements are implemented as documented in earlier phases. ERP configuration is to be done step by step. Final preparation, and go-live and support phases follow. (Avram, 2010) In post implementation phase the work of vendors and hired consultants will be over, as it is the trained employees' turn to take over (Murthy, 2008). Post implementation can be seen also as continuous improvement, a never ending phase (Avram, 2010). The organization-wide acceptance is important, and the system needs to be upgraded when new technologies are needed (Murthy, 2008).

When assessing ERP project success, we should not only look at the numbers and figures (known as the initial success), i.e. if the implementation has been done in given time and within the budget that was agreed on. Also the post-implementation phases should be taken into account when discussing the implementation success. (Zhen, et al., 2009) For example, Nelson (2005) suggests that in addition to the initial process-based measures of IT project success, time, money and requirements, three outcome-based measures of success - use, learning and value - should be considered as well when assessing the project success. Usage measures if the final service or product was actually used by its target audience, learning refers to whether the project increased stakeholder knowledge and helped the organization prepare for the future, and value measures if the project succeeded in improving and enhancing the efficiency or effectiveness of the client organization. Based on this, we could say that ERP project success can be measured with time, money and requirements, but also comparing the results with post-implementation phases. How much value does the ERP implementation actually create to the client organization and if the system will actually be used as it was supposed to be, are important questions when trying to evaluate the ERP implementation success. However, the success of ERP system and thus the overall ERP project is ultimately in the hands of the end users (Murthy, 2008).

2.1 The benefits and the challenges

As with many other things, investing in ERP has its advantages and disadvantages. Next subchapters will introduce what kinds of benefits organizations are looking for when implementing new ERP and what kinds of advantages there might be. However the

negative side and difficult challenges are shadowing these potential benefits, and here it is questioned if it is possible to cope without investing in new ERP solution. Also the main risk factors and biggest problems of ERP deployment are introduced.

2.1.1 Why invest in ERP?

As organizations keep on growing and they face unprecedented challenges and competition, many of them feel that they need to ensure their sustainable development. Globalization and transition from mass production to mass customization might create new kind of pressure to organizations. In order to enhance their business process performance and keep their business requirements and infrastructure aligned, organizations seek efficient management tools that can help them with rapid changes and requirements that are nowadays even more and more common. An ERP system is often considered as a solution to this need. (Lv & Chen, 2010) (Zamiri, et al., 2010) Table 1 summarizes the benefits of ERP implementation; that is the reasons why organizations choose to invest in ERP.

The overall benefits of using ERP include also influencing the firm structure to become one organization, change management processes so that there is a firm-wide knowledge based management process, unified technology platform, and enhancing business capabilities. An organization might want to get more unified organizational culture in which everyone uses similar processes and information. ERP can also help improving management reporting and decision making, as it could supply better data about business processes and organizational performance. As a single, integrated repository with data about all key business processes, standardized definitions and formats accepted by the entire organization, ERP promises a unified information system technology platform. In addition, enterprise systems enables organizations for example efficiently respond to customer requests and forecast new products. (Murthy, 2008)

If successful in choosing a proper ERP system, an organization will be able to enjoy the benefits of a flexible package. It has been recognized for long that organizations really have a need for flexibility in information systems. A proper ERP system can be changed and configured to a company's specific requests, which is important in today's business when new challenges are faced all the time. (Lv & Chen, 2010) All in all, ERP systems have the potential to enhance organizations' operational and business performance, which is a key reason why so many enterprises have decided to adopt ERP (Zamiri, et al., 2010). ERP system can help an organization, if successful, to reduce operating costs, generate more accurate forecasts of demand, decrease production lifecycle times, and enhance customer satisfaction. This way ERP system can enable an organization to reach millions of dollars of savings annually. (Lv & Chen, 2010)

The advantages installed ERP can offer are both direct and indirect. The direct advantages described earlier are something we can more or less easily measure and claim to exist because of the ERP. Indirect advantages, such as increasing customer satisfaction and improving corporate image, are a bit more difficult, since it is not so clear to show that they are the result of ERP installation. The benefits can also be tangible or intangible; whether advantages can be seen or are hidden. Measuring the intangible benefits is quite hard. (Murthy, 2008)

2.1.2 *Is it possible to cope without ERP?*

Even though ERP system implementation creates high hopes for organizations, not all ERP projects are success stories (Lv & Chen, 2010). On the contrary, there have been, throughout the years, quite a lot of problems with introducing new ERP systems, and the success has not been on the same level as was expected beforehand (Zamiri, et al., 2010). The challenges of ERP implementation are gathered to table 1.

In addition to investing a lot of money, ERP implementation requires a lot of time and effort from the people working within the organization. As organizations wish ERP solutions to unify the firm-wide business processes, working methods, and data, they also need to come up with the organization-wide definitions for these or perhaps completely redesign fundamental business processes. They need to retrain a number of workers and at the same time carry on business as usual. As it is possible to end up with a flexible ERP solution, ERP software are complex and most likely the end result is quite inflexible. (Murthy, 2008)

When adopting new software solutions, organizations have a common problem with gaps, or misfits, between the functionalities offered by the software and those required by the adapting organization. ERP solutions have also this problem. Organizations need to make a choice whether to customize the ERP package, live with the shortage, or adapt to the new functionalities. These misfits may occur in data, functional and output dimensions. (Soh, et al., 2000) As ERP is a fully integrated one system, making changes in only one part will not be effective enough without making changes in other parts as well (Murthy, 2008). Due to all this, organizations should take ERP complexity and inflexibility issues into account and select the kind of ERP system that provides the highest match to functional requirements (Lv & Chen, 2010). In addition to this, a wide gap between the expectations the end-users have for the system and the actual functionality the ERP provides support for is one of the major problems ERP deployment has. These system requirements should be identified as soon as possible in the deployment phase, otherwise the distance between business requirements and system's functionality will keep on increasing throughout the project. However, a number of different stake-

holders are always involved within ERP deployment. This naturally means that having different roles, each stakeholder can have an opinion of their own about the system requirements, which can create contradictions between stakeholder expectations and requirements. Zamiri (2010) identifies in his research that even though the end-users, the staff in the organization, are the ones who interact with the system on a daily basis, they do not have power and authority in the organization. He claims that ERP consultants and development and selection teams of all stakeholders have the main responsibility for the ERP system implementation success. (Zamiri, et al., 2010)

Companies aim to make profit, and money is always somehow behind any strategic decision. With ERP implementation managers in organizations look forward to decreasing organizational costs and enhancing their business processes. ERP's expected ROI (return of investment) has a significant impact on the ERP system selection. However, ERP's ROI remains quite a mystery to various organizations, and many people believe that ERP system actually does not add any value to a company. Implementing the system requires quite large investment and ERP project success should be measured in the business benefits gained. Many organizations may not have proper methods to do this. One major problem with ERP system implementation lies in the fact that the system itself is expensive to *buy* and to *implement*, and there are also additional costs with training, consultant and evaluation. (Lv & Chen, 2010)

Table 1: Summary of ERP implementation benefits and challenges.

ERP benefits	ERP implementation challenges
Unified structure, "one organization"	ERP software are complex, most likely end result is quite inflexible
Firm wide knowledge-based management process	Requiring huge investments: a lot of money, time and effort, also hidden costs
Unified technology platform	Need to retrain workers and simultaneously carry on business as usual
Improving management reporting and decision making	Gaps and misfits between functionalities supported by the ERP and required by the adopting organization
Providing better data about business processes and organizational performance	Organizations need to choose: pay more and customize the ERP, live with the shortage, or adapt to new functionalities
Customization, possibility to be changed according to organization's requests	Possibility to completely redesign fundamental business processes
Reducing operating costs	Need to come up with organization wide definitions for data, business processes, and working methods
Decreasing production lifecycle times	Differences between system requirements of various stakeholders
Generating more accurate forecasts of demand	Assessing ERP investment's ROI and value added to the organization is difficult
Reaching significant savings	Employees' and end users' negative attitude towards change and new ERP system

2.1.3 *ERP implementation risk factors*

Throughout the entire ERP system lifecycle there are multiple risks and threats that can be faced. These risk factors should be identified and managed so that they can be avoided or their influences can be minimized. Probably the six most common ERP project risk factors are involved with issues regarding control and plan, requirements, team, environment, user, and complexity. The most critical factors that are threatening ERP implementation success include unclear goals, lack of ERP usage in organization processes, lack of organizational changes, end-users don't have the proper attitude towards using ERP, lack of knowledge about ERP projects, and having difficulties with integrating ERP with other IT systems. (Fakhar, et al., 2013)

Reasons for ERP project failure can vary a lot. Murthy (2008) introduces a group of four cases with their reasons for success and most of all failures of ERP. Being poorly prepared for the major change in organization's key internal business systems, and not expecting such extensive business disruptions caused by the ERP implementation were found to be core reasons for ERP project failure with a multinational company. They also tried to do the implementation of new system company-wide, which did not go well. After using various ERP systems and investing and losing a lot of money, the company tried yet another system with phased implementation (one department at a time), finding better results than with the previous projects. Another company wanted to automate some parts of their manufacturing, distribution and financial information processes. They faced resistance of business changes, as the employees did not understand bad performance that was tried to be fixed with ERP. End user training fell short, as well, and the IT department underestimated the new system's power and requirements. The problems occurred were tried to solve and cover. Even though succeeding more or less in this, over running schedules with the ERP made the company miss important or even crucial seasons for their business. In a case where a company reaching success with ERP implementation, it had been made sure that internal business processes were in tune with the software's capabilities. Technology was not seen as a silver bullet hoping to solve all problems, but as a part of a larger whole. Also making use of (vendor's) consulting services were found to be helpful to reach success with ERP. (Murthy, 2008)

Poor requirement modeling can have crucial consequences regarding ERP deployment success, and ERP deployment requirement management alone needs to face many challenges. Zamiri et al. (2010) have listed these ERP deployment risk factors within requirement management, indicating that gathering ERP system requirements is quite a difficult task. ERP systems are general software packages that support a wide range of business models. The system requirements need to be identified in the early stages of the project in order to not let the gap between expectations and system functionality grow too wide, as there are often misfits between supported ERP functionalities and

business requirements. Inadequate documentation of business processes and business plan can lead to incorrect requirements. If the view of the future regarding for example customization is unclear, it might end up in shortages in maintainability requirement identifications and complexity in change. On top of all this, as there are many stakeholders, there are differences in the stakeholders' opinions as well, and the general feature of ERP systems creates difficulty of managing customer, country and industry specific requirements. (Zamiri, et al., 2010)

2.2 What to consider when looking for a best-fitting solution?

ROI and what kind of financial expectations organizations have for the ERP system play a major role when trying to find a best ERP solution. Since the investment is so huge, organizations should carefully think about how different alternatives could help them to reach their goals set for ERP implementation. In addition, the solution that a company ends up with should have the highest match to organization's functional requirements, i.e. the new system needs to fit with current business processes. (Lv & Chen, 2010)

As Zamiri et al. (2010) indicate in their paper, ERP deployment requirement management alone faces many difficult challenges. Managing requirements properly is crucial for project success, so the importance of proper requirement specification and modeling need to be acknowledged. They provide a framework that can be used as a tool to address the misfits between business requirements and system functionalities, and thus ease the ERP deployment. The framework divides stakeholders into categories such as decision-makers, managers, end users, and ERP consultants. The division takes into account the significance and authority of the stakeholder group, and based on these factors the stakeholders are positioned on the framework. The framework also represents the stakeholders' requirements for ERP functionality in different views of the requirements. (Zamiri, et al., 2010)

Due to organizations limitations in human resources there is often need for external ERP consulting with ERP implementation. Professional opinions and pieces of advice could definitely come in handy when trying to find the best-fitting solution. External expertise can also be a big help in customizing and implementing the vendor-supplied systems, and possibly save the organization from costly problems. Of course, it is important to find the right consultants in order to reach the wanted benefits. (Lv & Chen, 2010)

Tsai et al. (2009) have studied the relationships between ERP selection criteria and ERP success, and found out that some software selection criteria are linked to ERP success. The criteria were divided into categories. According to their study, higher software

quality is related to ERP's ease of integration with other systems, ERPs with a complete mechanism of internal auditing, and ERPs that have the capacity of integrating different platforms and data. Higher system quality is relative to the integrity of the model framework, ease of maintain, providing best practices, ease of use, consultant's suggestion, real-time online inquiries and reporting functions, and the rate of return in this investment. Maintainability results in selecting a software providing several successful examples, flexibility in adjusting demands according to business requirements, and with a test-passed high stability system. (Tsai, et al., 2009)

The ERP system has to have proper functionality to cover business requirements, and the technical architecture needs to support and go together with existing applications. Also the service and support level the vendor provides needs to meet customer requirements. In the end, the chosen ERP system and the development project planned around it needs to have the ability to be executed. When doing cost analysis, costs should be treated as total costs of ownership, not only buying the ERP but other costs added, as well (buying, implementing, maintenance, hidden costs such as hardware, etc.). (Avram, 2010)

The final ERP solution should have the proper flexibility to fulfill the organization's needs. Information systems flexibility is a true recognized need in various organizations, and a proper ERP system can be changed and configured to company's specific requests. While organizations need system flexibility, complexity, on the other hand, is another matter. ERP systems are very complex, which exposes the software implementation to risks. With complexity ERPs can offer more options for the system end-users, but it also increases the interaction, coordination and communication, needed between clients and vendors. There is a possibility that the more complex the new ERP system is, the more workers and system users have to put in time to learn new sets of processes of doing their everyday work tasks. Also vendor profile should have an effect on the ERP system solution. This can affect the ERP training costs and transiting from old processes to new ones. Since each vendor has their strengths and weaknesses, vendor profile would be good to take into account in order to minimize the implementation complexity. (Lv & Chen, 2010)

3 INFORMATION SYSTEMS INTEGRATION

There are many kinds of information systems used by all kinds of organizations, and the categorization of these systems can be made in various ways. Information systems can be divided, for example, into operations support systems (OSS) and management support systems (MSS). OSS collect, process and store data generated by the operations systems of an organization. They then produce data and information that can be used as input for management information systems. Different types of OSS include transaction processing, enterprise collaboration, and process control systems. MSS, in turn, aim to provide information and support for the management in order to reach more effective decision-making. Management support systems include management information systems, decision support systems, and executive information systems. In addition to these classifications, information systems can be categorized also into expert, knowledge management, strategic information, business information, and integrated information systems. (Murthy, 2008) Some examples of these are described more detailed in the following chapter.

Organizations have various separate information systems that they use in their everyday business. Usually these information systems are developed and implemented on different platforms and have different systems for data management, as well. This contributes to a situation where the right information can be difficult to get easily and on time. In order to avoid possible shortcomings in information systems interaction, and to fulfil new business process efficiency requirements organizations might end up in integrating their information systems into one. (Tomicic-Pupek, et al., 2012) Integration solutions are to fulfil broader business goals related to e-business, supply chain management, customer relationship management, and B2B commerce (Lam, 2004).

In systems integration (SI), components are after development integrated and tested in the deployment environment. A simplified process of systems integration can be modeled with the traditional waterfall model. The phases include defining requirements and design with stakeholder specifications, validation testing, and verification testing. In validation testing it is questioned whether the right things were built, as verification testing questions whether they were built right. In the waterfall model the process starts from the top and moves towards the bottom step by step, instead of being a circular, continuous process. (Madni & Sievers, 2014) Lam (2004) describes a lifecycle model for enterprise integration projects including four main phases: strategy, planning, implementation, and rollout. On each phase there are activities of three different types: business activities, technical activities, and organizational activities. In strategy phase CTO or similar establishes the business vision with support from business stakeholders. In the planning phase program managers translate the strategy into defined work programs, define the project scope, and identify and mobilize resources. In implementation

phase project managers, architects and developers execute the integration project. Finally, the integration solution is rolled out into live environment. (Lam, 2004) Systems integration can also happen in different forms. Vertical integration refers to a situation where a single organization or joint organizations have multiple acquisition programs, and components of systems from these are integrated to produce desired capability. Horizontal integration means systems developed by different acquisition programs, for different customers and purposes, are brought together to create a new capability. (Madni & Sievers, 2014)

Systems integration projects also face multiple challenges. Integrating information systems aims to form a coherent whole from component subsystems in order to create capability that satisfies the varying needs of several stakeholders. The key goal of information systems integration is to ensure that semantic and syntactic interfaces between component elements of the system perform as specified by contracts between these elements. Different information systems need to satisfy a wide range of requirements such as reliability, security and resilience that make information systems integration even more complicated. A major SI failure factor is poor specification modeling, for example incomplete, inconsistent, or misunderstood specifications, and thus the failure occurs at application's interface.

As with information systems in general, SI faces also the challenge of complexity. (Madni & Sievers, 2014) The scale of integration can be a challenge, as organizations can have hundreds or even thousands of various kinds of IT applications. The more there are applications, the more knowledge and understanding of these applications, not to mention effort, is required. The integration solutions and technologies used need to answer and support the organizations' needs for real-time response and information. In addition, standalone design is a challenge where IT systems were first designed to be standalone and are now required to be integrated. Technologies are also heterogeneous i.e. developed at different periods by different people, on different platforms with different technologies. Also organizations are heterogeneous, which especially in merger and acquisition scenarios create challenges. Poor documentation of IT systems makes it more difficult to understand the internal design of systems potentially affecting the integration outcomes. Individual IT systems can have syntactic and semantic differences in the way they interpret data. This can be a challenge, as data needs to be not only transferred from one application to another but also in a way others can consume it. Interfaces might have limitations regarding for example use of programming languages. Individual applications might also use their own, application-specific, security models; architecture-wide security model would be needed in case of integration. Sometimes legacy IT systems that use outdated and even unsupported technology need to be integrated as well. The limitations of this legacy technology need to be understood in order to find

out how well it can be made to interact with other more modern technologies. (Lam, 2004)

3.1 Different types of information systems

The categorization of information systems help to conceptualize the integration effort. Next a selection of various information systems are introduced in order to demonstrate how many different categories of IS there are. Figure 3 demonstrates the classification of information systems.

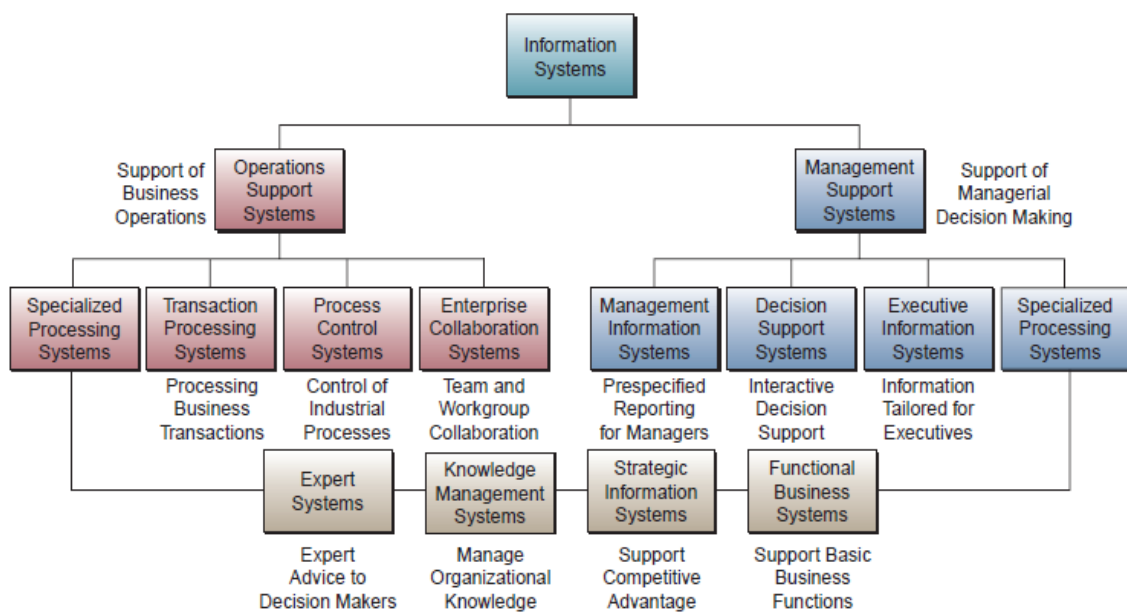


Figure 3: Classification of Information Systems (O'Brien & Marakas, 2009, pp. 13).

Operations and management support systems

IS can be divided, for example, into operations support systems (OSS) and management support systems (MSS). OSS are for both internal and external use and collect, process and store data generated by the operations systems of an organization. (O'Brien & Marakas, 2009) They then produce data and information that can be used as input for management information systems (Murthy, 2008). Operations support systems process business transaction, control industrial processes, support enterprise communications and collaborations, and update corporate database (O'Brien & Marakas, 2009). MSS, in turn, aim to provide information and support for the management in order to reach more

effective decision-making. Management support systems include management information systems, decision support systems, and executive information systems. In addition to these classifications, information systems can be categorized also into expert, knowledge management, strategic information, business information, and integrated information systems. (Murthy, 2008) (O'Brien & Marakas, 2009)

Transaction processing systems

TPS are included in the group of operation support systems. They record and process data from business transactions. Transactions can be processed in two basic ways: accumulated over a certain period of time and processed periodically, or data can be processed immediately after the transaction occurs. TPS are to support day-to-day operations. (Murthy, 2008) (O'Brien & Marakas, 2009)

Enterprise collaboration systems or office automation systems

ECS or OAS enhance teamwork and group communications and productivity. Taking advantage of tools such as email and electronic meetings or video conferences are examples of these kinds of systems. The idea is to reduce the time and effort needed to produce, access and receive business communications among individuals, working groups and organizations. (Murthy, 2008; O'Brien & Marakas, 2009)

Management information systems

MIS belong to the group of management support systems, and transform data into useful information. They provide this information as pre-specified reports and displays to managers and other professionals to support business decision making. MIS can be seen as a network of communication channels and information processing centres that collect information which is then stored, updated and processed, and supplied to various users for managing the organization. MIS can be used in various business functions such as production, marketing and finance. (Murthy, 2008; O'Brien & Marakas, 2009)

Decision support systems

DSS are management support systems that provide interactive data and support for decision-making processes of managers and other business professionals (O'Brien & Marakas, 2009). The need for DSS can be irregular, as it might not always support an ongoing process and can be used to solve particular problems on an ad hoc processing basis. Some characteristics of DSS include: fast response to unexpected situations that

result in changed inputs; ability to support the solution of complex problems; constructed to support one time decisions; and DSSs are typically designed for one particular decision-maker or a group of decision-makers. (Murthy, 2008)

Executive information systems

EIS (or executive support systems ESS) are management support systems to provide critical information for executives. The information is tailored from many different internal and external sources based on the executives' needs combining features of DSS and information reporting systems. These systems provide information and analysis for example about business performance, competitors' actions, and economic development. (Murthy, 2008; O'Brien & Marakas, 2009)

Knowledge management systems

KMS are computer based information systems for creating, managing, organising and sharing different forms of business information created within an organization. The system includes libraries for project management and enterprise documents, discussion database, and other types of knowledge bases. (Murthy, 2008; O'Brien & Marakas, 2009)

Strategic information systems and strategy level information systems

SIS are information systems that provide competitive products and services that give an organization the strategic advantage over its competitors in the market (Murthy, 2008). I.e. strategic information systems apply IT to help an organization gain competitive advantage with their products, services or business processes (O'Brien & Marakas, 2009). In addition SIS promote business information, improve business processes, and build strategic information resources for organizations. Strategic information systems locate and show ways to achieve competitive advantage of using information systems. They encourage the integration of existing and future information systems to minimize and eliminate information inconsistencies and inefficient use of IS resources. (Murthy, 2008)

Integrated information systems

IIS refers to a system that is integrated as combinations of various different types of information systems. The roles of different IS are integrated into one cross-functional information system that thus provides a range of various functions. (Murthy, 2008)

3.2 Enterprise Application Integration

There are different types of enterprise integration projects. Enterprise Application Integration (EAI) is integration of IT systems within the organization aiming to improve business efficiency and real-time information processing. Other types of enterprise integration include B2B integration, B2C integration, and web integration. (Lam, 2004) Enterprise Application Integration is about integrating enterprise applications to form a coherent information system. Defining the concept of EAI can be difficult, but for example Manouvier and Menard (2010) define EAI as “a collection of methods, tools, and services that work together to bring heterogeneous applications into communication, as part of the traditional, distributed or extended enterprise”. (Manouvier & Menard, 2010, pp. 23)

Exchange of information between applications in information system is in the core of EAI, as it deals with the domain of business applications in integration, for example ERP integration (Manouvier & Menard, 2010). EAI is based on the idea that integration between external and internal information systems brings value to the organization, and information sharing increases the value and quality of information. Organizations that wish to improve their productivity and reduce costs can find EAI to be the solution to answer this need. EAI, however, is a huge project for an organization and requires support from the very top to the very bottom of the organization. (Zhigang & Huiping, 2009)

Enterprise application integration focuses specifically on working on communication between applications that are not homogenous, and deals with how can be assured that heterogeneous applications, developed by different people with different technologies at different periods, communicate. Different types of applications include batch applications, transactional applications, client/server applications, web applications, and real-time applications. Software packages exhibit characteristics of one type or another, or even a sum of these characteristics. Software packages have generally improved their connectivity over the past years which increases the capacity to connect software packages to the rest of the system. (Manouvier & Menard, 2010)

Gleghorn (2005) lists four technical operations in data integration, also displayed in figure 4. Extraction process produces data to fit target application's needs. Data is sent in a format that can be packaged for transportation, for example ASCII or XML text file. After that is transportation process which needs to meet at least four responsibilities which are security, reliable communications, completeness, and logging and archiving. Then data from source application needs to be formatted in order to suit the target applications' structure. The transformation process has two steps: first mapping (creating a map to identify relationships between incoming data and target application) and then transformation (using the map to convert incoming data file into correct format). Final-

ly, insertion process validates the new data to meet target application's rules, handles workflow operations, and finally inserts the data.

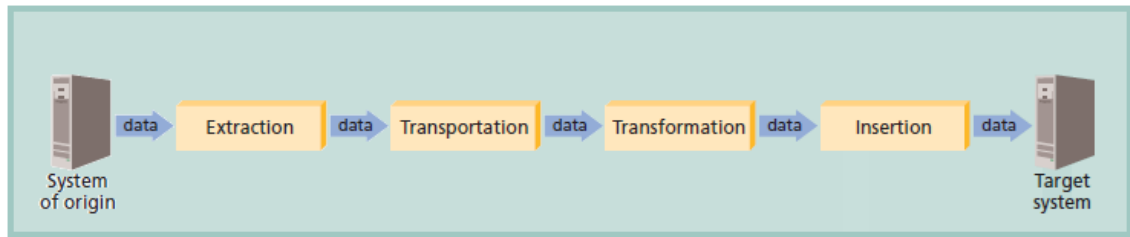


Figure 4: Basic integration operations (Gleghorn, 2005, pp. 19).

According to Zhigang and Huiping (2009) EAI strategy has five separate main components. First one is the integration principle, saying EAI should follow a principle of “unified planning, step-by-step implementation”. The principle is to be looked at the overall perspective of operations and strategy, having reasonable goals and an overall plan. Second component is implementation strategy. There needs to be defined the organizational changes needed for IS strategy of an organization to be successful, when it will be implemented and by whom. These should be taken into account in planning and making decisions, so that for example those to implement the strategy should be involved in its formulation. Third strategy component is enterprise innovation management: EAI is a chance to reach new business development and innovations. Fourth component emphasizes utilizing advanced technology in enterprise application management to reach the wanted goals and potential benefits. Fifth and final component is about the importance of understanding the business processes: which business processes need to be improved and how. Defining the current state and weaknesses of business processes help to define the target-stage. (Zhigang & Huiping, 2009)

There are a several factors identified that influence EAI adoption according to Reiersgaard et al. (2005). First one is external pressure that is created by the environment for example competitors, suppliers or clients. Second factor is internal motivation that can be strategic, technical, operational, financial, managerial or organizational. Existing IT infrastructure in the organization may inhibit the management's accurate decision-making. The acceptance that is needed to get the project going can be affected also by the benefits that people expect to gain from EAI adoption, as well as the barriers and costs of EAI project. Fifth factor influencing EAI adoption is IT sophistication and technical expertise of integration technologies in the organization. Final factors include supports and evaluation frameworks which are used to evaluate integration technologies

and assess EAI packages, and thus used as decision-making tools. (Reiersgaard, et al., 2005)

Naturally also EAI faces challenges and can end up in failure. For example Manouvier and Menard (2010) state that even having the best integration technology, most competent teams and architects cannot automatically guarantee achieving the initial goals set for IT and integration. (Manouvier & Menard, 2010) There are especially some technical system risks that EAI has to deal with. Especially accountability and security is one key risk, and data transmissions must be logged and archived so that they can be audited and secured. Incomplete, unreliable or invalid data, as the system needs to validate the received data to make sure they meet set requirements, and failures must be detected. Operational risks, for system breakdowns might not be obvious straight away, and integration process should be monitored in case something goes wrong in the operations because the process is pretty much automated. Project delays, for project parties must agree on various details of implementation which might lead to delays. (Gleghorn, 2005) In addition, need for staff training is an issue Reiersgaard et al. (2005) noticed that may apply for not only ERP adoption but possibly also EAI implementation. This can be due to need for replacing legacy systems, triggering similar problems than with ERP implementations such as lack of proper end user training. However, this is not necessarily the case with every EAI implementation, as research also shows that EAI can integrate systems without need for replacing them. (Reiersgaard, et al., 2005)

3.3 An alternative for traditional ERP

Looking at the pros and cons of ERP implementation, it can be seen that there are various issues hindering deeper application of traditional ERP. Could the balance of costs and benefits of ERP be turned into more favorable? In this section it is explored and justified why study new approaches to traditional ERP. Also some other suggestions to develop the concept of ERP are studied. Based on these fundamentals, a new approach to ERPs is introduced.

3.3.1 *ERP's need to change*

Organizations, business processes, competition, and customers among others have changed and developed over time (Lörincz, 2007). For example, the nature of work has changed and keeps changing. Work is becoming more peer oriented, distributed and interactive. Organizations are decentralizing their decision-making, and using new technologies. Work is becoming more modular, mobile, linked across time and distance by

technology. New working trends emerging from the use of participative technologies reflect major changes in how business is done, also to the structure of workforce. (Quam, 2010) Joroff et al. (2003) suggested already in the early 2000's that agile workplaces represent an important next step in the evolution of workplace.

Agile methods evolved already in the 1990's and have since started to gain popularity especially within software development. Agile principles emphasize practices improving transfer of knowledge and know-how. Organizations have started using agile, light and fast methods in their business. Competitive environment changes fast, and so does also customer needs. Organizations aim to lower costs and shorten product development lifecycles while providing high quality and performance of products. Organizations want and also need to manage processes effectively and efficiently. Agile methods response to changing environment, enhanced customer collaboration, and better innovation capabilities. (Tervonen, et al., 2014) All in all, organizations need operational agility to deal with the competitive pressure, high uncertainty, and changing work practices. That means that organizations seek to have the ability to respond quickly and effectively to fast changes and uncertainty. (Joroff, et al., 2003)

Customer demand and competition are affecting the business so that planning and scheduling become more challenged and complex. Several factors increase this complexity in organizations, including customers demanding for even shorter project cycle times, mass product and service customization, globalization of operations, outsourcing operations, and implementing CSM (Customer Service Management) and SCM (Supply Chain Management) systems. These same factors affect the customers' requirements and needs for the ERP systems they use, and create pressure for ERP projects. Even though organizations, business processes, competition, customers and many more factors have developed and faced changes over the years, ERP systems have changed only little since the late 1970's. This been said, ERP systems only execute the same logic as back in the days with just faster and in real-time. (Lörincz, 2007)

Not long ago the alignment of work and space was considered innovative, as nowadays the alignment of work, space, and IT is somewhat a practical necessity for organizations (Joroff, et al., 2003). The business - IT alignment in addition to business agility and speed to market are one of the top IT management concerns (Aarnink & Kruithof, 2012). Other main challenges organizations are facing are growing competition, deregulation, globalization, compliance requirements, merger and acquisition activities, and outsourcing coupled with supply chain structures. The business model and supportive IT system within an organization need to be compatible with these challenges. (Lörincz, 2007)

3.3.2 *The idea has been out there for a while already*

For example, Møller (2005), Johansson (2011), Al-Ghofaili and Al-Mashari (2014) and many more have studied new kinds of approaches to ERP. Møller (2005) claims that we need to consider the adaption of new technology, since ERP has become a pervasive and contemporary technology, the ERP market has matured, and the dominant ERP strategy is still single vendor strategy. As time goes on and organizations develop further, also business requirements change. This indicates that additionally ERP systems need to change and answer to these new requirements. (Møller, 2005)

Johansson (2011) studies the concept of ERP from the viewpoint of synchronization of ERP systems and business processes. Adopting ERP usually demands that either the system is being adjusted according to the existing business processes or the other way round. However, organizations' business processes in addition to technology used evolve and develop continuously. Thus organizations need to have high agility of business processes and IT technology used in order to respond quickly changing market conditions. Organizations also need synchronization which means that the organization's business processes and supporting technology evolve so that when either changes the other adjusts to the change. New ERP development approach Johansson (2011) studies is Microsoft's approach where ERP development is role-based i.e. persona-based. Microsoft describes it as the future, as ERP system builds highly on personas which help to understand for whom the product or functionality is developed. Microsoft personas are gathered and built from many interviews and observations of end-users, and presented to developers in many different ways. This new approach is to help the synchronization of ERP systems and business processes. (Johansson, 2011)

Al-Ghofaili and Al-Mashari (2014) and Johansson et al. (2015) in turn study cloud-based ERP systems which are hosted ERPs on cloud server. There are basically two kinds in the market: ERP on SaaS (Software as a Service) and ERP on IaaS (Interface as a Service). (Al-Ghofaili & Al-Mashari, 2014) Cloud-Based ERP has emerged from the success of cloud computing. The ERP market is moving to a cloud environment, pushing traditional ERP providers to develop their services into cloud based solutions. They have studied whether cloud-based ERP could be a viable option for organizations in all sizes, and results suggest that SMEs are the most suitable to adopt cloud ERP. In addition to security issues, cloud-based ERP can be less customizable than traditional ERP, which make cloud-based ERP a poorer alternative for large organizations. Hybrid ERPs that combine traditional and cloud ERP systems, however, were identified as a very suitable option for large organizations. (Johansson, et al., 2015)

The concept of ERP II has been introduced already in the early 2000's. A major factor for moving onto ERP II is the e-business challenge. ERP II concept can be defined as "business strategy and a set of industry-domain-specific application that build cus-

customer and shareholder value by enabling and optimizing enterprise and inter-enterprise, collaborative-operational and financial processes". (Bond, et al., 2000, pp. 1) Møller (2005) says that major vendors have already more or less adopted ERP II concept, either partly or fully. He introduces a conceptual framework for ERP II (figure 5). ERP II is a non-disruptive technology, an extension of ERP. Internet contributes to ERP II as it is web based, open and componentized. In the framework there are four layers which are elaborated on in the following: the foundation layer with core components; the process layer with central component; the analytical layer with corporate components; and the e-business (portal) layer with collaborative components. (Møller, 2005)

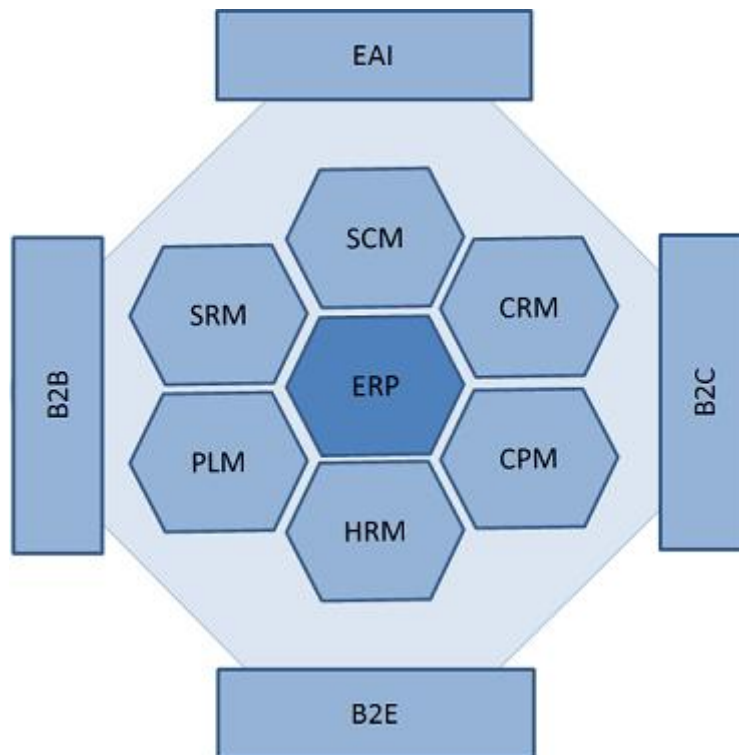


Figure 5: The conceptual framework of ERP II. (Møller, 2005, pp. 490)

The foundation layer is the core component of ERP II and basic architecture. A few of its core elements are integrated database and application framework. The process layer is the central component of ERP II, reflecting the transaction-based systems. The ultimate ERP II concept can be implemented as a set of distributed services. In the framework, ERP is the central component. Traditional ERP modules (e.g. HR, sales and financials) are still the backbone of ERP with additional modules like project or quality management. The analytical layer includes the corporate components that improve and supplement central ERP functions, but are not necessarily synchronized with the inte-

grated database. Supply chain management (SCM) systems support the planning and production of goods. Customer relationship management (CRM) systems are to manage various functions including customer identification process and customer service management. Supplier relationship management (SRM) is vendor side of CRM, managing supplier base and supplier relations. Product lifecycle management (PLM) is to enhance organizations in bringing their innovative and profitable products to markets. Employee lifecycle management (ELM) integrates and manages all aspects of information related to an employee starting from hiring to retirement from the organization. Corporate performance management (CPM) describes the methodologies, metrics, processes and systems used to monitor and manage the business performance of an organization. The final layer, portal layer, is where collaborative components deal with communications and integration between the ERP II system and external actors. In the framework, business to consumer (B2C) deals with commercial sales transactions with customers. Business to business (B2B) is the procurement side, and business to employee (B2E) is the employees' portal to the organization. Enterprise application integration (EAI) provides the ERP II system with a platform for integration with other systems both inside and outside the organization. (Møller, 2005)

3.3.3 *Next generation's ERP*

Organizations have been using various kinds computer-based of information systems since 1960's. Many organizations already using multiple information systems to support their business functions and external challenges wish to give up using many and move onto using only one - an ERP system. Reason why organizations might want to give up multiple information systems is that they do not communicate and interoperate with each other. Developing and implementing new information systems, even integrating them, has been known for a long time already. (Tomicic-Pupek, et al., 2012) Even though ERP systems have in general been seen as the mean to reach variable business goals, during the 2000's EAI has grown to an alternative for this (Reiersgaard, et al., 2005). However, integrating existing information systems into one interoperable system is not as common, because there may be lack of proper methods for integrating existing information systems and thus can be a challenge to many IT service providers. (Tomicic-Pupek, et al., 2012)

As demonstrated above, the concept of traditional ERP has not evolved (Lörincz, 2007) alongside with changes within nature of work (Quam, 2010), customers, markets, and business processes (Lörincz, 2007), and new approaches to ERP have been developed and studied for a while now.

There are multiple obstacles between ERP implementation and success with ERP. ERP system requires a lot of money, not to mention other costs on top of that. Additionally lack of proper knowledge of ERP systems can be fatal, and employees need to be trained to use new system while performing their usual work tasks. There can also be misfits with organization's requirements and supported ERP functionalities, and companies might need to redesign their business processes, in addition to dealing with the stakeholders and requirement management (Zamiri, et al., 2010). Also people's negative attitude towards change and new ERP system is an obstacle. Thus ERP implementation might not become a successful one, and companies ought to analyze whether adopting new ERP is worth it. (Murthy, 2008) Therefore, the issue with information systems outside ERP not communicating and interoperating with each other could be changed by integrating the already existing information systems so that they exchange data and offer new views to their users (Tomicic-Pupek, et al., 2012).

If the success of ERP system and thus the overall ERP project is considered to be more or less in the hands of the end users, their attitudes towards the project and end product are those that make-or-break the investment (Murthy, 2008). Defining and modeling general system requirements is difficult due to various opinions all addressed to the same system (Zamiri, et al., 2010). ERP functionalities might not answer the company's needs and in addition require business process re-engineering (Murthy, 2008). From these we can make a series of potential conclusions regarding a situation when an organization ends up not adopting new ERP.

- Since the employees are already familiar with the current systems they are using, there are no major system changes to object.
- Each departments' and business functions' requirements do not need to be combined and fitted together to be fulfilled by one system.
- Business processes do not need to be redesigned to fit the huge and complex ERP system, as new systems are 'renovated'.
- In addition, even though buying system integration services are not for free, an organization does not need to buy and implement complete systems from a service provider.

So, instead of purchasing and implementing a complex ERP system the organization could integrate their information systems into one or to interact more efficiently; that is the next generation's ERP. However, in their research in the early 2000's, Reiersgaard et al. (2005) found more similarities than differences between ERP implementation literature and EAI implementation case they studied. For example, the need for staff training may apply for EAI implementations as well due to possible need for replacing legacy systems. (Reiersgaard, et al., 2005) This indicates that the topic and hypothesis of EAI's superiority over traditional ERP implementation, or vice versa, need to be examined more.

4 RESEARCH METHODOLOGY

This chapter describes the research methodology that has been used in the empirical study. Topics such as research scope, data collection, and data analysis are introduced.

The concept of enterprise application integrations was researched with a set of semi structured interviews, listed in Appendix 1. The interviews took place in Turku and Helsinki during autumn 2015, and the interviewees answered questions regarding EAI. The meaning of the interviews was to study integration solutions and their characteristics in order to find out how EAI implementation works in practice and could EAI have the potential to be a major IT solution now and in the future.

All together five interviews were carried out with IT experts with different kinds of backgrounds and experiences within the field of IT. The interviewees were picked by the author's supervisor's recommendations and background search done in the Internet. As criteria for the interviewees to be chosen they needed to have experience in working with integration solutions and proper knowledge of integration characteristics. Respondents represent five different sized IT and consulting companies operating in Finland, alphabetically: AgentIT Finland Ltd., Integration House Ltd., PricewaterhouseCoopers Ltd., Sofokus, and W3 Group Ltd. Altogether the five interviewees have 92 years of experience (figure 6) in working within the field of IT. They have had the chances to take part in projects in all shapes and sizes with customers from quite small organizations to major organizations. All of the respondents have their educational background in computer science or information systems science.

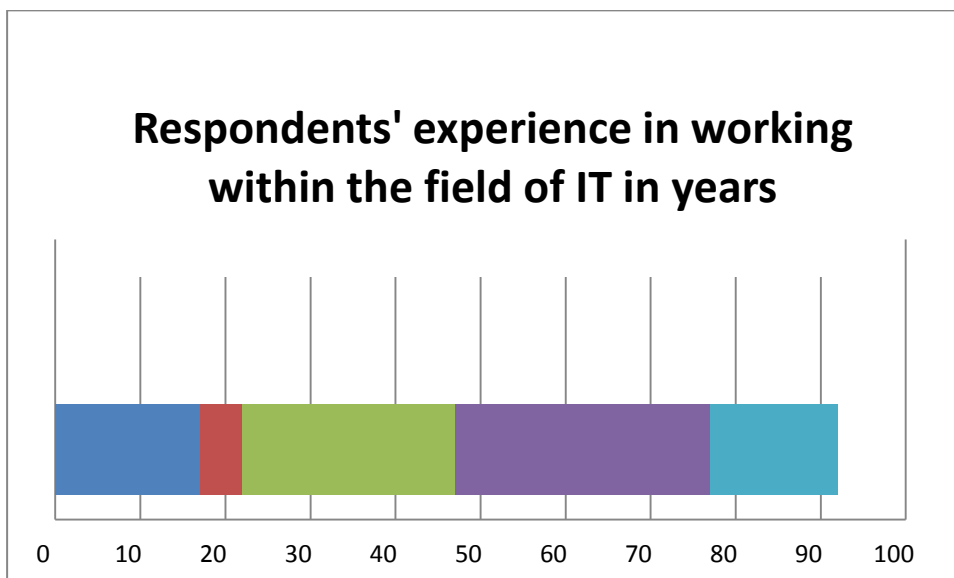


Figure 6: Interviewees' experience in IT.

Sharan (2014) introduces a few definitions to qualitative research. According to them, qualitative research studies things in their natural environments and settings, and interprets phenomena. It is more about discovering meanings, not frequency. Merriam (2014, pp. 13) summarizes the definition of qualitative research by saying that “qualitative researchers are interested in understanding the meaning people have constructed, that is, how people make sense of their world and the experiences they have in the world”. Four main characteristics of qualitative research include focusing on process, understanding, and meaning; the researcher is the primary tool in collecting and analyzing data; research process is inductive; and the end product is descriptive. Quantitative research in turn focuses on quantity (how much, how many), is predetermined and structured, has large sample sizes, and findings are precise and numerical. (Merriam, 2014)

When determining the concept of interview, Eriksson and Kovalainen (2008) explain that interviews are built on talk that is organized into a set of questions and answers. Usually it goes on so that the interviewer asks questions first and interviewees provide their answers second, but in addition can include everyday conversations. Eriksson and Kovalainen list different types of qualitative interviews, and determine guided and semi-structured interviews to have a predetermined outline of topics, issues, or themes, and can have both “what” and “how” type of questions. The wording and order of questions are though possible to be changed in each interview. Questions can be open or closed, meaning how wide or narrow answers the interviewee can provide, and open questions encourage more speech. (Eriksson & Kovalainen, 2008)

Out of the five interviews four were performed as face to face interviews and one interview was carried out via telephone. Interviews always took place at the interviewees’ office spaces or conference rooms, excluding the phone call interview case. Each interview session took time a bit more than one hour. In each case there were no time limiting factors, and there was no rush in completing the interview situations. This enabled never having to leave any questions out from the interview, and made sure the respondents could provide as comprehensive and long answers they wish.

All of the interviewees were offered the same set of open questions (see Appendix 1) without pre-given response options. Some questions included providing a value between 1 and 5 to provide a clearer understanding of the scale of the answers. The interviews had three main themes according to which the questions were categorized. The author noticed that a certain order for questions and themes suited the interview situations the best, as starting with the EAI benefits, moving onto limiting factors, and ending with risks and problems allowed the respondents to warm up to the topic via starting by introducing themselves and focusing on the concept selling side. During the interviews the main themes were emphasized and especially the client’s perspective to EAI projects. The interviewees were encouraged to share real life examples to their responds. At

the end of the interview the interviewees were given a paper with a list of twenty features (see Appendix 2) and they were asked to assess on a scale from 1 to 5 how well the given features apply to EAI projects. Only with the case of telephone interview the interviewee was offered with the twenty feature list before the actual interview happened.

During the interviews author made written notes to document the interviewee's answers. Also recording of interviews was planned to take advantage of, but due to technical problems that did not succeed. After completing each individual interview the author went through the notes and transcribed the responds. Once all the interviews were completed and transcribed, each respondent's answers were compared to others' for each question. From the responds author searched for similarities and disagreements, also what kind of issues did the respondents point out that no-one else mentioned. Because the questions did not cover issues that have specific right or wrong answers such as exact values, and the provided answers were clear, there was no need to contact the interviewees afterwards and ask for additional information or verification for some issues.

5 ENTERPRISE APPLICATION INTEGRATION PROJECTS IN PRACTICE

In the following chapter and sub-chapters the results of five separate interview cases done during October and November 2015 are examined. Finally the interview results are analyzed and reflected to the ideas introduced in theory section. Respondents are from five different sized IT and consulting companies operating in Finland, alphabetically: AgentIT Finland Ltd., Integration House Ltd., PricewaterhouseCoopers Ltd., Sofokus, and W3 Group Ltd. The order in which the respondents are introduced next is not according to the alphabetical list, but according to the order in which the interviews were done.

The first interviewee has a lot of experience in working within the IT field and around 17 years of experience with various information systems. For the past 8-9 years the respondent has worked with integrations, business area where the respondent ended up more or less by chance. The respondent sees integrations as a vast concept: from the technical point of view integrations are communication between various systems, on the other hand integrations are about business processes. The first respondent emphasizes cost efficiency, and works mostly with open source solutions. Customer orientation is important.

Second interviewee works in a software house as COO. The respondent has a Master of Science degree from a school of economics majoring in information system sciences. The respondent ended up in the field of IT via interest for computers and IT solutions in their free time. During the university studies the respondent made contacts one being their current boss. The respondent's current role at the company is within project management and the respondent sees oneself as the one whose job is to remove obstacles in the projects. This means working with documentation, the current situation in the client organizations, finding out the risks, and looking at the system interfaces.

Third respondent started studying information systems sciences already at the end of the 80's. He has worked in the IT field for decades and has a lot of experience working with big organizations as client. The company he is representing currently was founded in the early 2000's and they provide consulting services for information systems integrations.

The fourth respondent has studied information systems science, accounting, and finance in a school of economics. For many years the respondent worked as CIO for a big Finnish company operating in industrial products and services business area, and has also experience in working as information management consultant for a global IT company. The respondent is now working as CIO for their current company, too. The respondent has used their knowledge of both IT and financials during their entire career history.

Fifth respondent has completed a Master of Science degree from a university, majoring in computer sciences. 15 years of experience working within the IT field and various IT projects, nowadays mainly with integration projects. The respondent wants to emphasize that there are various kinds of integrations with various different technologies, and every integration case is unique and different to others.

In figure 7 the results of the small survey are introduced. In the survey the five interviewees were given a list of twenty features (see Appendix 2) and asked to assess on a scale from one to five (not at all to very much) how well they apply to EAI projects. Based on the given answers the average value for each feature has been calculated, and is shown on the figure. The features are reordered from the highest value (apply to EAI projects the most) to the lowest value (apply to EAI projects the least).

The features gathered to the list of twenty features were originally taken from table 1 where ERP advantages and disadvantages are summarized. The idea of this small survey is to compare EAI and ERP features and characteristics. From figure 7 we can see that reducing operating costs and improving management reporting and decision-making have got the highest values, both on average over 4 out of 5, meaning that the respondents assess these features to apply to EAI projects from quite much to very much. At the end of the list there is software complexity and end result inflexibility with value 2,4 out of 5 which means it is assessed to apply very little or somewhat to EAI projects. Also when comparing figure 7's results to table 1, it can be seen that according to the respondents, seven out of ten ERP benefits are located in the top ten of the list, and five out of ten ERP challenges were considered to apply to EAI only a little or somewhat. Looking at figure 7, it can be seen that the positives of traditional ERP apply to EAI quite extensively but the downsides not as much.

How well do these claims apply to EAI projects?

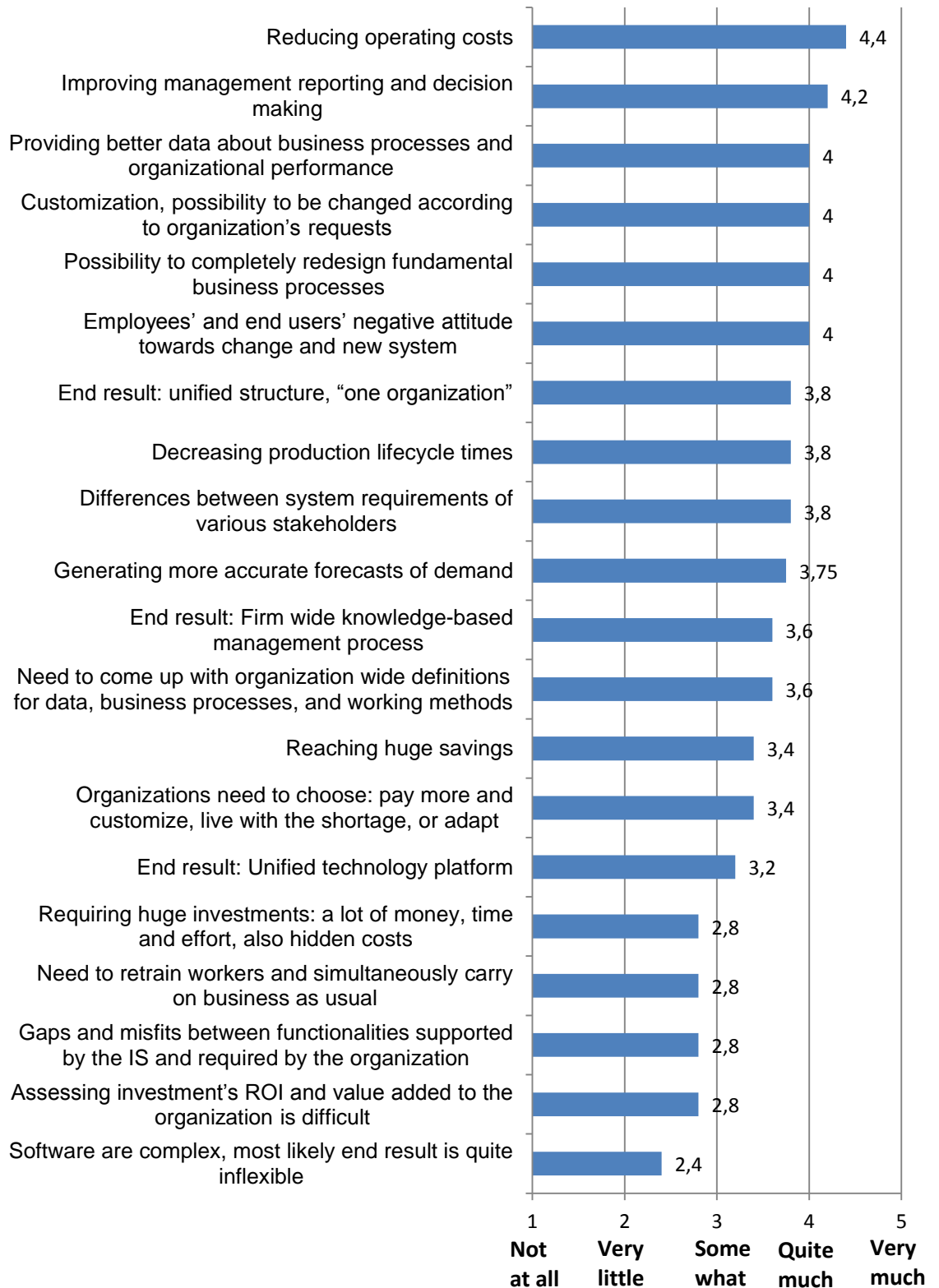


Figure 7: EAI features.

5.1 The benefits of EAI implementation

Two of the respondents said that investing in information system integrations is a necessity for any business operating today. Nowadays every information system within an organization needs to be connected to each other, it is self-evident. Of course it is very dependent on the customer and their situation (for example legal aspects and limitations) what kinds of benefits and on which scale can be reached. Cost efficiency and cost benefit are the two major EAI benefits. Respondent #1 claims that ROI is usually quite easy to assess in EAI cases, and say they can sometimes promise their customers that to six months. Automation of processes was a feature every respondent mentioned as EAI benefit, and it is seen to be often a reason why companies invest in integration solutions. Decreasing manual work and enabling tasks to be done in bunches instead of individually, for example billing. Many of the respondents feel like various manual working processes can often be eased and reduced. Respondent #1 said that they have had a client case where they succeeded in shortening a 7 phased manual work into just two phases. EAI enables automation of business processes and data transfer between several information systems. At the background as prime factors there are pleasing customers and enhancing their (user) experiences. One main goal of EAI that was mentioned is to minimize data and that the data would be centralized to fewer and fewer places. Additionally data migration cases, moving important data from one IS to another, are done a lot. Decentralization of data was found to be problematic for system maintenance.

Getting rid of vendor lock is also a benefit the respondent #1 mentioned for EAI, and on the other hand often the reason why a customer ends up choosing EAI. It is quite common that the customer organization has earlier acquired an expensive information system which requires expensive user licenses (worst case even a thousand of euros per user), the system has been customized with a huge amount of money, and the maintenance and system updating is expensive, too. Sometimes the customer might have a really old system in use, so old that there has been no support for it for years. To these situations EAI aims to bring an improvement. The basic idea is to come up with a smart solution with integration so that for example using expensive user licenses could be avoided or minimized. As digitalization and having everything in electric form are so common these days, it means that also integrations are more and more common. Respondent #5 said that today it makes no sense to end up implementing one major system, as building wholes from smaller pieces is definitely a smarter choice. All in all, EAI solutions are implemented to enhance business processes and fasten the communication between information systems within an organization. The aim of EAI is to enhance the customer's business and help to gain revenue and business benefits. Respond-

ent #2 really emphasizes the enhancing various things and processes within an organization.

Respondents #1, #4 and #5 point out that the objectives and hopes customers have for EAI vary a lot: sometimes the objectives are smaller and clearer thus simpler, while sometimes the EAI objectives are included in a big package of project goals. Customers' hopes and objectives are often seen to be related to some single need, and have mostly something to do with process automation. Usually the customers want to transfer data from one system to another in and combine information systems order to make their work easier. Respondents #2 and #3 mention that usually the clients do not ask for integrations directly, as they approach the vendor with a hope of their current information systems communicating better or have other wishes and objectives. Many customers might not also understand the complexity if EAIs. Sometimes the client can have unrealistic expectations and naive thoughts about integrations and their potential, as they do not really know anything about their current information systems and what can or cannot be done with them. In cases like this, the vendor just needs to be professional and take control, and sort out the facts to the client. Generally speaking customers have a problem they hope to be solved. These kinds of problems include dissatisfaction or changes in the organization. Customers reach for satisfaction when they are not happy with the current vendor or product or service, and they want to get rid of it. This drives the customers to look for new potential solutions. Sometimes also organizational changes, mergers and acquisitions lead to EAI. In principle, the customer wishes and goals are always met according to the respondents; they may not always reach perfection, but the customer wishes are generally always met. Respondent #5 feels like the objectives are met more likely in cases with clear objectives; the more concrete goals the easier they are to achieve, but if the goals are just some sort of visions without any concrete content, they can be really hard to meet.

If everything is done properly, EAI solutions can be really flexible. However, some integration solutions such as point-to-point integrations provide a result that is quite inflexible. Respondent #5 even said that integration flexibility is a marketing term used to sell integration solutions. The end result can be really flexible if the starting point is good and job is done properly, but flexibility does not always apply. It is a matter of what kinds of information systems and enterprise applications are integrated in addition to project size. In some cases the overall integration goal might even conflict with solution flexibility, for example if the customer wants to store the same data in various locations and be able to update the data via multiple sources. The flexibility of an EAI is pretty much dependent on the information system interface. The flexibility of the EAI solution is tied to the current information systems and how well the interoperability will work at the end. Usually the amount clients are willing to invest in the project and thus

the chosen integration solution influence the end result's flexibility. The respondents say that EAI can be really flexible, but it is not in any case.

System interoperability (see figure 8) is seen to be in the core of EAI and the way to reach the most important EAI benefits. Especially technical solutions aim for good interoperability. Interoperability is usually the goal and true meaning of EAI. If the case is viable and can be done, enhanced system interoperability is a huge EAI benefit. In general the interoperability can enhance a lot, but it depends on the information systems that are integrated; what the customers are looking for and what technologies are used to reach the goal. Respondent #4 said that pretty much everything is possible and thus it is difficult to give a universal response. System interoperability is in the background for starting EAI projects. Respondent #5 also feels that system interoperability does not always improve automatically due to EAI, but if the job is done well then it can enhance quite a lot.

As a single most important EAI benefit the respondents mention a variety of features:

- enhancing processes for example via automation, removing overlaps, and simplifying data management
- productivity, as it is important to do the right things the right way
- speeding up the messaging and communication within the organization and information systems
- supporting business processes and enabling business process automation
- data integrity and enhancing the customer experience
- finding solutions that bring value to the customer's business, enabling the customer to focus on their core business functions better and more efficiently.

When asked example situations where EAI solution would be superior to others (such as getting a completely new set of systems or continuing with old ones as they are), the responses vary only a little. Integrations can enhance business processes and old systems a lot, but it really depends on the situation which alternative is the best to reach the wanted goal. Respondent #2 said that their clients often ponder whether to continue with the old systems they have and have some sort of integration or build a completely new system. The big question in this is do the clients want to continue with the old system. If the old system is beginning to run out of power but people still like to use the old system, and getting a new system would be really expensive, or if an organization has multiple information systems and they wish to change one or more of them, EAI is a necessity. If the customer is happy with the old system wholeness they already have, and have a good vendor relationship, and EAI can bring them more and/ or new benefits and value. However, sometimes integration is the wrong way. Respondent #2 feels that in most cases from the technical aspect it would be best to give up using the old system and build a new one, but of course this solution is more expensive. So it pretty much comes down to the balance costs and benefits with the integration solution ver-

sus new IS package. Respondent #4 even assesses that in many cases EAI is not superior but more of a necessity, as operating without EAIs is no longer a viable option. Respondent #4 also points out that having big one-piece wholeness is almost always worse than having a set of smaller and focused, specialized systems and applications.

All of the respondents assesses that integration solutions are becoming more and more common and the amount will keep on growing. Some even believe that it is even inevitable that organizations take advantage of integration solutions which explains the frequency. A reason for EAI frequency is a change in people's attitudes and habits, as people will no longer want to have huge "mammoth" solutions but smaller and more agile solutions. If information and data does not flow between systems and is thus restored separately in various locations, it is really difficult to manage and maintain the data. Digitalization is nowadays included in every organization's business strategies, which at the latest creates need for integration solutions. EAIs are so common because they are needed in order for systems to communicate. All of the respondents assesses that nowadays integration solutions are quite common; almost every case they are working on have integrations involved in them. All of the respondents also feel like integration solutions will become more and more common in the future and will become some sort of a trend, even. This is because the customers will no longer want to invest in huge information system packages that are closed, technologies are changing and companies using older technology will be updating their IT. The benefits of EAI based on the interviews are summarized in table 2.

5.2 Requirements and limitations

Respondents assess that the limiting factors for EAI projects are mostly tied to technical factors. These are for example if the current information systems simply cannot be integrated because the systems are closed or there is no interface. Respondent #2 mentioned also some issues with the contract, if the client expects the vendor to take responsibility of a whole which would include responsibilities of some third parties as well. In addition to technical aspects, respondent #3 said limiting factors are related to customers' attitudes and expectations. For example if the customer wants a certain kind of solution but the relationship between price and cost-benefit is not good enough, there is no point of executing the integration. Speaking on Finland's level, respondent #3 feels like there are eventually quite little vendors and service providers. Many customers have ended up in vendor lock as they have first bought a solution that turned out to be bad but then they are still stuck with it. Thus one major limiting factor for EAIs can be simply the lack of service providers and professionals, the supply of skilled experts. If there are not enough people to actually realize integrations, they are much harder to do. Also the lack

of knowledge is limiting EAI projects; the customers might not necessarily know that things could be done in a smarter way and with a faster schedule by EAI solution. Respondent #5 feels like the way of doing things, corporate culture is the main limitation for EAI projects. Making things unnecessary difficult and not having proper communications are issues hindering the project's progress. Respondent #4 said it is a matter of how important IT is to the organization's business; is the role of IT critical or supportive. They list money, time, skills and IT knowledge, as well as information security as potential limiting factors for EAI cases.

The size of a client's organization naturally changes the field of the EAI project, but it is not a limiting factor; more like an additional challenge. All respondents point out that usually with bigger customer organizations the projects are also bigger and thus more complex, there are various vendors and a lot of bureaucracy. In a bigger organization there are more stakeholders and thereby a lot of different kinds of views, visions and opinions. Respondent #1 mentioned their work being in addition to integrating enterprise applications also occasionally "integrating people". This basically means that people who barely know each other from different sides of the organization with totally different habits and ways of doing work, are brought together and tried to fit in the same patterns. Respondent #2 feels like the organization size affects also the customer's attitude towards the severity of the project: the bigger the client organization the more money they are willing to invest and the more realistic expectations they have. A bigger organization might have its own IT department and thus more knowledge of IT, and also clearer processes for their work. On the other hand bigger organizations mean dealing with more bureaucracy which can make the work really stiff. Respondent #4 feels like there are both pros and cons of each organization sizes in EAI implementation. Smaller organizations might not have the resources, whereas larger organizations usually face bigger challenges with EAI implementations. In the end, organizational size is not a limiting factor, but it can slow down the project's progress. The most important factor in EAIs in big organizations is to take the size into account. If this is done, the size should not be an issue. The vendor just needs to be prepared well in order to deal with organizations in all sizes.

Also the organizational culture can slow down the project, but that either is not a limiting factor for EAI implementation: it can truly spice up an EAI project according to the respondents. Compared to organization size, respondent #2 feels like organizational culture affects EAI projects more. Especially conservative organizational culture can hinder the work. These kinds of situations are when the customer would like to do the project following a waterfall project lifecycle model, even though the vendor is strict in only using agile methods. Especially industries and branches and organizations where the people working are older, the attitude might easily be so that the old way of doing things is seen as the only way of doing. Resistance to change might come from wrong

parties (for example working people versus management) and in case the decision-maker cannot handle the situation, it is possible that the project cannot proceed. This kind of situation has happened to respondent #1 for example when the customer organization had planned to reduce staff, which made the employees unwilling to give up knowledge and information in order to protect their worth and thus jobs.

Thus the organizational culture can thus truly bring up challenges and obstacles to EAI projects. However, the goal of integrations is to ease and reduce work; not necessarily jobs but pointless execution of work. Respondent #1 feels that there is generally resistance to change when it comes to IT projects, but sometimes it is also negative attitude especially towards integrations. Organizational culture can affect EAI implementations mostly in form support, or lack of it, for the project. If the organizational attitude is towards any kind of change and the integration project, it makes the project really hard. It can also come down to decision-making and how fast or slow the process is. All in all, organization size and culture are not limiting factors for EAI but can slow down the project. It is often the case that data and information acquisition is difficult in bigger organizations. Also communication can be stiff within larger companies. If the key people are not available for the EAI for example due to other simultaneous projects, it right away has an influence on the EAI implementation, as well.

All the respondents except respondent #1 feel that it is possible that EAI requires BPR from the customer. It is dependent of the solution the customer is looking for, BPR can be included in the project objectives, for example if the goal includes also completely new information systems, and removing and simplifying business processes automatically requires BPR. When it comes to business - IT alignment and which one follows the other, respondent #2 said that usually the end result is some kind of a compromise. Respondent #5 said that in theory IT should support the business processes, but in practice it might end up so that IT determines too big of a piece of the organization's operations and processes. Respondent #1 said their starting point is that business processes should not adapt to information systems, but the other way around; integrations are done to support and enable the usage and operations of business processes. It can also be seen so that EAI itself will not require BPR from the customer, but it is more the new way of doing things the customer wants that will drive to redesigning business processes. Respondent #4 sees this the other way around; EAI can enable BPR for the customer organization. The main idea is to enhance business processes, as IT should never determine or define the business. IT not supporting business operations and processes is a really bad starting point, sums up respondent number four.

All of the respondents say that EAI always means some sort of change to the customer organization, which means that of course sometimes they might need change management, too. For example, change management is required if the customer wants to radically change some business processes. Integration itself does not require change

or change management; if change is what the customer wants to get, then integrations are to enable this. Respondent #2 assesses that there is always some sort of resistance for change within the client organization, but it does not really show to the vendor. Usually someone from the client organization, e.g. a manager, needs to sell the project to the rest of the organization. Respondent #5 wants to remind that only rarely nothing changes after EAI implementation, and always something new is created. As a result of changing business processes some jobs are lost which requires change management. However, respondent #1 assesses that EAIs do not really require a lot of change management. The processes and projects overall are quite see-through and even though some changes are needed, they are only small. Respondent #1 summarizes their thoughts: "If the realization of an integration requires big changes, it should not be done".

Figure 8 summarizes how big of investments are EAI implementations based on four investment categories according to the values given by interviewees. The respondents assessed the investment sizes on a general level and in relation to other types of IS projects. How big monetary investments EAI projects are depends a lot of the situation, what size of integration is in question, and how each person understands by big or small investment. One sees hundred, other thousand and third person hundred thousand as a small amount of money; it is all very relative. Respondent #3 said that in their projects the size of the investment in money is determined by three factors: the number of integrations required in the project, telecommunications protocols, and the price of the integration product license itself. However if the customer is willing to put more money on the integration tool license, it can ease the project and thus lower other costs. Respondent #2 feels that integrations can be as valuable as any other IT projects when measured in money, as respondent #1 feels that in general information system integration is a rather small investment, and in numbers we are talking about a few thousand euros. Three out of five respondents point out that with many IT projects time and money are tied together as they are charged by the hours. Usually the information system integrations take around a couple of weeks, but sometimes it could take even months. If the project is really big and there is a lot of data to be handled and processed, it affects the project scheduling. On the other hand, simple integrations can be done within one or two days. Respondent #3 assesses that EAIs require time from both the vendor and also the customer. Especially knowledge transfer and data distribution takes time. All in all it depends on the situation; is the vendor and/ or the client familiar with the tools and methods the EAI implementation in question requires. It is possible to deliver within weeks, but it could also take months.

Regarding human resources, three respondents on average assess EAIs to be somewhere between quite small and neither big or small investments. From both the client and the vendor EAI requires at least one core person to be available and who can always

be contacted if there is anything. Respondent #1 said that from the vendor's side EAIs don't require that much human resources even when the projects are really short, as very often it is only one person or a few people doing the work. From the customer is it required commitment and good decision-making in order to proceed with the project, but only one, two or three people from the customer's side take part in the EAI project. Even though the integration project would require only one person from the client's side to be invested in, this one person will most likely be very busy with the EAI project. Respondent #3 said that this is very much dependent on the customer and the selected integration solution how much human resources and their attention is needed. It could require only a little human resources, but big solutions concerning the entire customer organization is another thing. On the other hand, it is not expected that the customer really does a lot, as it is more a matter of vendor being able to reach out the customer representative if necessary. When talking about investing in EAI as in effort, it is based on the project scope and type of the selected integration solution; it is very much dependent on the size of the EAI implementation. If the starting point for the project is good, meaning there is enough and proper documentation available in addition to somewhat modern information systems, the project requires only a little effort. However, usually the case is that the current information systems are old and no one really knows them which automatically influences the amount of effort required. From the customer it is not required to give much effort, as one respondent said the purpose is that they as vendor take care of all work related to the project. Vendor even offers to take part and attend some so called additional events at the customer's in order to promote the project and minimize customer effort. As a vendor and service provider, the respondent said they are really interested in projects that are challenging which more or less automatically requires more effort and work from them.

Two of the five respondents feel like these resources EAI implementations require are too difficult to assess on a general level, as they are too much dependent on the prevailing situation. Time, money, effort and human resources are all tied together and thus each one affects the others. However, if the project is executed as a part of a longer term partnership, respondent number four assesses that it makes the EAI easier and lower the resources required. Always the size of the integration project determines the scale for money and time, and thus human resources and effort. Integration projects can take anything from one week to several months, assesses respondent number five.

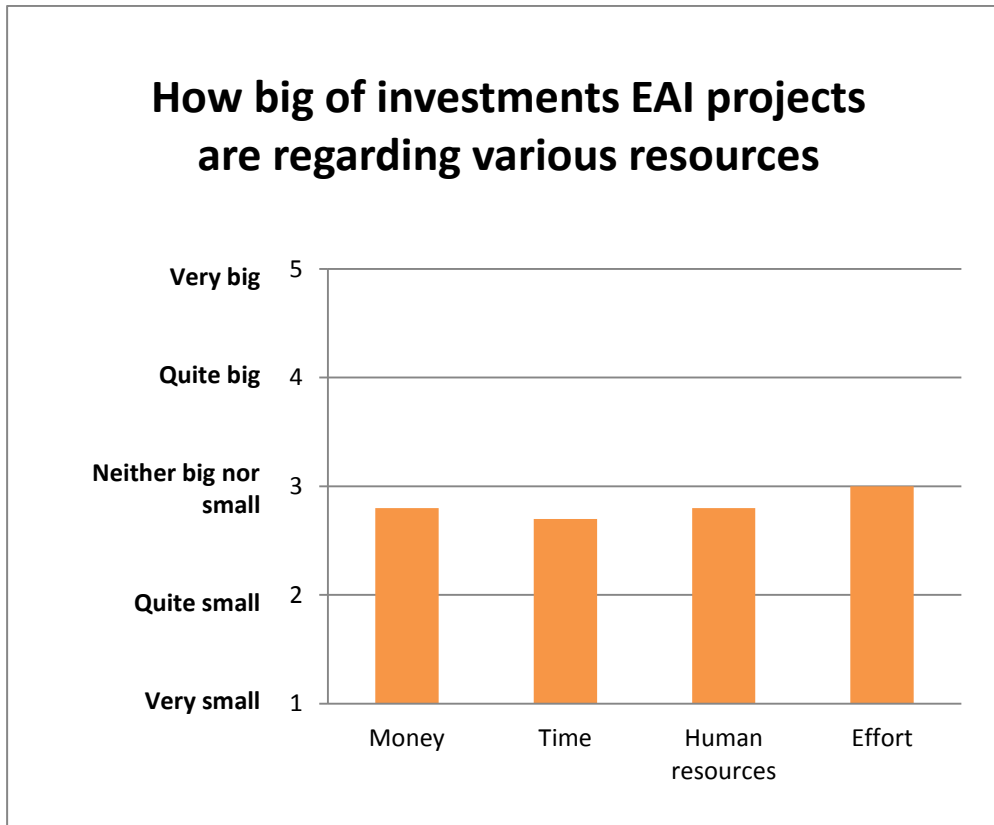


Figure 8: Investing money, time, human resources, and effort in EAI.

Respondent #1 said EAIs fit absolutely all kinds of organizations. A good integration complements and supplements information systems and business processes. Respondent #4 said that EAI does suit all kinds of organizations, or that it is not even a matter of suiting, as they are needed everywhere, simultaneously wondering if there even is any organization where there are no integrations done. Others are not as straightforwardly sure about EAI fitting all types of organizations. It is a matter of the customer's needs whether integration is the best solution. Not always the customer acknowledges that they want and need integration to solve the problem they have. The starting point and objectives determine whether EAI fits the situation. Respondent #3 feels that in general EAIs do suit all kinds of organizations but on the other hand the industry and branch in which the customer is doing business can have a huge effect. If there is only very little or nothing to be integrated, then obviously EAI does not bring any benefits. Generally it depends on the information systems in question. If there is no need for EAI, then there is no point of executing it. Also, if EAI execution is difficult and expensive, it might be better to move onto new system package instead of continuing with old IS. The current information systems have crucial role in EAI projects. The current information systems define the palette with which work and proceed in the project, and the true project requirements and limitations come from there. Current information systems form the basis of the organization's current business, too.

5.3 Problems in EAI projects

When discussing the most common risk factors that threaten EAI implementation, three main points stand out: technical issues, project management issues, and people issues. Technical risks and limitations are seen as a major risk factor, but usually they are analyzed and taken care of beforehand, and thus technical limitations should not become a surprise in the middle of the project and execution. Technical competence and having enough time for testing are really important in order to succeed with the EAI. Also biting more than one can chew might be fatal for the project; several respondents say that assessing required time and work wrong (too small) is a common risk with EAIs as with many other IT projects. Not having the proper skills and knowledge, wrong attitude, wrong methods, and not intervening and paying attention to errors are issues that endanger the whole project. Respondent #2 feels like the client does not always really understand what can and cannot be done and integrated, and they might not know what they want to achieve with the project. They do not understand the requirements of an integration solution, want too complex and/or expensive products or executions, or there is some serious lack of documentation for current information systems. This not having enough knowledge and understanding of the current information systems and business processes forms a risk for EAI implementations. Lack of comprehensive documentation, or if there is some documentation available and it does not represent the reality, is a risk for the EAI. With only little modeling and descriptions of the interfaces it is difficult for the vendors to provide any kind of cost estimation to the clients, which is definitely not a good starting point for a project and can also mean that the project will not even be started in the end. Respondent #5 even said that a common EAI implementation risk factor is “doing a lot of nothing”, where the customers might have big visions for EAI but there is no actual idea or proper planning for the project. The respondent #5 also added that each IS needs to have a clear role and integrations are to support the information systems.

Respondent #2 assesses that pretty much in every case there is a third party involved in the integration project. This emphasizes the importance and meaning of proper communication and knowledge transfer. One major thing that can and has gone wrong is providing an estimate of how much work a certain task or project will take, and then the planned approach does not fit for the situation after all. Also lack of proper specification is a project risk for the vendor. Having unwelcome surprises for example with telecommunications can postpone the project by weeks. Also projects not having clear specifications or system responsibilities are things that have affected EAI implementations negatively, or if data is stored and updated in various locations, data synchronization is difficult and can create problems. All in all, if the groundwork has been done badly, it has jeopardized the project outcome. Also the client's employees' negative atti-

tude and fear towards change have sometimes jeopardized knowledge transfer processes and thus the entire integration. Sometimes only single errors have managed to go through to execution, and that has affected the progress and final outcome. By doing things the right way, and with good planning and good groundwork, with proper documentation and good project management practices, the risks of EAI project can be prevented.

All of the respondents agree that EAI implementation can create new problems with the system usage. With proper planning the answer would be 'no', but what happens in reality and in practice can always deviate from the planned. If the project goals include issues for example regarding handling data, it might harm the end users' user experience and make system usage somewhat more difficult. These problems can happen if something goes wrong and there are problems in the implementation phase, so that for example important data does not transfer where it is needed. Respondent #4 mentioned that integrations are as strong as their weakest parts, which means that any vulnerability creates problems. If there is something wrong with the input, it means that the output will also be wrong automatically. It is also good for the customer to understand the information flows and project influence. For example dealing with delicate, secret, or classified information and data is something that is good to take into consideration with EAIs. Respondent #2 also mentioned that it is possible to get new kinds of problems after system integration, but it is a matter of who needs to face those problems. For example the vendor might need to "take a hit" sometimes if there are issues regarding the system maintenance and there are multiple vendors involved. All in all, the meaning of EAI is to add a new functionality or a completely new system to the whole which always means that there is something new as a project result and new kinds of problems can rise.

The respondents generally assess that it is not likely that customer's current information systems will not interoperate properly after EAI implementation. Respondent #2 said that these things are always specified beforehand because the service provider needs specific information about the systems in order to sign the contract with the client. So, as a background check the vendor determines what are the possibilities for system interoperability with the client's current information systems. Respondent #1 assesses that with their experience the integration professionals can well identify the project starting point. This enables a situation where the work is not even started if it looks like the current information systems seem bad, for example that they are almost impossible to get any data out: if the preliminary work results do not look good enough, the project is not done. However, respondent #5 mentioned that in many cases there are multiple vendors involved and the current information systems are usually quite old, so that they are not that easy to integrate. This is why one assesses that it is quite likely that current IS interoperability will not work properly. All in all the possibility for this is

seen to be really small; in theory current information systems need to get working properly together.

Generally speaking all of the respondents believe that nowadays it is quite or even very common to stretch budgets and schedules in EAI projects, as it is seen to be very common in the entire IT industry, especially if the project starting point is over optimistic and/ or the project has been over sold to the customer. Also reaching a proper level of agreement and understanding between stakeholders is crucial for sticking within budgets and the given schedules. Four out of five respondents also assess that budget and schedule overruns are not that common within the companies they are representing. For example by their own behalf a few respondents assesses the frequency to be not that common, and generally speaking quite or very common. Reason for the difference is that they aim to be realistic in their estimations and they might offer their client a price cap so that the client knows the maximum amount of money they need to pay for the project. With a lot of experience the service providers already have quite a good understanding what kinds of budgets and schedules an EAI project requires. The customer, on the other hand, might not always have this understanding. The company which one of the respondent works for provides other IT services in addition to just integration solutions, and sometimes the project can have multiple phases in addition to the integration. Respondent #2 said that if there is some schedule overrun in the project it is with the integration phase. All in all, there are so many influencing factors with the client's information systems and if there are any surprises, it can create huge challenges for the implementation as searching for further information takes time. For example if the service provider wants to use agile methods, the current IS architecture needs to support it and enable that kind of work. Usually overrunning schedules means that the service provider has to pay a penalty or similar, so staying on track and sticking to the schedule is important on that aspect, as well.

The practical benefits and challenges of EAI implementation based on the interviews are listed in table 2. Features introduced in figure 7 are also taken into account in this table in addition to the answers the respondents have given during the interviews. To compare EAI to ERP, see table 1 introduced in page 15 where the benefits and challenges of traditional ERP are summarized. A major difference between tables 1 and 2 is that table 1 is based on prior literature whereas table 2 is based on the five interviews.

Table 2: Summary of EAI implementation benefits and challenges in practice based on the interviews.

EAI benefits	EAI challenges
Cost efficiency, cost benefit	Customers' current information systems determine the EAI project foundation
Automation of processes, decreasing manual work	Customers' current information systems are usually quite old, not modern
Easy to assess ROI	Budget and schedule overruns
Getting rid of vendor lock	Technical issues: current IS need to be possible to be integrated with other systems
Enhance business processes	Integrations are as strong as their weakest parts
Fasten or enable the communication between information systems within an organization	Need to have comprehensive documentation of interfaces
Improving management reporting and decision-making	Employees' and end users' negative attitude towards change and new system
Providing better data about business processes and organizational performance	Customer needs to have enough knowledge and understanding of the current IS and business processes
Customizable, possibility to be changed according to organization's requests	Differences between system requirements of various stakeholders
Enables BPR and changes in the organization	Having multiple parties involved can e.g. create difficulties in sharing and transferring knowledge, and be time consuming
Relatively small investment	Can create new problems with old system usage
Fits all kinds of organizations	

5.4 Research findings

By looking at the responds and interview results we can see that they are in line with the research literature introduced in previous chapters. Next the interview results are analysed and compared with theory of previous literature. In the final sub-chapter the next generation's ERP framework is introduced and explained how it is created by the result findings.

5.4.1 Analyzing the interview results

All of the respondents feel like integrations are quite common solutions nowadays and will become even more common in the future. Some even understand enterprise application integrations as a necessity for any organization as they are vital in order to do business at full speed. This supports the ideas of Lörincz (2007) and Quam (2010) claiming that ways of working and doing business have changed dramatically within the past decades. Most respondents also mention agile methods as being part of today's dominating trends. Quam (2010) for example list work becoming more peer oriented, distributed and interactive nowadays. Organizations are decentralizing their decision-making, and using new technologies. Work is more modular, mobile, linked across time and distance by technology. Researchers even believe that new working trends emerging from the use of participative technologies reflect major changes in how business is done, also to the structure of workforce.

Increasing value and enhancing information's quality stood out during the interview sessions as important EAI benefits. For example Zhigang and Huiping (2009) support this, too, saying EAI's main idea is to via integrating information systems bring value to the organization, and sharing information increases the value and quality of the information. Thus EAI is a way to reach for improving productivity and reducing costs. As Manouvier and Menard (2010) state, enterprise application integration focuses specifically on working on communication between applications that are not homogenous, and deals with how we can make sure that heterogeneous applications, developed by different people with different technologies at different times, communicate. This stood out from the interviews as the core feature of EAI projects; a vital benefit that is in the background as a motivating factor when starting an EAI project. Working with information systems provided by multiple vendors was identified to have a huge influence on EAI implementation. Additionally Reiersgaard et al. (2005) identify factors affecting EAI adoption. External pressure, internal motivation, existing IT infrastructure in the organization, and comparing the benefits that are expected to gain from EAI adoption and the barriers and costs of EAI project affect the acceptance that is needed to get the project going. IT sophistication and technical expertise of integration technologies in the organization matter, too. Reflecting these factors listed by Reiersgaard et al. (2005) we can see clear similarities with the interview results that include the organization's attitude that was even referred to as level of seriousness towards the project, pressure from the markets to do something and reach for additional value and business benefits, necessity of integration solutions nowadays, state of current information systems and the organization's satisfaction with them, balancing between EAI project costs and benefits, in addition to technical knowledge and understanding within the organization. During the interview sessions the respondents pointed out that generally every EAI pro-

ject brings along something new to the customer organization. Possibility of business process re-engineering was seen as a positive feature of EAI; it enables development of business processes, it enables change. This claim is supported by for example Zhigang and Huiping's (2009) claim that EAI is a chance to reach new business development and innovations. Within the concept of traditional ERP, business process re-engineering is usually considered as a negative issue; the terms of the change and BPR come from the IS, not from the organization (Murthy, 2008).

Zhigang and Huiping (2009) point out that EAI is a huge project for an organization and requires support from the very top to the very bottom of the organization, and the interviews also support this claim. Organizational culture needs to be supportive for the EAI project in order for the work to progress smoothly. Additionally they emphasize the importance of understanding the business processes: which business processes need to be improved and how, as defining the current state and weaknesses of business processes help to define the target-stage. Most of the respondents mentioned these same issues to be important in EAI projects.

The interview results also show that EAI projects face various challenges, problems and risks, as for instance Manouvier and Menard (2010) claim, too. Even the best technology, most competent teams and architects cannot automatically ensure good quality and achieving the planned goals. For example, Gleghorn (2005) lists some technical risks of EAI, including lost or miss-sent data, accountability and security, incomplete, unreliable or invalid data. In addition to these, the interviews pointed out the importance of the current information systems' interfaces. Additionally, need for staff training is an issue Reiersgaard et al. (2005) noticed that may apply for not only ERP adoption but possibly also EAI implementation. However, this is not necessarily the case with every EAI implementation, as research also shows that EAI can integrate systems without need for replacing them. Interview sessions and especially results of table 2 show that need to retraining staff applies to EAI projects a little or somewhat. As mentioned, also EAI brings along some sort of change to the customer organization and sometimes the business goals set for EAI project include such issues that automatically influence the need for staff training.

Based on the interviews, end users' negative attitude towards change was noticed to be more relevant in EAI cases where the project is planned to enable bigger organizational changes. Generally organizational culture was found to slow down EAI implementations, but was agreed not to be a limiting or excluding factor for the project. Even though EAI is "only" integrating current information systems to communicate better, EAI projects might still need to balance between various requirements of various stakeholders regarding what all data and how it should flow between the information systems. Solution flexibility is an end result that is quite likely achieved.

When reflecting and comparing the research findings about EAI with prior literature regarding traditional ERP introduced in previous chapters, it can be seen that next generation's ERP does fix some of traditional ERP's main challenges, but not all of them. Table 3 lists the ERP implementation challenges introduced in table 1 and how next generation's ERP can answer to those challenges. EAI specific benefits and challenges are listed in table 2.

Table 3: Challenges of traditional ERP and how next generation's ERP can answer to them.

ERP implementation challenges	Can next generation's ERP fix this?
ERP software are complex, most likely end result is quite inflexible	yes
Requiring huge investments: a lot of money, time and effort, also hidden costs	yes
Assessing ERP investment's ROI and value added to the organization is difficult	yes
Gaps and misfits between functionalities supported by the ERP and required by the adopting organization	yes
Organizations need to choose: pay more and customize the ERP, live with the shortage, or adapt to new functionalities	partly
Need to retrain workers and simultaneously carry on business as usual	partly
Possibility to completely redesign fundamental business processes	partly
Need to come up with organization wide definitions for data, business processes, and working methods	partly
Differences between system requirements of various stakeholders	no
Employees' and end users' negative attitude towards change and new ERP system	no

From this table it can be seen that a majority of ERP challenges can be partly or fully avoided with next generation's ERP. Based on this research there are only two out of ten traditional ERP challenges that next generation's ERP cannot fix.

5.4.2 Framework for next generation's ERP

The research findings inspired the author to create a model and a framework to support organizations in finding a proper solution that suits their situation the best when considering their IT strategy and information systems. In the model introduced in figure 9, managers and other decision-makers are put to think about IT within their organization

and different aspects of the desired solution. That is because the current information systems define the EAI project: the starting point and possible limitations. EAI is a good choice if the organization is happy with the current information systems they have but wish to get even more out of them. Additionally, the managers and other decision-makers pondering to which direction to go with their IS investments should have a clear understanding of the role of IT within their organization. In terms of IT strategy, investment level is relatively small with EAI, and IT management should also think whether purchasing one major closed IS package from a single vendor is a serious lock-in factor and not a modern solution, while on the other hand having multiple parties involved can for example create difficulties in sharing and transferring knowledge and be time consuming. With the framework, introduced in figure 10, the managers and other decision-makers can locate their organization on the graph based on the assessment done with the model in figure 9, and thus determine what kind of IS solution could suit their organization. I.e. the model describes the questions IT managers should ask themselves and framework shows how to interpret those answers.

The model has five layers that represent different aspects IT management ought to consider when thinking about and reshaping their IT strategy and investing in new IT solutions. The inner a layer is the more important aspect it is, and the more it should determine the direction of future actions.

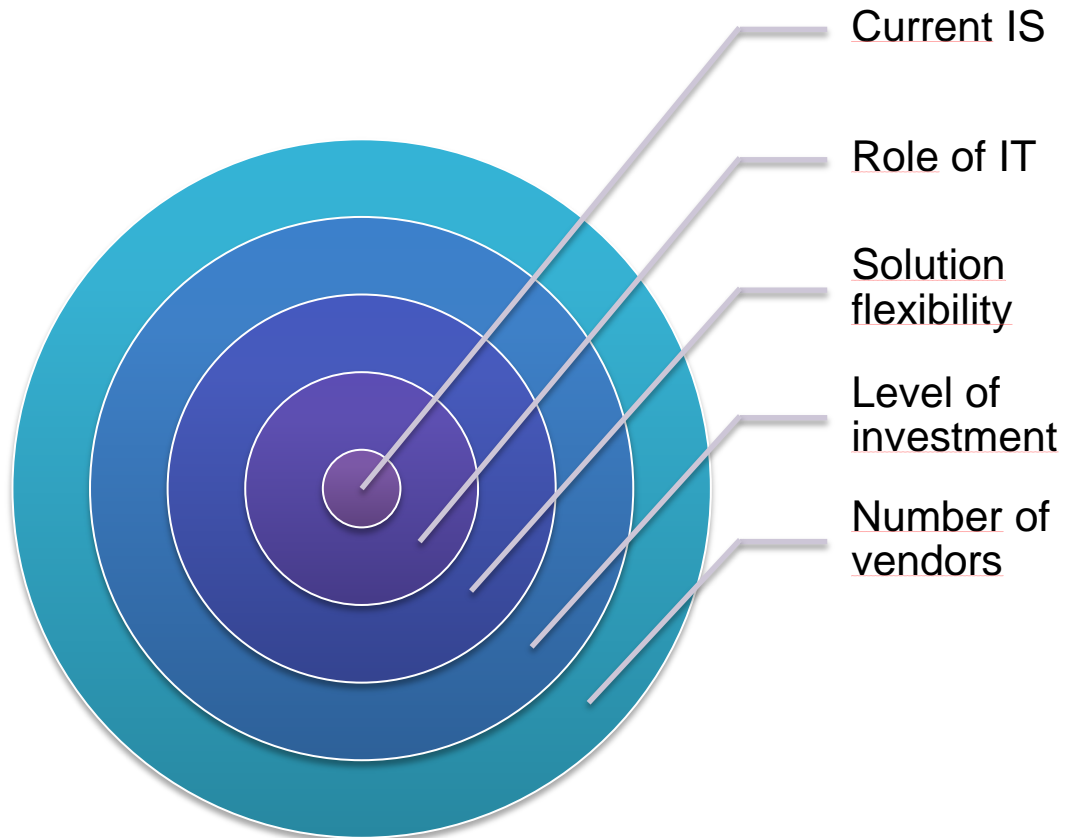


Figure 9: Model with which decision-makers assess their organization and solution requirements based on five prioritized core factors.

In the core of the model there are current information systems, and IT management should ask themselves how modern the systems are and what is the level of satisfaction with the current IS in their organization. If the organization is happy with the systems they already have, i.e. level of satisfaction with current IS is high, why waste the investment put into them and adopt a totally new IT package. On the other hand, if the current IS are out-of-date and do not serve the organization's needs, i.e. the age of current IS is high, there is no point of holding onto them. Next layer is about the role of IT within the organization. This means that it should be clear whether IT is a supportive tool or is it actually a crucial part of the business. The role of IT ought to steer the decision-making into proper direction. Third layer represents the solution flexibility. When searching for potential solutions, managers and other decision-makers need to know how high they desire the end result flexibility to be. After determining the first three layers' aspects, the IT management is left with investment level and number of vendors. The remaining questions to answer are how much is the organization willing to invest in their IS, and what is the amount of vendors they would like to work with. Obviously these steer the final decision as well, but should not be the core factors influencing the

outcome. The model's contribution is to help IT management in outlining the direction of their actions regarding IT investments: should they carry on with old systems, invest more in them, or adopt new information system(s).

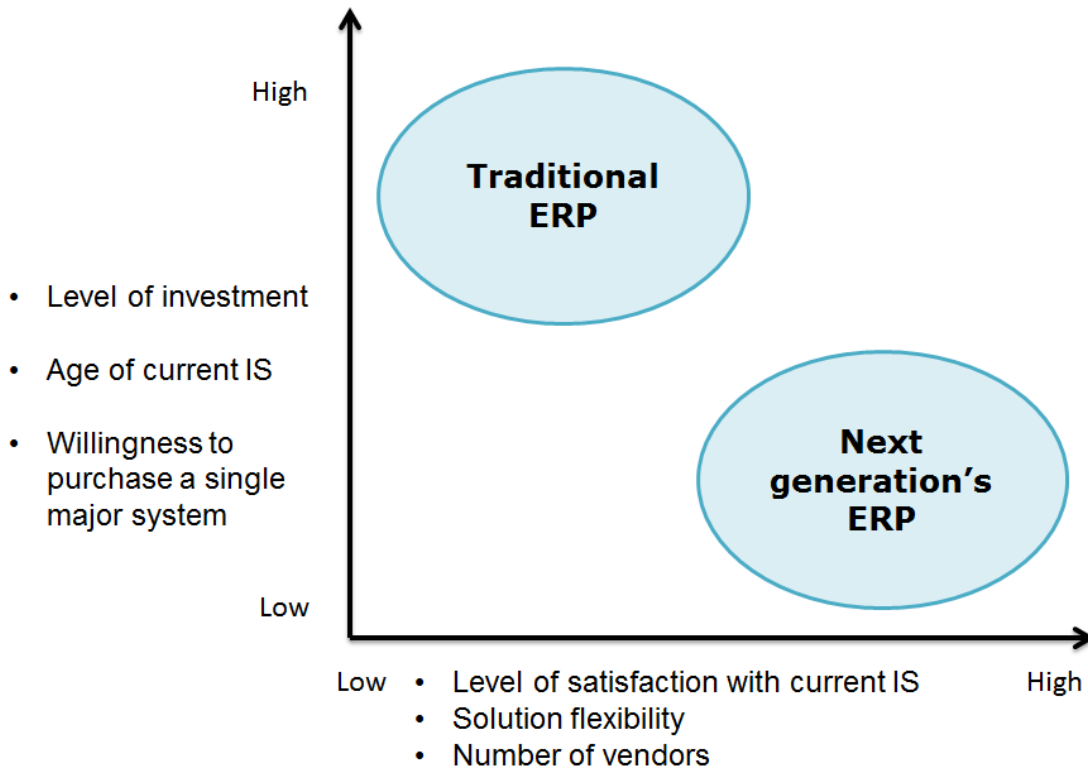


Figure 10: Tool to find out whether next generation's ERP solution could suit the organization's needs when investing in their information systems.

The framework can be used as a more concrete tool to help and support IT management determine whether the next generation's ERP could suit their organization's needs. The framework has altogether six features representing the current, the objective, or strategy, and they are to help to find the final solution. Managers and other decision-makers ought to assess their current IT and solution end results based on the six different features given on the framework. First three features are located on the Y axis: level of investment, age of current IS, and willingness to purchase a single major system. Level of investment is about the organization's IT strategy and includes not only money but also time and other elements that shape the total investment. Age of current information systems is used to describe a feature that is inversely proportional to how modern the current information systems are within the organization. Willingness to purchase a single major system in turn refers to the organization's strategy whether they would rather have multiple smaller systems building the whole or only one system taking care

of all the various aspects expected from the IS. These features on the Y axis are the kind that given lower values they are compatible with next generation's ERP.

On the X axis are the remaining three features: level of satisfaction with current IS, solution flexibility, and number of vendors. This means the managers and other decision-makers are to assess how happy they are with the current information systems they already have, how flexible do they wish the end result to be, and according to their IT strategy are they okay with having systems from multiple vendors or would they prefer systems from only one or a few vendors. These features on X axis are the kind that given higher values they are compatible with next generation's ERP.

On the graph traditional ERP is located in the opposite corner to next generation's ERP. With traditional ERP:

- level of investment is high because ERP can require millions of dollars only to implement, not to mention other costs
- age of current IS is high if there is need to update the organizations information systems and give up on using the old ones
- willingness to purchase a single major system is high because ERP is a big wholeness built of different modules
- satisfaction with current IS is low if the organization does not want to continue using them and/ or invest more in them
- number of vendors is low because ERP is a single vendor strategy
- solution flexibility is low because even though ERPs are advertised as flexible, customizable solutions, the end result is most likely inflexible.

With next generation's ERP:

- level of investment is low because EAIs are relatively small investments
- age of current IS is low because they need to be able to be integrated
- willingness to purchase a single major system is low because EAI is about integrating multiple separate information systems to interoperate
- satisfaction with current IS is high because EAI is a good choice when the organization is happy with their current IS but wishes to give them a boost
- number of vendors is high because there are multiple system vendors involved in the project
- solution flexibility is high because EAIs main advantages include customization and having high flexibility.

When using this framework in decision-making, the managers or other decision-makers should assess their organizations, and based on their answers locate their organization on the graph. In the lower right hand's side the author has located next generation's ERP, representing that if the organization is located there on the graph, then the next generation's ERP might just be the proper solution to their needs. The contribution of the framework is to specifically demonstrate when the next generation's ERP solu-

tion could answer the organizations' needs, and on the other hand, when traditional ERP would or would not be the best solution for them.

6 SUMMARY AND CONCLUSIONS

ERP (Enterprise Resource Planning) is a commercial IT tool, which integrates business processes and functions, and information used by multiple different departments. (Lv & Chen, 2010). ERP software packages are implemented in various organizations to manage and integrate business processes across different organizational functions and locations. They cost millions of dollars to buy and implement, and can require notable changes within organizations. Some gain significant improvements and benefits, whereas other organizations have had to settle for less or even noticed that they need to abandon the ERP system implementation. (Soh, et al., 2000)

As organizations keep on growing and they face new challenges and competition, many consider ERP system as a solution to their needs (Lv & Chen, 2010). The overall benefits of ERP include influencing the firm structure to become one organization, change management processes so that there is a firm-wide knowledge based management process, unified technology platform, and enhancing business capabilities (Murthy, 2008). ERP system can help an organization to reduce operating costs, generate more accurate forecasts of demand, decrease production lifecycle times, and enhance customer satisfaction. This way ERP system can enable an organization to reach millions of dollars of savings annually. (Lv & Chen, 2010) However, not all ERP projects end up in success (Lv & Chen, 2010). In addition to investing a lot of money, ERP implementation requires a lot of time and effort from the people working within the organization (Murthy, 2008). One major problem with ERP system implementation lies in the fact that the system itself is expensive to buy and to implement, and there are also additional costs with training, consultant and evaluation (Lv & Chen, 2010).

Many organizations also have various separate information systems that they use in their everyday business. Usually these information systems in one organization are developed and implemented on different platforms and have different systems for data management, as well. (Tomicic-Pupek, et al., 2012) Enterprise Application Integration (EAI) is integration of IT systems within the organization (Lam, 2004). EAI is based on the idea that integration between external and internal information systems brings value to the organization, and information sharing increases the value and quality of information. Organizations that wish to improve their productivity and reduce costs can find EAI to be the solution to answer this need. (Zhigang & Huiping, 2009)

Even though organizations, business processes, competition, customers and many more factors have developed and faced changes over the years, traditional ERP systems have changed only little during the past decades, and only execute the same logic as back in the days with just faster and in real-time (Lörincz, 2007). For example, Møller (2005), Johansson (2011), and Al-Ghofaili and Al-Mashari (2014) have studied new kinds of approaches to traditional ERP. This has inspired the author, too, to create a new

approach to traditional ERP: the next generation's ERP. It suggests that organizations could reach for similar benefits via EAI, i.e. integrating their current information systems, instead of adopting new ERP. The research questions in this thesis are: What are the weaknesses in traditional ERP deployment in today's business? How does the proposed next generation's ERP answer to these weaknesses?

The concept of enterprise application integrations was researched with five interviews with IT experts with different kinds of backgrounds and experiences within the field of IT. The aim of the interviews was to study integration solutions and their characteristics in order to find out how EAI implementation works in practice and could they have the potential to be a major IT solution now and in the future.

According to the interviewees, EAI solutions are a necessity in any organization doing business today, and investment level is relatively small with EAI. They are used to decrease manual work, automate processes, and increase data integrity. In the end, customers want their IS to communicate and interoperate. Getting rid of vendor lock might also be a big motivation for ending up with EAI solutions. End result is flexible, however, the current information systems define the EAI project. Technical factors were found to be most crucial limiting factors for EAI implementation. EAI seems to suit all kinds of organizations, but it is a good choice if the organization is happy with the current information systems they have but wish to get even more out of them. The managers and other decision-makers pondering whether to invest in EAI or not should have a clear understanding of the role of IT within their organization. They should also think whether purchasing one major closed IS package from a single vendor is a serious lock-in factor and not a modern solution. ERP requires changes on its terms whereas EAI enables change on the customer organization's terms. Table 2 summarizes the practical benefits and challenges of next generation's ERP based on the interviews.

Based on the study there are similarities in both the advantages and disadvantages between traditional and next generation's ERP. However, next generation's ERP provides a fresh viewpoint that responds to today's business challenges such as being agile, not to mention the ERP as we know it took shape already in the 1990's. Shared benefits include at least improving management reporting and decision making, providing better data about business processes and organizational performance, possibility to be changed according to organization's requests, reducing operating costs, decreasing production lifecycle times, and generating more accurate forecasts of demand. Table 1 summarizes the challenges of traditional ERP in today's business. Looking at the research findings about EAI, it can be seen that next generation's ERP does fix some of traditional ERP's main challenges, but not all of them. The results are introduced also in table 3. Shared challenges between traditional and next generation's ERP include differences between system requirements of various stakeholders and employees' and end users' negative

attitude towards change and new ERP. Issues the next generation's ERP solves partly or fully include the following traditional ERP challenges:

- ERP software complexity and end result inflexibility;
- requiring significant investments as a lot of money, time and effort, also hidden costs;
- difficulty in assessing investment ROI and value added to the organization;
- gaps and misfits between functionalities supported by the ERP and required by the adopting organization.
- organizations need to choose: pay more and customize the ERP, live with the shortage, or adapt to new functionalities
- need to retrain workers and simultaneously carry on business as usual
- possibility to completely redesign fundamental business processes
- need to come up with organization wide definitions for data, business processes, and working methods

What is interesting between traditional and next generation's ERP is that with EAI business process re-engineering was seen as a positive feature; enabling change and supporting the wished changes in the adapting organization. When taking a closer look at comparison between traditional ERP and EAI solutions (e.g. figure 7), it can be said that the positives of traditional ERP apply to EAI quite extensively but the downsides not as much. However, next generation's ERP is exposed to completely new challenges that don't apply to traditional ERP in turn.

The research findings inspired the author with creating a model and a framework (figures 9 and 10) for IT managers to support organizations in finding a proper solution that suits their situation - should organizations continue with current IS, invest in EAI, or perhaps purchase a completely new ERP or other IS package - the best when considering their IT strategy and information systems. Key in next generation's ERP is the current IS and role of IT within an organization. Next are more strategic points including solution flexibility, level of investment and number of vendors involved. The model describes the questions IT management should ask themselves and prioritizes the different aspects, and framework shows how to interpret those answers. With the model managers and other decision-makers are put to think about IT within their organization and different aspects of the solution. The model has five layers that represent different aspects IT management ought to consider when thinking about and reshaping their IT strategy and investing in new IT solutions. The inner a layer is the more important aspect it is, and the more it should determine the direction of future actions. In the framework IT management is expected to assess six different features and how low or high they wish the end result and final solution to be regarding those features. Managers and other decision-makers ought to assess their organizations, and based on their answers locate their organization on the graph.

In the framework (see figure 10), traditional ERP is located in the opposite corner to next generation's ERP because:

- level of investment is high with traditional ERP and low with next generation's ERP
- age of current IS is high with traditional ERP and low with next generation's ERP
- willingness to purchase a single major system is high with traditional ERP and low with next generation's ERP
- satisfaction with current IS is low with traditional ERP and high with next generation's ERP
- number of vendors is low with traditional ERP and high with next generation's ERP
- solution flexibility is low with traditional ERP and high with next generation's ERP.

The research shows that traditional ERP implementation includes multiple downsides, such as inflexibility and requiring big investments in terms of money and effort. In order to dodge these critical issues, organizations could find a solution from integrations between their current information systems. The study and results suggest that there are multiple factors IT managers needs to consider when planning their IT investments including their current IS, role of IT in the organization, as well as end result flexibility, investment level, and number of vendors. It seems possible that with this framework organizations can reach similar benefits as with implementing traditional ERP, but with smaller investments if they integrate their current information systems. The framework created in the thesis encourages IT management to assess their i) organization, ii) its IT, and iii) the solution requirements in order to determine what kind of ERP solution would suit their needs the best.

This research does not focus on organizations operating in any specific industry, and thus the issues are discussed on a high level without going into industry-specific aspects regarding organizations' IT strategies and the role of IT. The empiric research focuses only on the five interviews which are about EAIs on a general level. All of the respondents are working more or less with different kinds of integration solutions and thus might be favorable towards EAI. Also the comparison of traditional ERP and EAI is mainly based on ERP literature and EAI in practice. This research does not include any studies about cases of EAI implementation, and excludes IS solutions other than traditional ERP and EAI. The model and the framework created in this thesis have not yet been tested or used in practice, and thus this topic requires further research.

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APPENDIX 1: INTERVIEW QUESTION TEMPLATE.

The benefits of EAI

1. Why invest in EAI?
2. How common are integration solutions nowadays?
3. What kinds of hopes and objectives do customers have for EAI implementation?
How often are these objectives met?
4. How flexible are EAI solutions? Why is it so? How much does this have to do with project or organization size?
5. How much can the system interoperability enhance due to EAI in general? On a scale 1-5 (1 = not at all, 2 = very little, 3 = somewhat, 4 = quite a lot, 5 = a lot).
Any additional comments to this (system interoperability)?
6. What would you say is the one single most important EAI benefit?
7. In what kinds of situations, if any, is EAI solution superior to others, such as implementing new ERP, continuing with old system(s), moving onto cloud and web based services? For example when an organization wants to decrease costs, increase revenue, enhance business processes, etc.

Requirements and limitations

1. Resources: money, time, human resources, and effort.
 - a. How big of investments are EAI projects regarding **money**? On a scale 1-5 (1 = very small, 2 = quite small, 3 = neither big nor small, 4 = quite big, 5 = very big).
 - b. How big of investments are EAI projects regarding **time**? On a scale 1-5 (1 = very small, 2 = quite small, 3 = neither big nor small, 4 = quite big, 5 = very big).
 - c. How big of investments are EAI projects regarding **human resources**?
On a scale 1-5 (1 = very small, 2 = quite small, 3 = neither big nor small, 4 = quite big, 5 = very big).
 - d. How big of investments are EAI projects regarding **effort**? On a scale 1-5 (1 = very small, 2 = quite small, 3 = neither big nor small, 4 = quite big, 5 = very big).
2. How does organization size affect EAI implementation?
3. How does organizational culture affect EAI implementation?
4. Are there any (other) limitations for EAI projects?
5. Can EAI require BPR from the customer? Any additional comments to this?
6. What kind of change management does the customer need with EAI implementation?
7. What/ how big is the role of current information systems in EAI?
8. Does EAI suit organizations in all shapes and sizes? Why/ why not?

Problems and challenges in EAI projects

1. What are the most common risk factors that threat EAI implementation?
2. What things have gone wrong with EAI implementations? Why? What could have been done better in order to prevent this?
3. How likely is it that the customer's current information systems will not interoperate properly? On a scale 1-5 (1 = not likely at all, 2 = not likely, 3 = fifty-fifty, 4 = quite likely, 5 = very likely).
4. Can EAI implementation create new problems with the system usage?
5. How common are budget and schedule overruns? On a scale 1-5 (1 = not common at all, 2 = not that common, 3 = every other case, 4 = quite common, 5 = very common).

APPENDIX 2: LIST OF TWENTY FEATURES: HOW WELL APPLY TO EAI.

How well does this apply to EAI? Claim:	1 Not at all	2 Very little	3 Some what	4 Quite much	5 Very much	I don't know
End result: unified structure, "one organization"						
End result: Firm wide knowledge-based management process						
End result: Unified technology platform						
Improving management reporting and decision making						
Providing better data about business processes and organizational performance						
Customization, possibility to be changed according to organization's requests						
Reducing operating costs						
Decreasing production lifecycle times						
Generating more accurate forecasts of demand						
Reaching huge savings						
Software are complex, most likely end result is quite inflexible						
Requiring huge investments: a lot of money, time and effort, also hidden costs						
Need to retrain workers and simultaneously carry on business as usual						
Gaps and misfits between functionalities supported by the system and required by the adopting organization						
Organizations need to choose: pay more and customize the system, live with the shortage, or adapt to new functionalities						
Possibility to completely redesign fundamental business processes						
Need to come up with organization wide definitions for data, business						

processes, and working methods						
Differences between system requirements of various stakeholders						
Assessing investment's ROI and value added to the organization is difficult						
Employees' and end users' negative attitude towards change and new system						