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THE ROLE OF AGILE APPROACH IN ERP IMPLEMENTATIONS

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ABSTRACT

Lappeenranta-Lahti University of Technology LUT
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The role of agile approach in ERP implementations

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Traditionally, ERP implementations have been delivered using the waterfall implementation methodology, but the downside of the waterfall projects is that value from the project can be realized years later the requirements were collected. Once the system has gone live, the initial requirements may not answer anymore to the needs of the customers. Today, customers are no longer willing to investment to projects were value realization takes such a long time. Customers are starting to request faster results and ability to react to changes even during the project. Agile is a software development lifecycle method which utilized sprints and emphasizes changes made even at later change. However, the complexity and size of ERP implementations makes it necessary to scale the agile practices.

This qualitative research studies how the agile method can be utilized in ERP implementations and how the agile method suits ERP implementations compared to the traditional waterfall method. In addition, the thesis studies if there are challenges in adopting agile as well as how to successfully adopt agile into ERP implementations. The selected research methods are literature review and semi-structured interviews.

The study reveals that the agile method has become the main implementation methodology for ERP systems, and it will be the standard methodology in the future. Nevertheless, the ERP implementation methodology is not fully agile because ERP implementations are complex and not everything in the project can be managed in the same way. The work in agile ERP implementations start from the best practices which enable to see early how the system acts and looks like. The implementation is done in close cooperation with the customer, and there is an ability to react and do changes if the solution is not what the customers expected. In this way, the solutions answer better to the needs of the customers. The results of the study showed that challenges in adopting agile practices into ERP implementations are mostly related to change management and not to the actual implementation methodology. In the beginning of an agile ERP implementation project a lot of effort is required from the implementation partners in the amount of onboarding and training to get the project resources adapted to an agile way of working.

TIIVISTELMÄ

Lappeenrannan-Lahden teknillinen yliopisto LUT
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Tuotantotalouden koulutusohjelma

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Ketterän menetelmän rooli ERP-järjestelmien käyttöönotoissa

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Perinteisesti ERP-järjestelmän käyttöönotto toteutetaan vesiputousmenetelmällä, mutta näiden käyttöönottoprojektien varjopuoli on se, että projektin arvo saadaan realisoitua vasta pitkän ajan jälkeen siitä, kun asiakkaat ovat asettaneet vaatimuksensa järjestelmälle. Siinä vaiheessa, kun ERP-järjestelmä otetaan käyttöön, alkuperäiset vaatimukset eivät välttämättä enää vastaa asiakkaiden liiketoimintatarpeisiin. Tästä syystä asiakkaat ovat alkaneet vaatimaan nopeampia ratkaisuja ja mahdollisuutta reagoida muutoksiin myös kesken ERP-käyttöönottoprojektin. Ketterä menetelmä on ohjelmistokehityksen elinkaarimalli, jota hyödyntämällä projektista saadaan lisäarvoa nopeammin ja joka mahdollistaa muutosten tekemisen alkuperäisiin vaatimuksiin. ERP-järjestelmien kompleksisuus ja käyttöönottohankkeiden laajuus vaativat ketterän menetelmän skaalaamista tähän yhteyteen sopivaksi.

Tämä laadullinen tutkimus tutkii, kuinka ketterää menetelmää voidaan hyödyntää ERP-käyttöönottoprojekteissa ja sen soveltuvuutta ERP-käyttöönottoihin verrattuna perinteiseen vesiputousmenetelmään. Lisäksi tutkitaan, millaisia haasteita ketterän menetelmän omaksumisessa osaksi ERP-hankkeita on ja kuinka ketterät menetelmät voidaan onnistuneesti ottaa osaksi ERP-käyttöönottoprojekteja. Valitut tutkimusmenetelmät ovat kirjallisuuskatsaus ja haastattelut.

Tutkimus osoittaa, että ketterästä menetelmästä on tullut pääasiallinen ERP-järjestelmien käyttöönottomenetelmä, jonka merkitys tulee kasvamaan tulevaisuudessa. Menetelmä ei kuitenkaan noudata täysin ketterää kehitystä, sillä ERP-käyttöönotot ovat kompleksisia eikä kaikkea projektissa voida hallita samalla tavalla. Ketterää menetelmää hyödyntämällä ERP-käyttöönotot lähtevät liikkeelle parhaiden käytäntöjen mukaisista prosesseista. Projektia toimitetaan tiiviissä yhteistyössä asiakkaan kanssa, jolloin kesken projektin on mahdollista reagoida, jos jokin ei vastaa asiakkaan odotuksia. Tällä tavoin ERP-järjestelmä voidaan toimittaa nopeammin ja se vastaa asiakkaan tarpeisiin paremmin kuin perinteisissä ERP-käyttöönotoissa. Tutkimuksen tulokset osoittivat, että haasteet ketterän menetelmän omaksumisessa liittyvät pääosin muutosjohtamiseen. Ketterän ERP-projektin alussa käyttöönottokumppaneilta vaaditaan suurta vaivannäköä projektitiimin perehdyttämisessä ja kouluttamisessa, jotta he mukautuvat ketterään tapaan työskennellä.

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LIST OF ABBREVIATIONS

AI	Artificial Intelligent
ASAP	Accelerated SAP
CSF	Critical Success Factor
ECC	ERP Central Component
ERP	Enterprise Resource Planning
IDC	International Data Corporation
IoT	Internet of Things
LeSS	Large Scaled Agile
OCM	Organizational Change Management
PMO	Project Management Office
PoC	Proof of Concept
SaaS	Software as a Service
SAFe	Scaled Agile Framework
SCM	Supply Chain Management
SDLCM	Software Development Life Cycle Model

1 INTRODUCTION

In the first chapter of the thesis, the background of the research is presented. The research problems, targets and exclusions are introduced. In addition, the realization of the study is presented which includes the research methodology and the structure of the report.

1.1 Background of the study

Enterprise resource planning (ERP) systems have been the information backbone for the most organizations for decades. Today, the operational processes of enterprises have become more complex than what they were a decade ago. The business functions cuts across different business functions of the enterprise, and there is a need to have up-to-date information and link the different business partners. (Ali & Miller 2017, 666–667). In the constantly changing environment the role of the ERP system has become important as organizations need to perform in always-on, digitally connected and data-driven world where operating in a real time has become necessary. ERP systems help in keeping organizations competitive as they offer digital and data-driven landscape. (Accenture 2017, 3)

ERP implementation projects are the largest projects that many organizations ever face (Kraljić & Kraljić 2018, 190). Implementing an ERP system can be challenging, time-consuming and expensive (Ali & Miller 2017, 667). Recent studies have shown that many organizations still struggle with the complexity of ERP implementations leading the projects to go over the budget and the target schedule, and a large number of ERP implementations fail to achieve their implementation objectives (Ali & Miller 2017, 667; Wijaya et al. 2018, 571). In a large number of ERP implementation projects traditional waterfall methodology is still used as the main implementation approach but the downside is that waterfall projects take years to complete and the results can be seen only at the end of the project. (Wijaya et al. 2018, 572) A lot can change in that time as the operating environment is dynamic and prone to changes. In waterfall software development projects changes are not easy to make and as a result these projects tend to have a poor track record. (Bibik 2018, 1)

The ERP implementation challenges can be reduced by choosing more agile approach (Wijaya et al. 2018, 571). Agile is a software development model where the solution is built in smaller iterations and the outcome can be seen faster. (Bibik 2018, 1) Agile projects tend to be more successful because agile has the ability to address the problems that waterfall projects typically face (Moran 2015, 1). The Standish Group Report (2015) compares the success rate of waterfall and agile projects. The report highlights that the agile software development projects have higher success rate, have less challenges and lower level of failure when compared to waterfall projects as the Figure 1 presents.

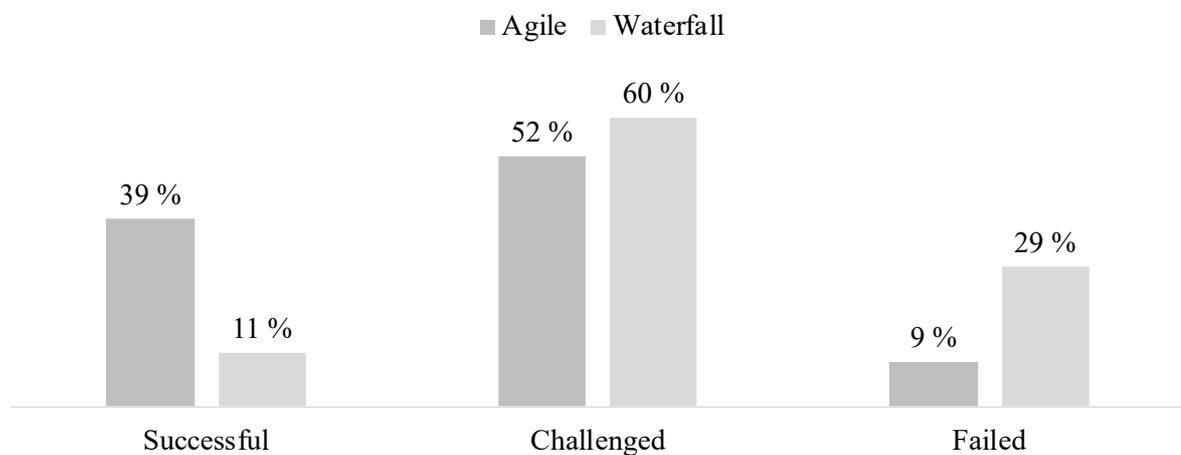


Figure 1. The success rate of waterfall versus agile project (Standish Group Report, 2015).

Even though a large number of organizations understand the challenges with the waterfall ERP implementation methodology the approach has not been changed (Robson 2013). One of the reasons is a belief that ERP systems cannot be delivered with agile approach. In addition, in the recent research the attention has not been focused on the methodologies that are used to implement ERP system (Kraljić & Kraljić 2018, 190–191) The theoretical analysis and case studies of ERP implementation projects executed with agile approach has not been widely discussed in the recent research (Isetta & Sampietro 2018, 4). There is a need for further research as adopting agile framework into ERP implementations is not simple. The complexity, size and interdependencies especially in SAP ERP implementation project bring challenges (Accenture 2017, 4).

1.2 Research problems, targets and exclusions

The objective of this thesis is to analyze the role of agile approach in ERP implementation projects. The traditional ERP implementations suffer from delayed value realization and exceeding the budget and schedule, which have led customers to request faster and more efficient implementations. In software development projects agile methods have been widely adopted with several benefits but the adoption in the ERP landscape has been slow. The goal in this study is to find out the reasons for slow agile adoption in ERP implementation projects and how agile method suits ERP implementations and to compare the agile and waterfall methods to find out what kind of value agile gives to ERP implementation projects. Traditionally, ERP implementations have suffered from several challenges and this study focuses on the challenges that agile projects may face and how to address those.

The research questions supporting the study are:

- How agile method suits ERP implementations compared to waterfall method?
- Are there challenges in adopting agile into ERP implementations?
- How to successfully adopt agile method into ERP implementations?

The study aims to provide information of the current role of agile in ERP implementations to project members and consultants who have limited experience of agile ERP implementations. The target is to help relevant stakeholders to recognize the common challenges that agile ERP implementation projects may have and how to address these challenges in order to have a successful ERP implementation. Additionally, the aim is to provide academic research on the topic since agile ERP implementations as a research topic has not yet been widely studied in the academic publications.

The study researches the topic from an implementation partner's viewpoint where customer organizations are implementing ERP systems together with the external implementation partner who is an active member in the implementation process. Later in the data analysis chapter of the study a company that is implementing an ERP system is referred as a customer. The focus in this thesis is in the newest SAP ERP product SAP S/4HANA which is later referred outside

the theory chapters as ERP system or S/4HANA. The ERP system is available as on-premise, cloud and hybrid editions for deployment but the thesis is focusing on studying only the on-premise edition where the platform is managed by the customer. The implementations in this thesis cover only new ERP implementations, and system conversions or upgrades from previous ERP system to a newer version are excluded from the study.

1.3 Realization of the study

The data for the theoretical part of the thesis is gathered from academic literature. A framework presented in the Figure 2 provides a foundation for the theoretical part of the study. Articles and books are searched and downloaded from databases with certain keywords such as “software development models”, “ERP implementation” and “agile ERP”. The articles are analyzed precisely in order to build up the desired theoretical background for the study. The aim is to use books and articles that are published in the 21st century, but the basic unchanged data can be older than that. The research utilized in the theoretical part does not need weighting based on how long ago it was conducted.

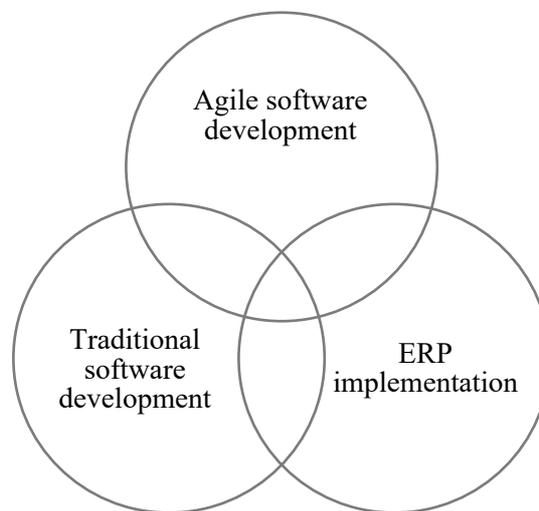


Figure 2. Framework for the literature search.

The theoretical part is linked closely to the empirical part of the study. Theory presented in this study is providing a foundation for the data gathering. The method used for data gathering is quantitative using semi-structured interviews. From the theory six themes that support the

research questions of the study are formed and six experts on agile methods for ERP implementations are interviewed. Chapter five presents more closely the research methodology that was utilized in the empirical part of the study.

1.4 Structure of the research

The research study consists of eight chapters. All of the chapters of the study are presented below in the Table 1 which describes the inputs and outputs for each chapter. The theoretical chapters of the thesis are chapters from two to four. The main idea behind the theoretical chapters is to present concepts of software development, ERP implementation and agile method in ERP landscape. The chapter five illustrates the research methodology which was used while this study was conducted. The results of the conducted research are analyzed in the chapter six which focuses on providing the interviewees' point of view to the topics of the interview. Further discussion on the topic as well as the reliability of the study is analyzed in the chapter seven. The last chapter concludes the research study into one chapter.

Table 1. The input-output model.

Input	Chapter	Output
Introduction to the study	Introduction	Background of the study, research problems and targets, research methods and structure of the research
Theory of traditional and agile software development	Software development	Presenting traditional and agile software development life cycle models, and large-scaled agile and hybrid-agile methods
Theory of ERP system, ERP system's life cycle and ERP implementation project	ERP system and implementation project	Presenting concept of ERP system and SAP's ERP, describing ERP system's life cycle and the main strategies and approaches for the ERP implementation
Theory of traditional and agile ERP implementation methodologies and the challenges	Traditional and agile ERP implementation	Presenting waterfall and agile implementation methodologies, and common challenges related to waterfall and agile ERP implementations
Theory of research method	Research methodology	Describing the used research methodology in the study
Interviews of six experts on the role of agile in ERP implementations.	Data analysis	Providing the interviewees' views on the value of agile in ERP implementations, challenges in adopting agile and golden rules, and insights for the future of ERP implementations
The further analysis of the results of the study	Discussion	Further discussion on the topic. Presenting the reliability, validity and limitations of the study and suggesting ideas for further research
Outcome of the study	Conclusions	Representing the main findings of the study

2 SOFTWARE DEVELOPMENT

Software development is a complex activity with a lot of variety in tasks and requirements (Nerur et al. 2005, 74). Initially, software development life cycle model (SDLCM) was invented to give structure to various software development practices within a project. SDLCM is used as basis for project management and it includes a framework that can be used for software development tasks and methods. It divides complex tasks into smaller subtasks helping with planning and monitoring work, supporting cooperation and communication between the different people and groups involved and ensure quality of the result. (Kneuper 2017, 41–43)

SDLCMs have been split into two categories: traditional plan-driven models such as waterfall and iterative models such as agile. Firstly, in this chapter traditional software development is presented focusing on the waterfall model which is the most popular plan-driven model for software development. Secondly, the concept of agile software development is presented, as well as one of the most popular agile methodologies Scrum, and the concept of scaling agile into large projects. Lastly this chapter presents hybrid methods that are a combination of agile and waterfall methods.

2.1 Traditional software development

The waterfall model is one of the well-known models for traditional software development. The waterfall model was the first model developed for the software development processes and initially it was introduced by Winson Royce in the 1970s. The waterfall model is based on plan-driven process where all of the process activities are planned and scheduled first before the actual software development starts. (Sommerville 2016, 47)

The traditional approaches are guided by the belief that the systems are fully predictable, and projects can be executed through extensive planning (Nerur et al. 2005, 74). In the waterfall model the phases are in a sequence, meaning that after one phase has been completed and documented the outcome becomes the input for the next phase. The next phase cannot start until the previous phase has been finished. (Sommerville 2016, 47). The phases of waterfall model are presented in the Figure 3.

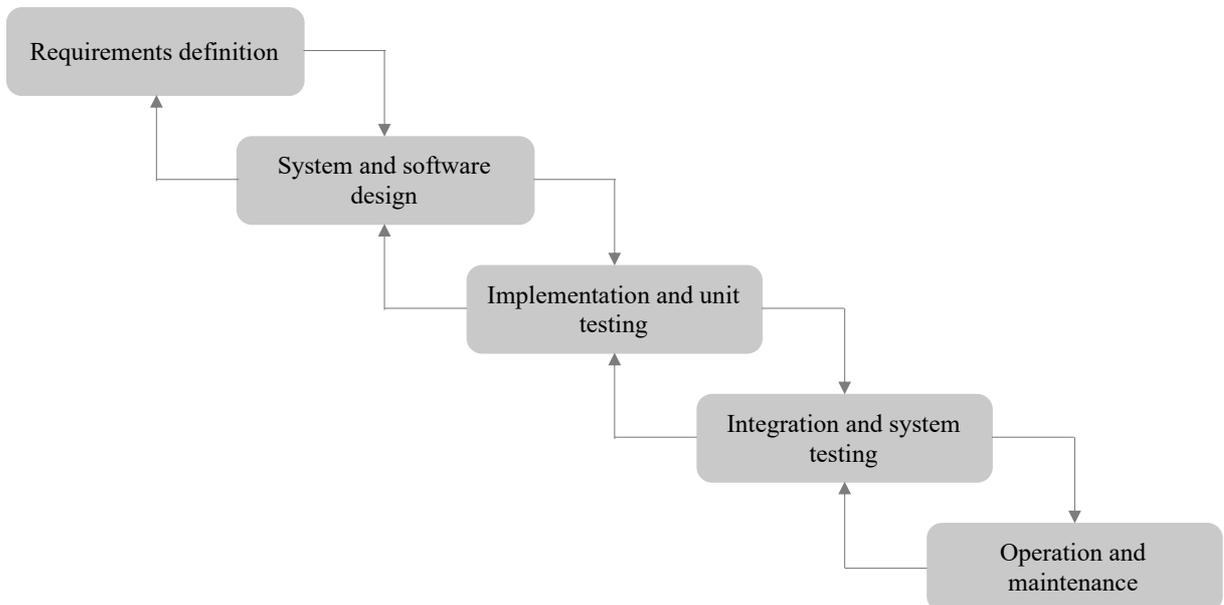


Figure 3. The phases of waterfall model (adapter from Sommerville 2016, 47)

In the waterfall model project goals, objectives and requirements are typically defined in detail and the deliverables of the project are agreed between project team and customer at the early stage (Croitoru 2018, 44). The features are being fixed in the actual contract between the customer and the project delivery team (Measey 2015, 24–25). According to Measey (2015, 24–25) analyzing and designing the solution up front leads to a greater understanding and the solution is less likely to contain errors. It also makes more certain for a customer what the outcome of the project will look like (Croitoru 2018, 44).

The waterfall delivery becomes predictable via detailed delivery stages that are signed off as milestones (Measey 2015, 24–25). The result of each phase is a documentation which needs to be approved before moving to the next phase (Sommerville 2016, 48). A large amount of documentation is produced in the waterfall model as process and product knowledge are codified in it (Nerur et al. 2005, 75). If a project resource leaves during the project the delivery will not be impacted because the continuity of the project is ensured by documenting (Measey 2015, 24–25).

The waterfall approach emphasizes that changes made in the early stage of the project are less expensive than changes made in later stages (Alleman 2002, 73). When a new information

emerges, it causes changes to the documentation that was produced in the earlier stages and results into a need to rework and retest the system design or implementation. In waterfall all the changes require customer approval and changes cause delays to the overall process. (Sommerville 2016, 48, 73)

According to Moreira (2013, 16) the issue with the waterfall model is that not everything can be known in advance. In practice, the waterfall projects never follow a simple linear model because phases involve feedback from one phase to another (Sommerville 2016, 48). The waterfall projects tend to have a poor track record because the project schedule is defined in the beginning of the project where the information about the work is not yet fully known (Moreira 2013, 12–16). Kumar Adi (2017, 12) suggests the main problem with process-centric approach is that the working software is produced only at the end of the project life cycle. For large software projects which take several years to complete it means the outcome can be seen only at the end of the project (Bibik 2018, 1). This may cause that by the time software is available for users it may not answer to their needs anymore and becomes immediately useless (Sommerville 2016, 73).

As today's businesses are operating in an ever-changing environment it is impossible to set exact software requirements upfront. Requirements change because it is impossible to predict what kind of effect a new system has on work practices and how it will interact with other systems. Also, users may gain more insights of the real requirements after the system have been delivered. Other external factors too might drive requirements to change. (Sommerville 2016, 73) According to Measey (2014, 14) with the waterfall model there is a high amount of risk and uncertainty and for this reason it is not suitable for long and ongoing projects. The waterfall model is more suitable for simple environments where the requirements, technology and design are well defined in the beginning and variation is not expected. For more complicated and complex environment, a learning approach such as agile is needed. (Measey 2015, 14)

2.2 Agile software development

Agility as a concept means an ability to create and answer to the change (Azanha et al. 2016, 23). Agile software development started emerging in the late 1990s to tackle the difficulties with existing solution development processes that were caused from the rooted plan-driven practices and the unreadiness for change (Moran 2015, 1; Sommerville 2016, 73). The agile approach applies lean thinking to information technology environment (Fair 2012). The basic principles of agile were set in the Agile Manifesto in 2001 published by several independent-minded software practitioners (Croitoru 2018, 32; Kuster et al. 2015, 32). The Agile Manifesto (2001) consists of four core values:

1. Individuals and interactions over processes and tools
2. Working software over comprehensive documentation
3. Customer collaboration over contract negotiation
4. Responding to change over following a plan

Agile recognizes that the software is made by people and not by processes or tools. The tools and processes may guide the work but cannot replace the people who are working and delivering the software. (Silberbauer & Coyne 2017, 5) An agile team is self-organized, motivated and working in an environment where they get support and trust to get the job done (Bibik 2018, 4). Agile teams work closely together and the key for success is the co-operation. For the team to work in the most efficient way they should be physically in the same place. (Croitoru 2018, 43)

In agile the customer is satisfied through the early and continuous delivery of valuable software (Bibik 2018, 4). Agile methods are based on the incremental development method where small releases are made available to the customers every two to three weeks (Sommerville 2016, 74). The software is continuously improved from iteration to iteration as the complete software cycle from design to test is done in each iteration (Bibik 2018, 16). Agile method sees the value in an active collaboration throughout the software development process instead of negotiating over the contract terms (Silberbauer & Coyne 2017, 5). Thus, the agile project requires daily

communication and collaboration between the business and technical team members (Bibik 2018, 4).

In agile project the primary measure of the progress is a working software (Bibik 2018, 4). As opposed to the waterfall model agile emphasized the working software over the comprehensive documentation. Nevertheless, it does not mean that the working software does not consists of any kind of documentation. The documentation in agile is created in order to create a working software which meets the user's needs and not the other way around. (Silberbauer & Coyne 2017, 5)

Not everything in the software development project can be thought through and planned for in advance. Some aspects of the software are only discovered during the development process together with the customer. In the fast-changing world it is extremely valuable to have the ability to response to the new discoveries and needs. The business needs and priorities might change during the software development process making it is important to embrace the change instead of sticking over to a plan which was created long before the project had even started. (Silberbauer & Coyne 2017, 5)

In agile the software is developed during the project in order to obtain feedback and ensure that the finished product aligns with the changing environment (Measey 2015, 14). By welcoming the change instead of avoiding it projects can be delivered with higher value to the customer (Croitoru 2018, 32). In addition, the team should reflect regularly how they could become even more efficient and adjust and tune their behavior accordingly (Bibik 2018, 4). The differences between traditional software development and agile software development are presented in the Table 2.

Table 2. Traditional versus agile software development (Nerur et al. 2005, 75)

	Traditional software development	Agile software development
Fundamental assumptions	Systems are fully specifiable, predictable, and can be built through meticulous and extensive planning	High-quality, adaptive software can be developed by small teams using the principles of continuous design improvement and testing based on rapid feedback and change
Control	Process centric	People centric
Management style	Command-and-control	Leadership-and-collaboration
Knowledge management	Explicit	Tacit
Role assignment	Individual – favors specialization	Self-organizing teams – encourages role interchangeability
Communication	Formal	Informal
Customer’s role	Important	Critical
Project cycle	Guided by tasks and activities	Guided by product features
Development model	Life cycle model (Waterfall, Spiral or some variation)	The evolutionary-delivery model
Desired organizational form/structure	Mechanistic (bureaucratic with high formalization)	Organic (flexible and participative encouraging cooperative social action)

Agile is not a methodology, tool or process but a model which guides the work within a team (Silberbauer & Coyne 2017, 4). As a term agile refers to any process that is align with the basic principles of agile as presented in the agile manifesto (Singh 2017). There are several methods for agile software development and project management purposes that that follow agile principles. According to Bibik (2018, 7) three of the most common methods to implement agile are Extreme Programming (XP), Scrum and Kanban. These three methods vary from each other on the amount of regulations and rules on how things should be done in the process. XP is a very strict process whereas Kanban has the minimum amount of sets and regulations on the process. Scrum falls somewhere in between these two and the method can be shifted to be more or less prescriptive based on the situation. According to Bibik (2018, 7) Scrum incorporated the best of both XP and Kanban. (Bibik 2018, 7) The Scrum methodology is presented below.

Scrum

Scrum is the most popular approach to the agile software development (Silberbauer & Coyne 2017, 23). Scrum was introduced by Jeff Sutherland and Ken Schwaber in 1990s to provide a process framework for organizing and managing work on complex products (Robson 2013, 25; Schwaber and Sutherland 2017, 3). Such as other agile methods Scrum is also based on the principles of agile manifesto. Nevertheless, Scrum does not mandate any specific development practices, but it focuses on providing framework for agile project organizations (Sommerville 2016, 85).

The basic concept of Scrum is based on that functionalities of a project are phased into time boxed iterations called sprints that last from two to four weeks (Sommerville 2016, 86). During the sprint the goal is to build a tested working piece of system and at the end of each sprint the working software is released into production (Robson 2013, 25). Each sprint builds upon the previous one and after the previous sprint has been completed, a new sprint can start immediately. (Silberbauer & Coyne 2017, 23; Schwaber & Sutherland 2017, 9). The equal lengths sprints make a periodic schedule and help to maintain routine in the teamwork and reduce change (Croitoru 2018, 39). The shorter the sprint is, the easier it is to predict the outcome and plan what needs to be done next (Bibik 2018, 16). The Scrum framework is presented in the Figure 4.

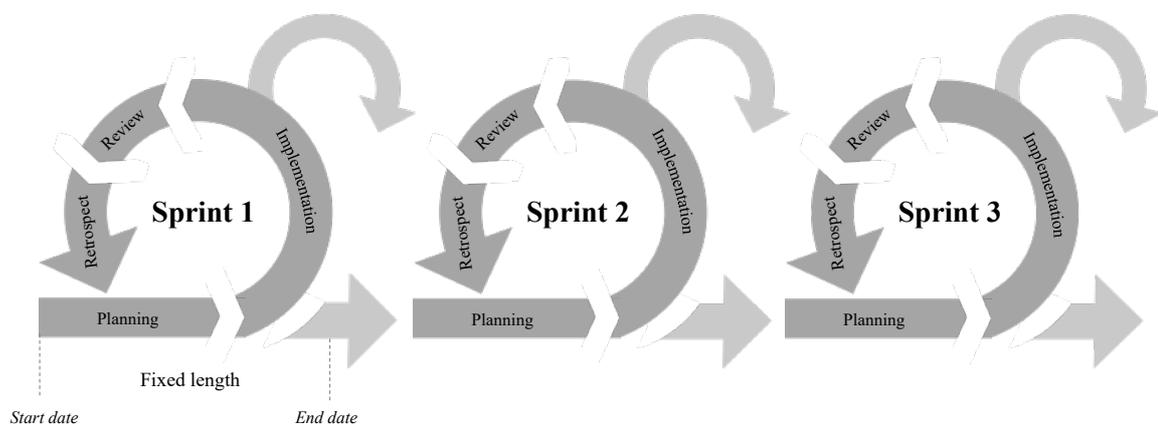


Figure 4. Scrum Framework (adapted from Scrum.org 2019; Measey 2015, 135)

A Scrum team is small, and it consists of five to seven people (Croitoru 2018, 36). The team is self-organized and cross-functional which means that the roles are not given in advance, but the team chooses the best way to accomplish their tasks. The Scrum team is qualified to carry out the work without being dependent of people outside the team members. (Schwaber & Sutherland 2017, 6) The roles in the Scrum team are a product owner, a development team and a Scrum master. Ultimately, the product owner is responsible for identifying what needs to be built for each sprint whereas the development team builds and demonstrates the working software. The role of Scrum master is to coach the team in understanding Scrum values and ensuring the team works according to Scrum process. (Silberbauer & Coyne 2017, 23–24)

In the Scrum world, the requirements are called user stories. User stories differ from normal requirements because they are persona driven and represented from the user's perspective instead of the system's functional point. A product backlog is an ordered list where all the user stories that are known to be needed in the product are captured and prioritized. The product owner is responsible for managing and ordering the product backlog. (Schwaber & Sutherland 2017, 15)

In Scrum the work starts from the highest priority items, and the team estimates how much backlog can be covered in a single sprint. During the sprint daily meetings, which are known as standups in Scrum terms, are held where the progress is reviewed and if necessary, the work is reprioritized. The idea in daily standups is to share the progress, bring up problems that have arisen and state the plan for upcoming day. In addition to standups, there are sprint review meetings known as retrospectives at the end of each sprint where the team together reviews the way they worked and what could have been done better. (Sommerville 2016, 86–87)

2.3 Large-scale agile

Development of large-scale software systems has not changed much from the 1960s (Kneuper 2017, 51). Initially, agile methods were developed for small programming teams working on small and medium-sized systems and software products. However, larger systems and larger organizations also need faster delivery of software. (Sommerville 2016, 88) Nowadays, agile approaches have been adapted to work in a wide range of environments and organizations want

to apply agile practices to a broader set of projects. All the project teams are in a unique situation and they have own goals, abilities and challenges to overcome but what they have in common is a need to scale the agile practices to address a wider organizational demand. (Silberbauer & Coyne 2017, 31–32)

Large-scale agile has multiple characteristics, such as a project consisting of multiple agile teams, a large number of external experts are involved in addition to team members, extensive integration takes place with existing IT-systems and migration of large amount of data needs to be done from the legacy systems. All of these add complexity to the software development and managing different stakeholders within the project. (Rolland 2016)

The two most commonly known large-scale agile frameworks are Scrum of Scrums and Large Scaled Agile Framework (SAFe). In the Scrum of Scrums framework Scrum teams process normally, but the work between Scrum teams is coordinated by one person from each team who attends a Scrum of Scrum meetings. SAFe is based on the principles of other agile practices and in the core of the framework is a set of best practices and guidance to expand those principles across the enterprise. (Silberbauer & Coyne 2017, 24–29)

Often, scaling agile adds complexity to the work and the challenges that arise need to be overcome. Intense collaboration is in the core of agile but in large projects this type of collaboration is difficult. When the team size grows, the communication challenges and risks increase and coordinating the project team becomes difficult. (Silberbauer & Coyne 2017, 33) Moreover, in larger project teams tend to be broken into smaller sub-teams to ensure better communication, but the downside of sub-teams is that the teams might work inconsistency which leads to unnecessary rework (Elshamy & Elssamadisy 2007, 46). For a larger project it becomes difficult to estimate the efforts and the time required for the project throughout its life cycle (Balaji & Murugaiyan 2012, 29).

Another issue that need to be considered in large-scale projects is what to do with the distributed teams as teams might be located in a different countries or time zones. Distributed teams make effective collaboration even more challenging and might lead into miscommunication. It is likely that the project team consists of members from different divisions, partner companies or

external firms which often results the relationship to be more contractual instead of collaborative. In addition, the existing organizational structure and culture in the companies may support waterfall values, increasing the complexity of scaling agile strategies within the organization. (Silberbauer & Coyne 2017, 33–34)

Silberbauer and Coyne (2017, 32–34) state that by nature, some applications are more complex than others. The existing legacy systems and the legacy data sources might be far from today's standards and require a lot of work when making changes. The system that is being developed may run in several platforms or different technologies are being implemented which makes the work complex. The team might face other issues which require careful planning and consideration before taking actions. In large scale projects the regulatory and industry standards are often applicable which increase the formality and become automatically requirements and not just a nice to have capabilities. (Silberbauer & Coyne 2017, 32–34).

2.4 Hybrid methodologies

According to Nerur et al. (2005, 74) a software development community has been divided into two groups where others support traditional approach and others agile approach. In addition, there are beliefs that both methodologies have their own strengths and weaknesses, and therefore are suitable for specific types of projects. (Nerur et al. 2005, 74) The question of which process model should be used depends on the customer, regulatory requirements, the environment where the software will be used and the type of software that is being developed (Sommerville 2016, 46).

Many organizations claim to manage projects according to agile practices but in the reality, they are mixing agile and waterfall methods (Gren et al. 2018, 3). In many cases the best approach is not a single approach but a mix of agile and traditional methodologies which can be customized based on the unique project requirements (Azanha et al. 2016, 125). According to Gren et al. (2018, 3) in some cases organizational context might be less adapted to pure agile approach for which combining two approaches suits better.

The company's strategy, culture, business environment, risks and complexity need to be aligned with the approach for each project (Azanha et al. 2016, 125). Agile principles are applied to shorten the iteration life cycles, respond to the feedback earlier and more often and tolerate with the changing requirements which result from the continuous feedback. Even teams who use traditional processes can take advantage of agile methodology and the benefit from adopting agile principles. (Silberbauer & Coyne 2017, 65)

3 ERP SYSTEM AND IMPLEMENTATION PROJECT

ERP systems integrate the information and business processes into a single system within and across different functional areas in the organization (Ganesh et al. 2014, 7; Kumar & Hillegersberg 2000, 23). According to Ali and Miller (2017, 666–667) all the major Fortune 500 companies have adopted an ERP system. Nowadays businesses can hardly be imagined running without an ERP system (SAP 2019, 5).

Firstly, this chapter presents the basic structure of ERP systems and SAP which is one of the leading ERP system providers in the world and their newest ERP system. Secondly, ERP system life cycle is introduced which includes the phases before and after the actual implementation. SAP has introduced their own life cycle models that are presented in the chapter four. Lastly, this chapter explains the concept of ERP implementation methodology and strategies for the implementation.

3.1 Basic structure of ERP system

The ERP system connects most of the departments in the enterprise and supports the information flow within the entire organization (Jovinic et al. 2012, 71). The ERP system is based on the usage of organizational and enterprise data which is stored in a central database (Ganesh et al. 2014, 7). The central database has relation to different stakeholders and applications as presented in the Figure 5.

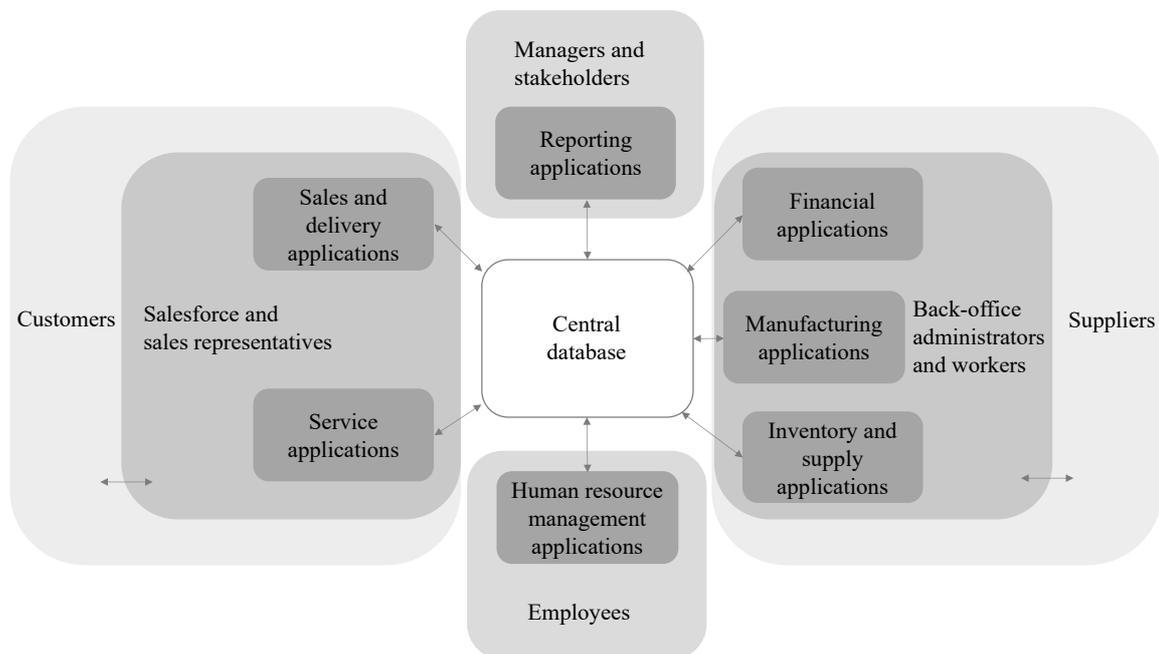


Figure 5. The relation of stakeholders in ERP central database (adapted Upadhyay & Dan 2009, 187)

The ERP system offers different level of access to the data for different kind of users as the management cannot reveal all the organizational data of the enterprise to all the users (Bansal 2013, 1). The integration of ERP system is not limited only to the organizational boundaries because it allows external business partners such as customers, vendors and sub-contractors to be integrated to the system, which makes ERP systems extremely large and complex (Grabot et al. 2008, 4; Jovinic et al. 2012, 71). Nowadays ERP systems have become platform for electronic business, business-to-business and business-to-customers applications allowing the organizational to manage their customer relationships and supply chains and reduce inventory costs (Ali & Miller 2017, 671).

The ERP system consists of modules which take care of different functions of business processes (Ganesh et al. 2014, 8). All of the modules in the ERP system share a central database (Upadhyay & Dan 2008, 295). Modules are covering commonly one function or serving a certain need of a department in the organization such as finance or sales. Typically, ERP vendors provide different packages for different industries in order to provide specific solutions for industries' needs. (Ganesh et al. 2014, 8)

ERP systems allow companies to benefit from accurate, timely and integrated information which helps them to improve decision making and the entire organization can operate at the same level of efficiency (Hassabelnaby et al. 2012, 618; Upadhyay & Dan 2009; 187). In addition, the greater interaction between customers and suppliers helps the organization to produce the products and services that matches the customer specifications (Madanhire & Mbohwa 2016, 225).

SAP's ERP system

SAP was founded in 1972 by five former IBM engineers (Lau 2005, 35). From the beginning the purpose of the company has been to offer standard software for integrated business solutions (Jacobs 2017, 358). Today, SAP is one of the largest ERP vendors in the market and in 2018 more than 76 percent of the world's business transitions run on SAP technology and SAP solutions (Kurbel 2013, 127; SAP 2018b, 4).

Over the years, SAP has released multiple ERP solutions. Early version of highly integrated solution SAP R/2 was launched in 1978. R/2 allowed interactivity between modules and had additional capabilities in the system, such as order tracking. The next step in the ERP history for SAP happened in 1992 when new product R/3 was released. R/3 was distinguished from earlier ERP systems because it was the first system that used client-server hardware structure. (Jacobs 2017, 359–360) In 2004, SAP made more changes to R/3 when the system started to run on a platform called NetWeaver. The ERP solution consisted both of the old core, the R/3, but was running in a new platform and was named as SAP ERP Central Component (ECC). (Kurbel 2013, 127–128)

Today, the digital economy is driving the change and organizations need to operate in the real time with the latest technology. As the pace of change continues to be fast, customers need new-age ERP solutions that are easily scaled, cloud-native and more focused on user experience. (Kulkarni 2019, 2) In order to support their customers in the journey with the digital transformation SAP started to make major changes to their solution portfolio in 2010. The outcome of these investments was SAP HANA which is a data-centric intelligence platform. (SAP 2018, 3) In 2015 a new ERP system SAP S/4HANA was introduced which is developed

to run completely on HANA platform. It is used as a foundation for other SAP and partner business functions to enable seamless integration and shared capacities. (Frost & Sullivan 2018, 3) S/4HANA offers opportunities to connect it to new solutions, equipment, and technologies such as artificial intelligent (AI), blockchain, and internet of things (IoT) (Lowson 2019).

According to Singh (2017) existing ERP users need to move to the intelligent ERP and adapt their hardware architecture and redesign the business suite for the digital world. The leading research provider International Data Corporation (IDC) has predicted in their technology spotlight report that by 2023 half of the public companies in Forbes Top 2000 list will refresh their systems because of the need for an intelligent ERP (Rizza & Permenter 2019, 1). In addition, SAP made a decision that by 2027 the support for SAP ECC will end and all the existing ECC customers needs to transit to S/4HANA (SAP Support 2020). According to report by IDC this will lead the number of ERP implementations to increase during the upcoming years (Rizza & Permenter 2019, 1).

Existing SAP customers who are planning to adopt the SAP S/4HANA have two options for the implementation, they can either convert the existing SAP system to S/4HANA or build the new system from the clean core (SAP 2019, 15). The new implementation is referred as a greenfield implementation. In addition to new customers greenfield implementation is a good option for the existing SAP customers since it gives a possibility to reengineer business processes and to go back to standard by adopting the leading best practices (Kulkarni 2019, 7; SAP 2019a, 16). A brownfield implementation where the existing SAP customer is converting the previous ERP system to SAP S/4HANA requires much less remapping effort thus it is less expensive option. The brownfield strategy is suitable for customers whose current business processes are optimized and meet the needs of the business (Singh 2017; Kulkarni 2019, 9–10). As mentioned earlier, this thesis focuses to study only greenfield implementations.

3.2 Life cycle of ERP system

ERP system's life cycle should be introduced first to better understand the ERP implementation project. Zwicker and de Souza (2005, 200) present the four stages of ERP system's life cycle

which are decision and selection, implementation, stabilization and utilization. The Figure 6 presents the relationship between these stages. The stages are closer examined in this chapter.

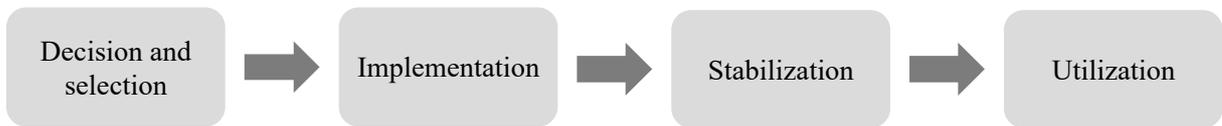


Figure 6. ERP system's life cycle (adapted from Lau 2005, 200).

Decision and selection

At the first phase of the ERP system life cycle a company makes a decision that they will introduce an ERP system to their operating environment, selects a desired ERP system vendor and a supplier who will deliver the system. An implementation plan is part of this phase after the supplier has successfully been selected. The planning includes a project scope, goals, measurements, defining a project team and responsibilities and an implementation strategy. (Lau 2005, 200)

Implementation

In the actual implementation stage the modules of the system will be put into operation. The implementation stage involves all the activities which are executed from the implementation planning to the beginning of the operating system such as adjusting the business processes to the system, data conversion and loading the initial data, configuring the hardware and software and training users. (Zwicker & de Souza 2005, 201)

During the ERP system implementation there can be several installations of the ERP system (Kurbel 2013, 162). The system landscape in SAP ERP implementations is tiered, meaning the changes can be made in separate systems. The development items can be separated from test, training and production in a way they do not disrupt each other. Depending on the situation companies can choose how many tiers they want into their system landscape (SAP Help 2020). The Figure 7 presents SAP's ERP system landscape with three installations.

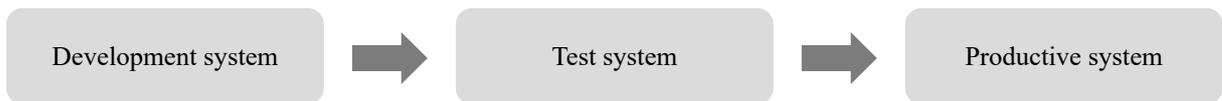


Figure 7. SAP's ERP system landscape (adapted from Kurbel 2013, 162)

In the three-tier system landscape the development system is used to configure the system to meet the company's functional specifications. The changes are exported to the test system where they are tested throughout. After successful testing the installation is adopted as a productive system (Kurbel 2013, 162; SAP Documentation 2020) Several landscapes improve the security of the implementation and the risks and problems in the implementation can be mitigated because changes are mainly made in one place and changes are tested in a separate system. (SAP Documentation 2020; SAP Help 2020)

The ERP system is a standard software and it incorporates best practices which are the vendor's most effective way to perform the business processes (Lau 2005, 38). SAP's best practice solution for ERP system is Model Company which is tailored specifically to accelerate and simplify the adoption of the system (Singh 2019). According to Grabot et al. (2008, 139) best practices are seen as standard processes which are considered as a major condition of successful implementation. Ideally, best practices can be implemented to any real business process scenario without programming by configuring parameters and master data (Ali & Miller 2017, 673). However, it is not always possible to map the business processes with standard configurations because every company has different requirements, meaning often that standard does not fit with their needs (Gronwald 2017, 63; Kurbel 2013, 159). According to Kurbel (2013, 159) company who is implementing ERP system can either:

- modify the system to correspond their needs by customizing the solution by doing additional programming or
- adopt the best practice solutions which often requires organizations to align and reengineer their business processes around best practices.

The consulting industry has an important role in supporting organizations implementing ERP systems. The ERP implementation requires a comprehensive preparatory work such as mapping company's requirements and defining organizational structures into the ERP system. The

definition of organizational structures needs to be done in concept supported by the ERP system. In addition, ERP implementation requires comprehensive knowledge of processes, functions, data and information technology. (Kurbel 2014, 159)

Normally, ERP implementations take place once in every 10 or 20 years thus the companies who are implementing the system do not have the knowledge, resources and expertise required to successfully implement the system. Therefore, it is recommended to rely on the expertise of external consultants especially with SAP's ERP and other SAP systems. (Kurbel 2014, 159) In addition, the organizational change management (OCM) has an important role in ERP implementations because implementing the ERP system results organizational changes that cause uncertainty and need to be managed carefully (Ali & Miller 2017, 673; Gronwald 2017, 64).

Stabilization

In the stabilization phase the company and its employees begin to use the system and it becomes a part of their daily life. The phase is crucial for the successful transition to the new ERP system as it includes the first moments after the go live. The stabilization period requires a large amount of managerial and technical effort. Many kinds of problems can arise in the beginning of the system operation such as operation issues, training deficiencies, and bugs in the system that were not noted in the earlier stage and there is pressure to solve arising problems rapidly. The length of this stage is normally up to eight weeks. (Zwicker & de Souza 2005, 201)

Utilization

Finally, in the utilization phase the system becomes an elemental part of all the company's operations. However, not all the possibilities have yet been recognized and implemented to company's daily operations. After a certain period of time a new ideas and needs can arise. Continuous improvement of the system will continue as new functionalities will be implemented to the ERP system. (Zwicker & de Souza 2005, 201)

3.3 ERP implementation strategy

Even though ERP solutions are supplied as pre-built software and with in-built business process functions, there is no industry standard strategy of how to implement ERP system. Instead, each organization approaches the implementation process based on their own business strategy and needs. (Ali & Miller 2017, 676) ERP implementation approaches have been categorized based on how the system is implemented to the existing solution (Nagpal et al. 2015, 3). According to Kurbel (2013, 215) before the implementation can happen company must choose whether the system is taken into use in one step or in multiple phases.

In big-bang implementation the ERP system is launched through the whole organization at once (Zwicker & de Souza 2005, 204). The strategy where the system is implemented gradually is referred as a phased-rollout strategy. The phased-rollout strategy can be structured using different techniques based on company's strategic business goals, timelines and resources. (Dunaway 2012, 51) The rollouts can be modular where system is implemented module by module, functional where group of modules are implemented at a specific point or it can be unitary by implementing a module group unit by unit, department by department or division by division. (Zouaghi 2012)

ERP implementation strategies vary depending on the organizational structure of the company. Small businesses are easily leaning toward big-bang approach whereas large companies implement the system incrementally to have more control on the implementation. In addition, factors such as the complexity of the business, organizational and hierarchical structure, the industry and business culture have to be considered when the strategy is selected. (Zouaghi 2012)

With the big-bang implementation strategy the transition time to the new system is reduced but often the big-bang implementations are more complex and have higher risks. As a result, a large amount of effort is required in the stabilization phase to stabilize the system. The complexities and risks in the implementation can be managed with the phased-rollout strategy. However, one of the disadvantages of phase-rollout strategy is that the implementation with multiple releases

often takes a long time. (Zouaghi 2012; Zwicker & de Souza 2005, 204) The Table 3 summarized the main advantages and disadvantages of both strategies.

Table 3. ERP implementation strategies (Zouaghi 2012; Zwicker & de Souza 2005, 204).

	Big-bang implementation strategy	Phased rollout implementation strategy
Strategy description	<ul style="list-style-type: none"> • ERP system is implemented in one cutover 	<ul style="list-style-type: none"> • Multiple cutovers and releases (modular, functional or unitary)
Advantages	<ul style="list-style-type: none"> • Reduced transition time to new system • Eliminates the development of interfaces between new and old system 	<ul style="list-style-type: none"> • Failure can be mastered and possibility to return to old system • Defining priorities in implementation • Learning through experience
Disadvantages	<ul style="list-style-type: none"> • Complex implementation with high risks • Returning to the previous system almost impossible • Requires large amount of effort in stabilization phase 	<ul style="list-style-type: none"> • Implementation takes long time • Adjustments and changes during the project • Development of interfaces from new system to old required

The ERP implementation is a complex process because it includes both technical and organizational interactions (Kraljić & Kraljić 2019, 190). When selecting the most suitable implementation approach, organizations should not only be considering their resource availability but as well the readiness for the changes that ERP implementation will bring (Ali & Miller 2017, 676).

3.4 ERP implementation methodology

According to Nagpal et al. (2015, 1–3) ERP implementation methodology is collection of methods that help the organization to reach the desired target. It consists of well-defined processes that are used in managing the implementation process. The methodologies offer tools which are needed in conducting, planning and controlling the implementation process effectively and efficiently in order to have a successful implementation of ERP system. (Ganesh et al. 2014, 37–39)

According to Kraljić et al. (2014, 310) ERP implementation methodologies have similarities with SDLCMs but the main difference with ERP implementation methodology is it is not meant to describe how the system is developed but rather how it is adopted to the organization. Such as SDLCMs ERP implementation methodologies are based on a process model which describes a type of process that is modeled into phases. The phasing is used in order to structure such a large entity. The project phases describe the objectives, activities and stakeholders involved and also describes the order where the steps are carried out. (Kraljić et al. 2014, 310; Kurbel 2013, 160)

The implementation methodologies may include tools, templates and specific deliverables (Dunaway 2012, 46–48). The software tools represent all the factors and the interdependencies between the factors that need to be considered. Based on that the user is guided through the implementation process and reminded of the open tasks. (Kurbel 2013, 160) In the beginning of the project implementation methodology defines the organizations business needs and the visibility is maintained throughout the execution of the project. (Ganesh et al. 2014, 37)

ERP implementation methodologies have been designed with a possibility to scale them from a large multinational and multisite project to a small limited-size project with a constrained scope. It is flexible and extensible, and the methodology is possible to be tailored to match organization's specific needs. (Ganesh et al. 2014, 37) According to Kurbel (2013, 160) a company planning to introduce an ERP system has three different option when selecting the implementation methodology:

1. Work with an ERP vendor and apply a recommended product-specific implementation methodology
2. Work with an external consulting company and apply firm's own implementation methodology, or use the ERP vendor's recommended methodology
3. Work independently and use their own implementation methodology which have been applied when other software was implemented in the company.

According to Kurbel (2013, 160) ERP system vendors and consulting companies recommend applying a methodology that has been proven successful in previous ERP implementations.

Therefore, it can be said that the best option is to apply a methodology that is invented for a specific ERP product or rely on the expertise of consulting firms. (Kurbel 2013, 160) This thesis focuses on studying these options. SAP's implementation methodologies Accelerated SAP (ASAP) and SAP Activate are presented in the next chapter and in addition the chapter six discusses the consulting company's own implementation methodology which is based on the Activate methodology.

4 TRADITIONAL AND AGILE ERP IMPLEMENTATIONS

An ERP implementation project is normally large-scale and cuts across different business functions. Managing large-scale projects bring difficulties as projects are typically managed from different locations, in different time zones and by different user groups. (Chen et al. 2009, 159) Nevertheless, managing an ERP project is not the same as managing a large-scale IT project because the ERP implementation is not only about implementing a new system but is more an enterprise wide transformation journey (Alleman 2002, 70).

First, in this chapter the traditional ERP implementation and SAP ASAP implementation methodology, which follows waterfall software development practices, are presented. Second, the common challenges that traditional ERP implementations face are examined. Next, the agile ERP implementation and SAP Activate implementation methodology, which is based on agile methods, are presented. Lastly, the common challenges that are linked to agile ERP implementations are examined.

4.1 Traditional ERP implementation

Traditionally, ERP systems have been implemented using linear waterfall-based methodology where each phase is carried out after one has been successfully completed (Kralji & Kraljić 2018, 193). According to (Blick & Quaddus 2005, 136) SAP system is complex and the implementation requires a different kind of approach that other software systems. SAP brings its own culture which needs to be adapted to the organization's existing culture. (Blick & Quaddus 2005, 136)

SAP ASAP implementation methodology

The ASAP methodology was introduced in the 1990s as a result from experiences and insights from consultants, customers and SAP employees who had been involved in SAP ERP implementations. At that time many of the implementation projects were running long and exceeding their budgets and some projects even completely failed. In order to answer this, SAP

created a methodology which would assist companies to implement the ERP system successfully. (Kurbel 2013, 161)

The standard ASAP methodology is completely based on waterfall project management principles (Kraljić & Kraljić 2018, 193). The ASAP methodology consists of toolbox with computerized tools and supporting features which were designed to simplify the implementation process and help to implement the system quickly and efficiently (Capaldo & Rippa 2009, 647; Kurbel 160). The ASAP roadmap describes the five-phased process model of the methodology which is presented below in the Figure 8. Each phase includes concrete specifications for planning the phase and for project management purposes (Kurbel 2013, 161).

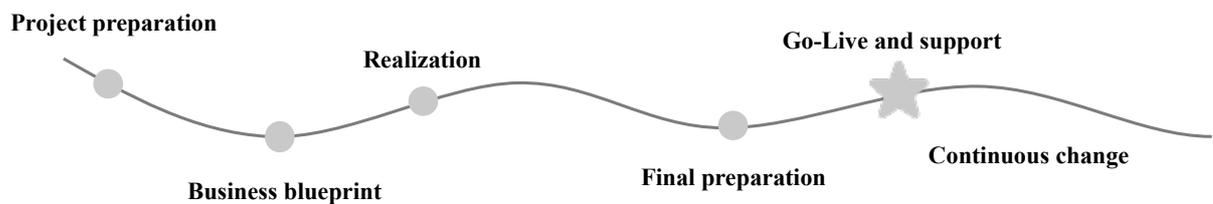


Figure 8. ASAP methodology phases (adapted from Kurbel 2013, 161)

The first phase in the ASAP roadmap is the project preparation which includes all the planning and preparations in the implementation program. This includes defining the scope, creating project plan, setting the project organization and steering committee and assigning resources to the project team. (Kurbel 2013, 161) The main tasks to be completed by the end of the phase are identifying the project objectives, building a capable project team and getting buy-in from stakeholders and senior management (Singh 2017).

In the second phase of ASAP methodology the business blueprint, which is an abstract description of the future system, is created. The conceptual design of the solution will be done in this phase and the blueprint includes analysis and design documents that are used in the realization phase of the project. Detailed project requirements are specified through interview sessions or in requirement workshops together with experienced consultants and employees involved in the process area. The requirements are compared to ERP functionalities and for the requirements which cannot be mapped to the system are discussed separately. The main focus in the business blueprint phase is to define and document company's business processes. For

this purpose, SAP offers reference model which contains typical business processes and available system functions. Moreover, the phase includes developing the system landscape, creating organizational level structure, defining data interfaces and specifying data conversion needs. Before the phase can be marked successfully completed the quality of the phase is checked. (Kurbel 2013, 162)

In the realization phase the requirements, specifications, and design decisions that were done in the business blueprint phase are implemented. The phase is the most time-consuming and most of the work involved in the implementation happens in the realization phase. The realization phase is executed in a two-step approach. Firstly, the general configurations are done wherein organization fit in to the standard software. Secondly, the provisions for the functions that are not covered by the standard software will be made. In addition, data conversion and bridge programs as well as individual system extensions, reports and forms are developed, and authorization concept is created. Testing is completed, and necessary user documentations and trainings are determined and prepared. Lastly, the quality of the phase is checked. (Kurbel 2013, 163)

In the final preparation the aim is to ensure the system's readiness for cutover and go-live and the cutover from the previous system to the new one is carefully planned. Final testing, transferring and converting the data from the previous system to the new one and user trainings are essential part of this phase. (Kurbel 2013, 164) The phase is completed when mock rehearsals are successful, workload testing is completed, and end users are trained (Singh 2017). In the last phase the actual installation of the ERP software happens. The main focus in the tasks is to ensure that the ERP system runs smoothly and supports users. After the new system has been implemented errors and shortcomings can arise which are either dealt immediately or issues are saved and resolved later. (Kurbel 2013, 164)

The smooth run of operations can be included to be part of the ASAP methodology. In the run phase the continuous operability of the solution is ensured. (Singh 2017) The continuous change will go on because the first implementation of the ERP system will not be the last as ERP system changes over the course of its lifetime. New findings, experiences and requirements can come up and more projects will follow. (Kurbel 2013, 165)

4.2 Suitability of traditional ERP implementation methodology

Critical success factors (CSFs) are conditions which must be met in order for ERP implementation process to be successful. The CSFs present managerial or enterprise areas that need special or continued attention to bring high performance in organization's activities because the CSFs have direct influence on the project outcome (Ali & Miller 2017, 673–674). Understanding the common challenges in ERP implementations by focusing on the lessons learned helps organizations to mitigate risks associated with the implementation and not to exceed the budget and schedule (Ranjan et al. 2016, 389). In the literature several reasons for the challenges that occur in the ERP implementations are recognized.

According to Daneva and Wieringa (2008) complexities and challenges associated with ERP implementations are due to the nature of ERP systems. For many organization ERP implementations can be difficult, time-consuming and expensive. The failure is common even among ERP implementation projects with the most favorable conditions. (Ali & Miller 2017, 672) One of the most common cause of failure in ERP implementations is a combination of poor planning and high system customization (Ali and Miller 2017, 680). The planning and scheduling are challenging in traditional ERP implementation projects because everything needs to be identified upfront. However, as the projects take even years a lot of updates are required to the schedule. Traditional ERP projects require a huge project management effort because continuous planning and status monitoring is needed. (Robson 2013, 23)

According to Robson (2013, 22) is it very difficult to create estimates on complex SAP implementation projects hence most of the traditional implementation projects run over the budget. The aim in waterfall projects is to identify all the possible design and scope details in blueprinting phase prior any development takes place, but it is very unlikely that no changes will be identified during the realization phase. At the beginning of the project, where the requirements are captured, customers' understanding of the implementation project is minimal. A long time passes until the requirements are realized, and the customers' understanding grows along the project, meaning it is likely that changes to the initial requirements and business needs will occur. (Robson 2013, 22)

Often ERP implementations suffer a failure in redesigning business processes and there is a lack of clarity about what is required in the implementation. The organizational changes that ERP implementation brings needs to be managed carefully because if change management is not handled well ERP projects might even fail. (Ali & Miller 2017, 673) According to Ranjan et al. (2016, 394) most of ERP implementation failures are people related rather than technological issues. The key questions related to OCM are how to integrate the ERP system, what should happen to the legacy applications, and how the business processes should be revised. Having realignment strategy is necessary because the inability to answer these questions causes technical and administrative problems, delays in the system implementation and in the worst-case scenario may even result to the project failing. (Ali & Miller 2017, 673)

According to Wijaya et al. (2019, 514) one of the factors that cause ERP implementations to fail is poor project management effectiveness. In addition, Casanova et al. (2019) pointed out that many organizations do not have the experience that is required on managing large multivendor IT projects, they fail on setting up the project governance and do not understand what kind of input is required from business sponsors. Due to these limitations, organizations find it difficult to meet their business needs which were set in the beginning of the ERP implementation project. (Casanova et al. 2019; Wijaya et al. 2019, 514)

Typically, teams in traditional ERP implementation projects are structured along technical lines which according to Robson (2013, 23) creates huge challenges if the tasks run late. When one part of the solution is delayed the downstream team is unable to perform their tasks. As delays are common in traditional ERP implementations it means that teams have to deal with a lot of pressure to meet the targets before the deadline. The pressure to meet the timelines only increases towards the end of the project. (Robson 2013, 23)

Stender (2002, 908) believes the implementation of ERP systems should be much faster and more efficient than building the required functionalities from scratch because ERP systems are considered as pre-packaged software solutions. According to Wijaya et al. (2019, 514) the main reason for the challenges and complexities in ERP implementations are related to the implementation methodology. Waterfall approach causes delays to the project's value realization and challenges may lead the implementation projects to go on for even five to ten

years. (Casanova et al. 2019). For this reason, agile methods should to be considered in order to improve the quality of ERP implementation (Wijaya et al. 2019, 514).

4.3 Agile ERP implementation

Agile has a successful history in managing and developing software systems, and over the last years agile adoption has grown significantly in a custom software development. The transition to agile has been slow in ERP implementation projects as ERP systems are very different from other software systems. However, agile in greenfield ERP implementations bear a lot of opportunities to the implementation projects. (Fair 2012; Misra et al. 2016, 40)

According to Fair (2012) ERP vendors have commonly instructed the preferred implementation approach for their product. As waterfall approach have been the main delivery approach for over 20 years the implementation partners have adjusted their implementation methodologies to match with these preferred methods. (Fair 2012) Over the years the business expectations for ERP implementations have changed and today customers are requesting shorter time to value and reduced implementation costs. Customers want to perceive the value incrementally and are no longer willing to engage with the high risks of big-bang implementations that often waterfall implementations are. Moreover, customers want flexibility and options to their implementations. (SAP 2018a, 4)

Nowadays, ERP vendors such as SAP and their implementation partners are promoting agile approach for implementing the ERP system (Casanova et al. 2019). By using agile methodology, the value in the ERP implementation is delivered incrementally in multiple releases which leads cost and effort savings as well as faster deployments and reduced risks (SAP 2018a, 5). However, the scale and complexity of SAP products makes it necessary to scale agile software processes (Schnitter & Mackert 2011, 216). This chapter presents the SAP Activate implementation methodology which follows agile principles.

SAP Activate implementation methodology

The SAP Activate is the first agile based framework for SAP's ERP implementations. Initially the SAP Activate was introduced in 2015 and it has become the successor for the ASAP methodology (Kraljić & Kraljić 2018, 193; Singh 2017, 27). The SAP Activate is more than just methodology because it offers best practices and tools for guided configuration for S/4HANA (Bardhan et al. 2019, 458). The framework supports the deployment of S/4HANA for on-premise, cloud and hybrid environment (Singh 2017). As mentioned earlier, this thesis focuses only studying the implementation of on-premise editions of the SAP's ERP software.

The agile methodology utilizes sprints which enables more efficient and higher quality delivery and reduces the risks associated with the implementation. In agile the project phases are incremental whereas in waterfall methodology the project phases are sequential. (Bardhan et al. 2019, 460) The Activate methodology has been structured into phases, workstreams, deliverables and tasks. The main phases of the Activate methodology are prepare, explore, realize and deploy. Additionally, two more phases can be included to the implementation which are discover and run. (Singh 2017) All the six phases of the Activate methodology are presented in the Figure 9.

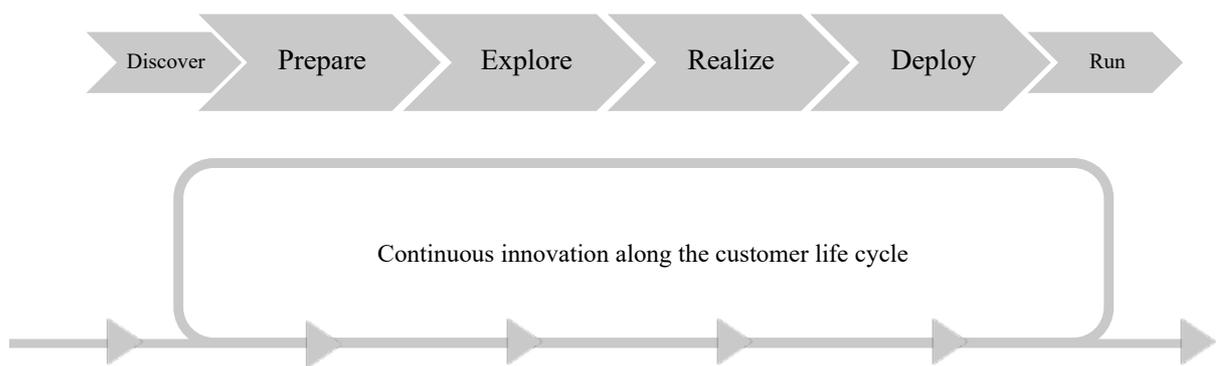


Figure 9. SAP Activate methodology phases (adapted from EurSap 2018; Singh 2017).

In the Activate methodology the work starts from the best practices that offer simplification and speed to the implementation of S/4HANA as the adoption of the system is fairly complex. SAP Model Company includes standardized ready-to-run business processes which have been adopted, tested and explored for years. In addition to Model Company, SAP's implementation

partners offer additional best practice solutions which customer can utilize in the prepare phase when they are working together with external implementation partners. To be able to start the work with best practices preassembled version of SAP S/4HANA system is needed where the solution can be explored. Either on-premise sandbox system or cloud-based ready to run solution is available for these purposes. (Bardhan et al. 2019, 465–466; SAP 2018a, 6; Singh 2017)

Optionally, the ERP implementation can start with the discover phase. The discover phase gives customers a possibility to experience and try out the system before the actual implementation begins. The phase helps to better understand the business value and benefits of implementing S/4HANA, and target technology architecture and the implementation strategy can be already defined. SAP offers a role-based trial experience which is based on pre-configured business scenarios. (EurSap 2018; SAP 2018a, 8)

The first actual phase in the Activate methodology is prepare where the project is kicked off and planned. In the phase project plan is created, project goals are defined, business value objectives of the implementation are identified and quantified. Moreover, the phase includes nominating the project team and the responsibilities within the team, ensuring executive sponsorship and project standards and setting up project governance and organization. (EurSap 2018).

In the explore phase the business users explore the best practices and standard processes. The best practice solution functionalities are explored against customer's requirements in the fit-gap analysis in order to evaluate how well the standard solution meets with the company's business needs. The target is to leverage standard business processes as much as possible and have a standardized solution. The business users and the consulting company agree on the configurable objects as the areas which are not covered by best practice solution need to be aligned with the specific business process requirements that customer have. (Bardhan et al. 2019, 467–468; EurSap 2018)

In fit-gap analysis the key is to recognize what needs to be build and what can be done by configuring the system. Based on the findings, the solution is scoped and required content is

being activated. (SAP 2018a, 8) The fit-gap analysis has replaced the costly blueprinting phase from the ASAP methodology where the solution was designed based on customer requirements (Napgale et al. 2015, 5; Singh 2017). Utilizing fit-gap analysis makes the scope validation more efficient and faster. In addition, the explore phase includes master data load preparation and initial preparations for testing and training needs (EurSap 2018).

In the realize phase the business requirements which were identified in the explore phase are implemented to the system. The realization is the first actual development phase of the project where agile sprints are used in configuration, custom-made developed coding and required testing. The phase is often referred as build and test, and agile methodology allows shorter configuration and build cycles. The integration to business functions is tighter and feedback is collected from the stakeholders. The first objective is to ensure that a minimum viable product (MVP) is ready for the use and later additional features can be added around the solution in upcoming sprints. (Bardhan et al. 2019, 468, Kraljić & Kraljić 2018, 194)

The realize phase includes loading the master data and testing the custom-developed objects. The key business users are trained to be trainers, using train the trainer approach where the key users will later provide trainings to the end-users. The end-user trainings are also planned. The end-to-end integration testing with all the different SAP components are done in this phase to ensure the data and information flows' completeness and correctness. (EurSap 2018)

In the deploy phase the final preparation and execution of cutover activities are done before the system is released into the production. It is essential to ensure that the users, system and data are ready for cutover. The end users are trained, final master data is uploaded, roles and authorizations for business users are validated and the sites are prepared for the transition. Before the actual go-live happens, a dry run should be performed to identify any challenges that might occur in the actual cutover. Finally, the support is launched before the final handoff to business users. (Bardhan et al. 2019, 460–470; EurSap 2018; Kraljić & Kraljić 2018, 194; SAP 2018a, 8)

In the run phase the system operation, monitoring and support takes place. S/4HANA system is further stabilized and the possible issues and errors in the system will be corrected. To ensure

smooth operations and running of the system a dedicated IT or SAP helpdesk can be established and the business users work closely with the internal SAP support and external consultants. (EurSap 2018)

4.4 Suitability of agile ERP implementation methodology

Misra et al. (2016, 40–42) envision that agile will be mature and popular project management methodology within the decade. Not much research has been done on the topic of agile in ERP implementations but it can be indicated that adopting agile practices would result to reduction of time-to-market for new products, improvements in the product quality and predictable as well as innovation of products and business processes. Agile brings flexibility to the ERP implementation allowing developers to go back one or more steps to do changes in order to fix the problems that have occurred. Ability to do go back and do changes reduces the time of delays in the implementation. (Misra et al 2016, 41–42)

According to Stender (2002, 908–908) applying agile methods allows better organizational learning when users are actively involved in the implementation process. Active involvement helps the organization to collectively identify the advantages and potentials of the new system which leads to more precise and better qualified requirements for later iterations when these are based on practical experience and knowledge about the system. (Stender 2002, 908–909)

However, Stender (2002, 909) also points out not all application areas and software systems are equally suitable for incremental implementation approach. In addition, Alleman (2002) sees fundamental conflicts between agile methods and ERP project requirements. In the traditional ERP projects the project requirements need to be set in the early stages even before the system development whereas in agile the feedback is collected continuously from customers even if it results changing the initial requirements. (Alleman 2002) It is seen that as ERP is a standardized software, applying an approach designed for constantly changing and unknown requirements is not applicable (Casanova et al. 2019).

According to Kraljić and Kraljić (2018, 190) it is commonly believed that ERP systems cannot be part of agile development due to their complexity and nature. It is seen that agile

methodology cannot be applied to ERP implementations because ERP implementations are too big and complex to be managed and delivered by small agile teams (Casanova et al. 2019). It is seen that agile cannot provide the same level of documentation, compliance and approvals to the project as waterfall approach does (Roberts 2016b).

Agile requires team members to be physically in the same room. Often, in ERP implementation projects teams are distributed with a mixture of local workforce and outsourced vendors, meaning getting the teams to be physically in the same room would be a struggle. For that reason, according to it is seen that agile cannot work in an SAP project environment where the teams are not physically in the same place. (Roberts 2016b) Moreover, the SAP's ERP system consists of a large amount of integrations between business processes. The work may be distributed across different teams which may cause challenges to the implementations, and it is seen that agile cannot work in a situation like that. (Roberts 2016a)

Agile would require from ERP projects for short, early and continuous delivery of products (Misra et al. 2016, 41). It is believed that highly integrated ERP requirements cannot be broken down into user stories which are developed and tested in short sprints based on agile practices. According to Casanova et al. (2019) one common belief is that ERP system cannot be delivered incrementally to end users as they would not be able to perceive any value before it has been fully built and integrated. (Casanova et al. 2019)

According to Misra et al. (2016, 41) even traditional ERP projects tend to run over the project schedule for one to two years. As agile method allows changing the initial requirements and require short and continuous delivery of the product and it is important to first address the challenges related to meeting the project timelines in traditional projects. (Alleman 2002; Misra et al. 2016, 41) According to Roberts (2016b) it is believed that agile method adds risks to the ERP implementations where the stability and resilience are seen as the keys for successful implementation.

5 THE RESEARCH METHODOLOGY

This chapter presents of the used research methods for the empirical part of the thesis. Firstly, the selected research methodology, the research interview using semi-structured interviews, is presented. The data collection part describes how the semi-structured interviews were conducted, interviewees were selected and presents the interviewee profiles.

5.1 Research methodology

In the research interview the discussion between two or more persons helps the interviewee to gather valid and reliable data relevant to the research questions and objectives. In addition, interviews can be used to refine the ideas in the field where the research questions and objectives have not been fully formed. (Saunders et al. 2016, 388) There are several types of interviews. Interviews can be formalized and structured with standardized questions to each interview, or they can be informal and unstructured conversations. Saunders et al. (2016, 390) categorize research interviews as:

- structured interviews
- semi-structured interviews
- unstructured or in-depth interviews.

In the structured interviews the questions are same for all the interviewees and the questions are always asked in the same order. The researcher should ask the questions exactly as written with always with the same tone of voice in order not to indicate bias. Because of the nature of the structured interviews, are often also referred as quantitative research interview. (Saunders et al. 2016, 390–391)

In the semi-structured interviews, the researcher has a list of themes with possibly supporting key questions which might be covered in the interview. However, not all the interview questions are asked every time and the order of the questions can vary depending on the flow of the discussion. The unstructured interviews are informal and used to explore in depth the area which the researcher is interested. There is no predetermined list of questions, although the

researcher has a clear idea of the aspects that should be explored. The interviewee has an opportunity to talk freely of the topic area. The semi-structured and unstructured interviews are often referred also as qualitative interviews. (Saunders et al. 2016, 390–391)

Since this research is exploratory and the purpose is to find out the role of agile approach in the ERP implementation projects, the chosen research methodology is qualitative, and interviews are conducted as semi-structured interviews. The methodology was chosen because the questions are complex and open-ended, and there is not a one single answer to these questions. In addition, there is a possibility that the interviewees might lead the conversation to the topics that researcher has not previously considered but are significant to the study and might help to formulate the research question and objectives. (Saunders et al. 2016, 394–395)

Reliability and validity are the consideration about the quality of the conducted research. Reliability refers to the replication and consistency of a research, meaning if the research was repeated by another person, would the findings of the research be same. On the contrary validity of a research refers to the appropriateness of the research measures, accuracy of data analysis and generalizability of the findings. (Saunders et al. 2016, 202) The data quality in semi-structured and in-dept interviews should be considered because data quality issues are associated with these types of interviews (Saunders et al. 2016, 396). The reliability and validity of the conducted research is considered in the chapter 7.2.

5.2 Data collection

The qualitative data used in this study was gathered by interviewing six experts on the role of agile in ERP implementations during July and August in 2019. The number of interviewees were limited to six because it was seen that no new findings would come out by interviewing more experts. The semi-structured interviews were conducted as face-to-face or online meetings. The interview was an open discussion based on the themes presented in the Appendix 1. The interviews did not follow any transcription but in some interviews more detailed questions were asked from the interviewee in order to guide the discussion to the desired research topics.

The data collection started by exploring potential interviewees. When a potential interviewee was recognized, the person was contacted via email and interview date was agreed on. In order to help interviewees to prepare for the interview the interview themes in Appendix 1 were provided to interviewees latest by two working days before the interview session. Interviewees were selected based on two main criteria: the interviewee had experience from both agile and traditional waterfall software projects, and the interviewee had several years of experience on ERP system implementations with SAP's ERP system. Preferably, the interviewee had also participated on agile ERP implementation. Interviewee profiles are presented in the table 4 below.

Table 4. Interviewee profiles.

Interviewee	Job title	Agile project roles	ERP experience
A	Associate Partner	Scrum Master, Technical Lead	20 years
B	Managing Consultant	Functional Lead	25 years
C	Associate Partner	Delivery Executive	15 years
D	Managing Consultant	Scrum Master, Functional Lead	18 years
E	Associate Partner	Delivery Executive	25 years
F	Senior Project Manager	Scrum Master	20 years

All of the interviewees work for Company X which is a multinational information technology company which offers business, strategy and technology consulting services. Company X is one of the leading companies in the global transformation. It offers capabilities and services that enable digital transformation with multiple solutions including SAP. Company X is one of the SAP partners globally and has released agile framework for ERP implementation.

Interviews were recorded with the permission from the interviewee. In the beginning of each interview a short introduction of the research itself was given and the research questions, scope and targets were explained. The data analysis started by transcribing the recorded interviews which was started immediately after each interview. The transcribed interviews were summarized under key themes which are presented in the next chapter.

6 DATA ANALYSIS AND RESULTS

In the following chapter, the conducted interviews are analyzed and formed as a single analysis. The interview discussions and results are presented and analyzed under five key topics are formed in a way they help answering the research questions of this thesis.

6.1 Agile ERP implementation methodology

Company X's implementation methodology is designed for SAP S/4HANA on-premise edition. It leverages a pre-assembled best practice solution which is built on top of SAP Model Company. The implementation methodology has been developed by combining SAP's and Company X's experiences from the large number of implementations that have been executed over the years. By exploiting these experiences, Company X has introduced more capabilities to the SAP Activate methodology, adding more sprints and capabilities into the MVP product and how they are delivering the approach. In the interviews, interviewees discuss both Company X's implementation methodology and the Activate methodology because both methodologies are based on similar modelling.

Today, the standard ERP implementation approach is a hybrid which combines waterfall and agile principles. Even though the implementation methodology is not fully agile because it utilized also waterfall capabilities, it is referred as agile methodology by the interviewees. The agile methodology follows agile set of principles, focusing on thinking the outcome and the solution first. Interviewee A remarked that the goal with the agile methodology is to go back to standard as much as possible which means that the aim is to minimize the need for custom change. Customers should adopt the standard best practice processes instead of requesting a detailed design effort to customize the solution for their needs. Thus, with the agile implementation methodology, the best practices are adopted except for the areas which are really unique for the customer.

Interviewee B highlighted that executing ERP implementations with the agile approach is very different from what it used to be with the traditional waterfall approach. A lot of the work that has been done in the end of the waterfall project has now been shifted to the beginning of the

agile project. With the agile methodology the system is really used from the beginning because the work starts from the best practice processes, whereas in the traditional ERP implementations the system is available only after it has been completely built. According to interviewee C the best practice system is the reason why the agile approach can be utilized in the ERP implementations nowadays. The customized solution is associated with high costs and adopting the standard solution leads to cost savings.

Interviewee E explained that the Activate implementation approach has landed as hybrid based on the lessons learned from the earlier implementations. Traditionally the ERP system has been implemented using fully waterfall approach, but this has been a mis-success. In addition, S/4HANA has been tried to implement using fully agile approach which also did not succeed. It was learned that one single approach does not fit ERP implementation programs which are large and complex by nature.

Interviewee A remarked that ERP systems are highly integrated business critical applications that cannot be completely agile because they are controlled and largely integrated. This sets limits on how broadly agile can be applied. Interviewee E supported this by pointing out that not everything in ERP implementation projects can be managed in the same way because projects are very large and complicated with a lot of separate moving parts and tasks function in a different life cycle. From the functional point of view the ERP implementation approach is agile but there are parts in every implementation which are better suited for waterfall. According to interviewee C the main reason for this is the alignment when the tasks are needed to be completed from the overall development stage perspective.

The tasks in the ERP implementation project which are more linear, have a long lifecycle and are critical because they have to be performed at a specific point of the program are typically better suited for waterfall. According to interviewee C and E certain tasks around infrastructure, data centers, data migration, security, building, testing, and OCM have these characteristics. On the other hand, the business process streams in the ERP implementation are better suited for agile, and the design, code, test and deploy of the business processes are run together with the customer in parallel streams in sprints.

Giving an example why sprints should not be utilized for all the work in the ERP implementation, interviewee E pointed out building the data centers and laying out the infrastructure. The actual work for building the data centers and laying out the infrastructure in the program takes from six weeks to two months. Breaking that work into sprints is unnatural and unnecessary rework because the actual build takes too long. Running the work in sprints would lead it to fall apart hence waterfall offers more suitable tools for managing that kind of work.

Even though the standard ERP implementation approach is hybrid it left to the programs to decide the extent of how certain things are managed. According to interviewee E the client culture, the size of program, the solution structure as well as what is being done and how it is being done are subjective factors which dictate a discussion in the implementation program if things are managed in agile or waterfall manner. Interviewee A added to this by saying that the key questions are what is the business appetite to deliver the project agile, the business criticality, how integrated and innovated the system is and what is the impact if the project is not delivered on time. The balance in the ERP implementation projects that Company X runs with the hybrid implementation methodology are around 60 to 75 percent agile and 20 to 25 percent waterfall. The responsibilities within the program and how the program is managed tend to follow the same balance.

6.2 Waterfall ERP implementation methodology

ERP system has been implemented very carefully in a controlled way because the system consists of lot of integration within the application. Interviewee A pointed out the ASAP methodology is a proven, well-rehearsed and well-documented process but the challenge with the methodology is that the implementation would take a long time. Interviewee F supported this by saying that in the waterfall methodology SAP has harmonized the processes, procedures and instructions for the documentation that is created along the implementation project. In addition to excellent ERP software one of the reasons why SAP has succeeded is that they have invented the ASAP implementation methodology which guides the implementation process.

Interviewee E explained that initially the ASAP methodology was introduced to cope with the challenges that ERP implementation programs were facing in the 1990s. At that time a large number of companies were moving to the integrated ERP system for the first time, and there were not enough qualified people running the programs that as a result started to fail. In order to react to failed implementations, SAP created the ASAP methodology which was the first SAP best practice methodology around having a successful implementation of an ERP software. The methodology was based on the lessons learned from the failed implementation projects.

At the time the first ERP implementations were happening, it was also the first time the companies were moving to integrated solutions, as interviewee C mentioned. Typically, before implementing the ERP system customers had point solutions, meaning they had separate solution for supply chain, finance and order to cash process. The implementation followed the waterfall process where at first the requirements were gathered, then the blueprint created from as-is to-be solution followed by the actual implementation where all the requirements were implemented. The requirements that were implemented at that time were relatively new because the companies did not have the integrated system yet in place.

A large number of ERP implementations were done 20 to 25 years ago when the waterfall was the predominant approach. Interviewee E remarked that at the time the ASAP methodology was introduced there were no terms such as rapid development and agile. Thus, the main reason why the waterfall method was used early on until fairly recently is that it was the standard in the industry without other alternatives. Moreover, interviewee A pointed out traditional ERP implementation projects have been largely waterfall because the nature of the ERP landscape is highly integrated which supports waterfall implementation methodology well.

At the time the agile method was first introduced there were a lot of growing pains with socializing the concept into large-scale projects. Initially, agile was adapted quickly by young junior programmers working on small applications. According to interviewee E a lot of resistance to agile was caused by senior business and technology people who understood large ERP implementation programs. They did not feel like agile was something to be taken seriously with the large multi-year ERP implementation programs. Thus, agile took off but it stayed with

the relatively small and simple discrete life-cycle type of technology and waterfall coexisted as the predominant approach for large multi-year programs such as ERP implementations.

According to interviewee A a number of new questions started to emerge to the classical delivery model which started the journey toward agile in the ERP landscape. Customers were requesting faster and cheaper results, more efficient implementation projects and to have a better user experience which initiated the move from the classical delivery model towards more agile delivery model. The agile methodology for implementing ERP was published at the time SAP S/4HANA was introduced. Along with the development of the new ERP system, SAP redesigned implementation approach and presented the Activate methodology, making a transition from waterfall to agile. According to interviewee E by presenting the next generation ERP system S/4HANA SAP is again expecting a big spike in ERP implementations. Based on the lessons learned and how implementations failed in the early 1990s, SAP is being prepared with the new modern and agile implementation approach.

Historically customers have always wanted a design effort for the ERP system to match with their business needs. Often what was being done was based on things that were already existing in the best practice solutions. Interviewee C pointed out that customers' willingness to adopt the standard by using the best practice processes is the biggest difference why ERP can be implemented with agile approach today. According to interviewee A the waterfall is a good option for the foundation projects which are the first implementations because it consists of lots of controls and checks. If there is an existing project and existing system, there is possibility to go fast and apply agile principles.

Interviewee B pointed out that Company X does not choose anymore between agile and waterfall methodologies for implementing ERP, and the only approach they use is agile. In addition, interviewee C explained there is not any type of greenfield implementation projects where the waterfall implementation methodology would be more suitable option for implementing the ERP system than the agile approach. However, as an exception interviewee C mentioned an industry implementing ERP for the first time because in that case there would not be best practice solution available for the company's needs. But looking at the history of

SAP and the fact that its ERP system is persuaded across all the industries the scenario is very unlikely to happen.

6.3 Main value of agile in ERP implementations

One of the key benefits of agile in ERP implementation for interviewee C is the completion in shorter iterations. The work starts from the best practices which enables to visually see the results a lot faster in the system than what is possible with the waterfall approach. Similarly, interviewee A pointed out that building the solution in iterations leads to faster value realization because with agile approach there is a need to introduce MVP or some business incremental value at regular delivery rate. According to interviewee E it makes agile very effective way to get an outcome quickly as it forces both customers and consultants to make decisions quickly and move. Also, interviewee F highlighted that by using sprints customers get the value out of the project investments quickly.

Interviewee A remarked that agile gives a possibility to think through the business requirements in terms of user stories. This means the requirements are looked at from more persona driven perspective focusing on what they think, what they feel and what they say hence agile delivers the solution that matches with the users' needs. User stories fill in the product backlog which is cataloged according to what are the must have, should have, could have and would have user stories. The business stakeholders are adopted early into the implementation process and they are playing an important role in prioritizing the user stories.

The business stakeholders select the must and should items that are seen as the most important ones and those are taken into the early sprints. Interviewee A pointed out that prioritizing is essential as there is a limited capacity of team delivering the solution. The first output of the agile project is a small deliverable item, also known as a layer outcome in a layer solution. Along the project there is an opportunity to reprioritize and refocus on the parts that are seen as the most essential. This way, customer gets to see the outcome they desire first.

When the business is onboard continually the outcome is exactly what they are looking for, and there are no surprises when the solution goes live. In this way, agile gives a possibility to note

if something is not exactly what was expected. For example, customers may have different expectations of how the screen looks and interacts with the system, or how something is named in the system. Interviewee C remarked that in these cases agile gives an opportunity to get the feedback and response a lot more effectively during the project than what is possible with the waterfall methodology. Interviewee F supported this by saying that with agile there is an opportunity to fail fast if the result is not what was expected. Also, for interviewee D, the value agile gives is the visibility customers have about the work. Later on, there will be no surprises how the system feels or looks like. In addition, the solution is better when it is done together with customer in short iterations because seeing the system early makes customers to question the solution and realize what the functionalities that they really need into their ERP system are. Thus, the requirements will be more precise which makes the system to answer better to customers' needs.

On the other hand, looking at the waterfall projects interviewee A pointed out that at the time the business sees the solution up to eighteen months may have passed since the business gave their requirements, but the business conditions have not been moved on. Customers may be surprised on how the solution looks and feels like as long time has passed. Interviewee C remarked similarly that traditionally waterfall projects tend to be twelve months long and the output of the project can only be seen after eight months into the project. However, the requirements are set up in the beginning of the project, but the results are not seen until several months into the project which often is late.

According to interviewee A in the worst-case scenario even while the waterfall ERP implementation project is still running the functionalities are no longer what the business wants, meaning the business advantage is gone and the solution becomes automatically a legacy system. In addition, interviewee F pointed out that nowadays customers are no longer willing to invest into projects where the value realization takes such a long time. For interviewee B one of the problems with traditional waterfall-based implementation approach is that customers are only able to see the ERP system as described on paper in the blueprint phase. The system is only available after it is completely built but the customers are not able to fully trust the system until they had seen it.

On the contrary, agile gives a possibility to showcase the real business processes in the real operating system. With the best practice solution, such as Model Company, it can be promised to customers that from the moment designing starts the system can be showcased to them to demonstrate how the business processes work in a real life. Interviewee B remarked that even though the showcased business processes are not based on the settings of the customer, it can be showed in the general level, for example how the purchase order, purchase requisition process, the goods receipt and invoicing are done.

Showcasing the system has several benefits and combines multiple activities into one. According to interviewee B change management is affected early because from the moment the business processes are shown to the customer, they start to think what the impact of the standard processes on their organization is. Often, it results to the acceptance of the best practice processes being easier, and customers are willing to adopt the standard. Complementary, interviewee D pointed out the showcasing gives multiple benefits because customers learn how the processes work and how the system operates at the same time the system is shown to them. By showcasing the system customers can build their knowledge on the system and receive training at the same time.

Interviewee D remarked that the need for training the users becomes smaller or might even disappear in the agile ERP implementation projects because many customers have been engaged with project activities early on. Although customers might not use the system themselves, they learn at the time the system is showcased to them. Interviewee B supported this by saying that as showcasing happens early in the project the training is tied up already to the explore phase and the need to organize trainings later in the project becomes smaller. In addition, according to interviewee D the training that starts early and happens in small steps along the project is better, which usually is a side result of utilizing the agile methodology. On the contrary in the waterfall method the training occurs only later during the project.

According to interviewee E agile projects have much more oversight on how it is facilitated. Often, large waterfall ERP implementation projects struggle in meeting their deadline and the deliverables. The reason for this is that typically only two project managers and project management office (PMO) are responsible for managing the schedule, issues and meetings.

However, in a large implementation program the ability to have accountability is lost because an enormous group of people needs to be managed. Agile breaks people up into smaller teams and breaks the work products into smaller and more easily manageable pieces. No more the responsibility is focused only to the PMO because Scrum masters are pushing the responsibility of product functions into each team. Interviewee E remarked that this results in better visibility and accountability and drives higher productivity and higher degree of accountability.

Table 5. Main value of agile in ERP implementations.

Interviewee ID	Main value of agile in ERP implementation project
A	<ul style="list-style-type: none"> • Business stakeholders adopted early into the process • Project outcome is exactly what business is looking for
B	<ul style="list-style-type: none"> • Value realization is quicker • Seeing the system makes the acceptance of best practices easier • Combining multiple activities: training is tied up to the explore phase and change management is affected early
C	<ul style="list-style-type: none"> • Results can be visually seen early as the work starts from the best practices • Possibility for customers to give feedback and to react early
D	<ul style="list-style-type: none"> • The solution is built together with customers who have the visibility of the work • Learning happens along the project as the system is showcased and the training requirement becomes smaller
E	<ul style="list-style-type: none"> • Effective way to get the outcome quickly • More oversight on how the project is facilitated • Higher productivity and accountability
F	<ul style="list-style-type: none"> • Value realization is quicker • Customers are able to give feedback early • “Fail fast” -possibility

6.4 Main challenges in adopting agile into ERP implementations

According to interviewee B the lack of training is one of the reasons why the waterfall ERP implementation methodology is still used instead of agile. People are not aware of the new way of implementing ERP, meaning that they are not aware of the best practice solution and that is should be utilized when a new project is introduced. Similar findings came from interviewee D who pointed out that waterfall has been seen as a safe choice to propose to the customers because there has not been enough knowledge and capabilities in clients' nor consultants' side about the agile ERP implementation methodology. In addition, when the target system is as complex as SAP's ERP not everyone is able to see the possibility to work in agile manner.

In interviewee E's opinion the problems with introducing agile approach are mainly related to the change management and not that there would be many problems with the agile implementation methodology itself. The agile ERP implementation projects have challenges because of the comfort level that people have towards the waterfall implementation approach. Typically, ERP implementation projects have experienced senior consultants and project managers who are custom to work with the waterfall methodology since ERP has always been implemented using it. Having worked with the waterfall methodology for a long-time people have become custom to the methodology and its tools and are familiar with both the strengths and the weaknesses the methodology has. However, agile changes completely the dynamics of how the ERP implementation projects are run. As a result, a lot of effort is required to get people acclimated to the changes that agile methodology brings, and often the learning curve that agile creates has been underestimated.

The change has also an impact to the clients because agile ERP implementations are run with really high client participation. Typically, within the client organizations most of them have not adopted agile in a large organizational scope. Although the interest toward agile has been addressed, there has not been enough reasons to apply agile across the enterprise. Therefore, as remarked by interviewee E, clients do not understand what agile means and typically there is a lot of confusion early on to roles and responsibilities and how to work in this new methodology. Similarly, interviewee C stated that ERP implementation is the first time most of the customers are implementing agile for a large organizational wide scope. Nevertheless, many organizations

have experience from agile in narrower scope where they have been applying short iterations to solve a fairly narrow scope problems whether in form of Kanban, Scrum or Six Sigma. Similar thoughts came up in discussion with interviewee D who pointed out that challenges are result from the fact that for many organizations a large scope agile is still quite unknown.

Although some organizations have experience from agile, interviewee D highlighted that it does not mean they know how to work with it. Agile requires the support from business but often the connection to the business stakeholders is not working in a way it should. The people engaged with the agile ERP implementation project may have general IT knowledge on topic but do not understand the functional area that throughout it would be beneficial for the project. In Scrum the decisions need to be made rapidly in standups which is why there is a need to have the business stakeholders in the meetings who have the ability to make the decisions right away. If that is not the case, there is a need to go get the approvals for the decisions elsewhere which causes delays. Often, the extra time it causes means that the work will be shifted from one iteration to another.

Interviewee E pointed that some enterprises have challenges in adopting agile because they operate in a consensus-decision making model where everyone gets together, and decisions are not made until everyone agrees. Agile does not work in a client culture like that because it requires people who have the ability to make the decisions to commit. Otherwise, coming out of Scrum meetings there may be a need to revisit the decisions that were just made. In addition, agile requires a significant business sponsorship and engagement, and without it the agile projects might not get the necessary visibility in the record. According to interviewee A long running projects can suffer from something called agile fatigue where the organizational change, people moving out of their roles, need for a command or shift in the focus can lead to the situation where the momentum behind the agile model can fade.

According to interviewee A some of the customers are custom to work with the factory model where the requirements are collected and handed off to offshore delivery team who is driving the solution. However, agile does not work in a culture like that because it requires much more collaborative and coordinated ways of working. Similarly, interviewee E remarked that the fact that workforce is not physically in the same place is a huge gap that needs to be addressed in

the beginning of the implementation program as one of the fundamental assumptions of agile is that small highly empowered teams are physically in the same room where they can see each other and work collaboratively in efficient and highly structured way. The co-location is essential because the team is able to hear what others speak and work more collaboratively.

The biggest challenge in the agile ERP implementations is the lack of integration in the work because SAP is a fully integrated system as mentioned by interviewee C. There is a tendency to sub-optimize the overall solution if only dealing with agile in one functional area, for example order to cash, because the process has such a tight integration with logistics and warehouse management. Similarly, interviewee D pointed out the business functions cannot be built in a box because the ERP system is highly integrated, and the data associated with the different business functions cuts across the entire organization.

In the agile ERP implementations organizational problems may arise which is why the agile projects require the right governance. Interviewee C pointed out normally in agile software development projects the ideal number of team members is five to seven people but as ERP implementations are large-scale projects with a broad scope the team size for one functional area in SAP implementation can be from twenty to thirty people. Interviewee C pointed out that agile cannot be effectively run with teams of 20 to 30 people and the teams need to be broken down into smaller sub-teams and continue to come back together. However, the projects struggle with how teams are broken up and effectively brought back together in a way that they stay integrated.

According to interviewee E the feedback and complains that are received early from both the clients and the consultants is that the speed in the agile ERP implementation project feels uncomfortable. They feel like the project is moving too fast and they have to make irresponsible important decisions quickly which feels unnatural for them. In addition, traditional ERP implementation projects require people with different roles and skills to engage to project activities. According to interviewee F it may be challenging to form that kind of teams in the agile ERP implementations. Agile changes the way teams are functioning because teams should be cross-functional, and members should be able to take multiple roles.

Another challenge that agile ERP implementations have, according to interviewee E, is that the customers do not have the expertise and staff that is required to do agile projects in the best basic premises where all the people are physically in the same place. Customers have a knowledge gap inside the company because of the outsourcing and offshoring which occurred in the early 2000s. At that time the costs associated with IT personnel was not seen strategic and many functions were outsourced, and remaining staff offshored into local centers into areas such as Eastern Europe or India. Now for the first time in 15 to 20 years these companies are making a decision to implement a new ERP system and adopting agile. Not having the knowledge that is required to run agile projects means customers require a lot of help early on the implementation projects.

The problems related to the knowledge gap are not limited only to client organizations because Company X and other implementation partners as well as SAP have similar problems as mentioned by interviewee E. None of these companies have enough people physically in the countries where clients are based, meaning they are having challenges in staffing the agile ERP implementation projects and delivering the implementations as planned. What is left in the countries where the implementations are happening are mainly senior consultants who are really expensive and recent graduates who are inexpensive but do not have the required experience. Interviewee E explained that the people in the middle are the key for running a successful ERP implementation program.

Table 6. Main challenges in adopting agile into ERP implementations.

Interviewee ID	Main challenges in adopting agile
A	<ul style="list-style-type: none"> • The momentum behind agile can fade • Customers work in a factory model • Interfaces between the solutions put on brakes how agile to go
B	<ul style="list-style-type: none"> • People have not received enough training on the best practices and agile methodology
C	<ul style="list-style-type: none"> • Lack of integration in the work • Sub-optimizing the overall solution • Governance issues • Optimizing the team sizes
D	<ul style="list-style-type: none"> • Lack of integration in the work • The connection to business and not enough knowledge on agile • The inability to make decisions rapidly • Waterfall seen as a safe choice
E	<ul style="list-style-type: none"> • Senior people familiar with waterfall methodology • Clients do not understand how agile works • Clients operate in a consensus model and cannot make rapid decisions • Underestimating the amount of change management • Not having enough knowledge and personnel
F	<ul style="list-style-type: none"> • The integrated nature of the ERP system does not fully support agile • Having all people with all the required roles in agile teams

6.5 Golden rules for agile ERP implementations

The initiation for trends such as adopting agile into the client organization comes from the consulting world and interviewee D highlighted that the consultants are playing a key role bringing agile into the client culture. However, as the agile ERP implementation methodology is still relatively new there has not been enough knowledge to do projects in agile manner. Interviewee D made a remark that it takes time before certain methodology can be taken into use in practice because the idea needs to be planted to the customers and the consultants first. Interviewee B highlighted the importance of the methodology training, especially for the consultants. For the future ERP implementations to be run with the agile methodology, people

should be trained so that they are not afraid of the unknown methodology and are comfortable to work with it. Company X has organized quarterly training events on the tools they have for implementing the ERP system, the agile implementation methodology and the best practice solution.

Interviewee E pointed out that a lot of effort is required from Company X and other implementation partners in the amount of change management to get the senior people who are familiar with the waterfall methodology to work with the agile methodology. Often the amount of change management that is required has been underestimated. For the people who are custom to work with the waterfall methodology, agile turns the work on its head. Agile changes the roles the individuals perform, the responsibilities, and the dynamics how the ERP implementation projects are run. This causes a lot of disruption early in the project, and a lot of pain is required to get the team members acclimated to scrum boards, scrum masters, sprints and to the new methodology. Interviewee E highlighted that for the first sprint or two there is a need to be very conscious of the fact the team is not finished to perform with the maximum capacity because there is a learning curve which needs to be considered.

A recommendation is to bring in a change manager to reduce and ease with the amount of onboarding that is required in the beginning of the project as interviewee E suggested. The change manager is responsible to onboard and train all the project resources who are coming to the project initially and the idea is to get team members acclimated to their new roles. In the first sprint or two there is a lot of complaining and lot of resistance but after the first sprint cycles have passed, everyone gets more comfortable with their new roles and responsibilities. After that there is no longer needed to train that many people and agile adoption tends to happen easily. Nevertheless, underestimating the effects that the change has on the productivity of the teams is the biggest problem interviewee E has seen.

If there are consultants who are coming from another agile project, the onboarding is not as difficult. Agile has been around long enough and there are starting to be people who have been through one or two of agile ERP implementations which means learning curve is coming less and adoption done in early stages is improving. Interviewee E's point was supported by

interviewee D who made a remark that today the consultants are having more knowledge and capabilities to do agile ERP implementation projects.

Also, in addition to the consultants, the customers are having a lot of confusion early about the roles and responsibilities and how to work in the new methodology. At the beginning of the agile ERP implementation project teams are filled with people who are willing to adopt agile but do not understand their roles and how the methodology works. The situation leads to a lot of onboarding that needs to be dealt early in the project. According to interviewee E the amount of onboarding and training that is required needs to be appreciated when going into the agile ERP implementation project. Once the customers get comfortable, just like training the consultants, then adopting agile is fine.

Interviewee C remarked that training is something where attention should be paid in agile ERP implementations. The teams need to be trained on the agile tools that are used in the project whether agile processes are run for example in DevOps, Jira or in some other tool. Nevertheless, regardless of the training efforts, there still will be some people in the project who have received zero training on agile tools. The most important thing is to ensure that everyone is aware of the agile tools that are used and that in the end it comes down on having an agile mindset.

Working in the agile manner requires the customers to be bold, trust the consultants and let them guide the work. In addition, the customers need to know the agile model, be committed to work as agile guides and be engaged to the project activities. As remarked by interviewee D the business needs to commit and be available to the project all the time. In the waterfall projects customers were able to focus to daily tasks simultaneously but in the agile there is a need to participate to the daily standups. However, it does not mean that a person should be present all the time but working in the agile manner requires a significant business engagement.

Similarly, interviewee A made a remark that agile requires a significant business sponsorship and engagement, because without it agile may not get the necessary visibility in the record. It is a one thing to watch out the stakeholders and one thing to have their support. The agile enablement should be done at the senior stakeholder level and more senior the sponsorship is the better. Interviewee A listed that there are various types of education, engagement, business

change and consulting activities to be sure the business understands what agile really means. It is important to know that agile does not automatically mean smarter, cheaper, faster and better. However, it can be that way, but that is not always the case. Accordingly, the business should go with their eyes open and understand agile requires all types of responsibilities, and it is not just one way.

Naturally, adopting agile into the ERP implementations is easier if agile is not completely unknown concept for the customers, meaning the customers have already been developing other systems using the agile approach, or they have adopted agile into the enterprise in some other form as interviewee D mentioned. However, some customers operate in an organizational culture which does not support agile work. Agile requires very empowered people, sitting in the same room, making decisions and acting by them, and according to interviewee E it all goes back to the OCM and onboarding training. There is a need to coach clients that they cannot continue to operate in an organizational culture anymore where they require everyone to agree before making any decisions. Customers need to pick the people who are the decision makers or otherwise agile does not work.

According to interviewee E enough time for setting up the project needs to be reserved. Often a big mistake is to think that work could start right after writing the contract papers because the project planning can take as long as several months to ensure that that everyone has been trained on agile, there are all the right people who have the ability to function as agile guides and then to get all of them to the same rooms to be able to start the programs. Once everything in the project has been set up, the work tends to flow fine, but setting up the project takes time.

Interviewee E made a remark the fact that the implementation partners do not have enough local workforce to staff the projects has led them to make a strategic decision to begin to train more of a local workforce in countries where customers are based, and the ERP implementation projects are happening. In addition, interviewee E instructed that the challenges related to the lack of personnel and knowledge that customers are struggling with can be mitigated by starting the projects with enough planning in advance. This is done in order for the customers to train their personnel and in some cases bring them onsite and staff them to their new roles. It is

important to work together with the clients, ensure that they have trained their people and pulled together the agile teams with the right people.

Interviewee E guided to keep the teams as lean and small as possible which means having the right mix of the right stakeholders who have the ability to make decisions and commit. The number of people that are needed in a sprint will vary much depending on the client culture how custom and comfortable they are having empowered people who can make decisions and much depending on the complexity of what is involved in the implementation. The gate for interviewee E is to allow as many people in the room that are necessary as long as they are active participants in the process, meaning they are actively involved in the decision making.

The sprint team sizes vary considerably depending on the engagement even within the same project from team to team. However, what it wanted is all people who are actively involved and that might be as few people as three to four or as many as ten to fifteen people, it is depending on the context. There is no one size that fits all answer. If there are people who are in the room and are not involved and are just sitting there, then they should not be part of the sprint team. Similarly, interviewee D pointed out the team structures are depending on what is the scope of the project. However, the teams should be mixed with different business functions together, for example finance and supply chain working together.

According to interviewee C the challenges related overall governance problems in agile ERP implementations could be tackled with clear communication. The right governance structure is needed to ensure the integrating is done appropriately across the different agile teams when they have been broken down into smaller sub-teams. Moreover, to ensure good communication interviewee C added it is important that the team is co-located as much as possible. Similarly, interviewee A explained that often the collaborative and coordinated way of working in agile means being co-located, working kind of co-creation and co-innovative ways. Nevertheless, that is not always the case because often co-location is uneconomical. Thus, the teams tend to work near shore way with the rough shore team that is highly collaborative. Getting into that kind of collaboration requires a good toolset. Interviewee F supported this by saying the co-location makes the work easier but with the right toolset working in the different locations is something that teams get used to.

Interviewee A pointed out that in the traditional agile projects every sprint is followed up by the next sprint and all of them bring the incremental value to the customers, but the substitute sprint may have an impact to the previous sprint as some solution rework is done. Especially with business-critical applications such as ERP systems there is a need to be sure that what has been done really works. For these applications' regression testing and end-to-end testing needs to be done constantly to make sure the system is really working, and what is being done does not impact to other part of the solution. This was supported by interviewee B who highlighted the importance to consider the integrations of SAP while planning the project. End-to-end planning needs to be done, meaning the functionalities which cover multiple business functions such as finance, sales, procurement and production are covered in the plan. In this matter, interviewee D pointed out the downside of agile is that the big picture cannot be seen as early as in the waterfall projects. Thus, it is important to always keep in mind on the business processes even though the processes are cut down into smaller iterations while working in the agile manner.

Interviewee B pointed out that it is essential to focus on standups and sprint planning. During standups teams should be careful that the standup is only about what was done yesterday, what they are planning to do today and what are the blockers. Otherwise if the standups are not restricted only to those things, they will become project meetings again which can happen quite easily. Therefore, it needs to be made clear that the interest is only to discuss about the tasks that individuals have and how they are progressing. Often that is something that is hard to keep.

Also, interviewee B made a remark that sprint planning is crucial that everyone have a real clear idea on what is expected during the sprints and who is responsible for it. The sprint planning is not easy especially in the relation to the project resource availability because not all the resources are linked full time to the sprints. The customers may hire the resources to work full time such as they did with the waterfall model, but the activities assigned with the individual are limited only to couple of hours in the sprint. The questions that arise are what to do with the rest of the time. The balancing with the project resources should be done planned well.

According to interviewee A it would be good to look for things such as continuous planning, continuous design, continuous build, continuous test and continuous integration in ERP

implementations. Then the operating model would be heading towards DevOps model where the operation team, the development team and the project team are working side-by-side together in one unit and they are driving change and incremental value to agile project. However, interviewee A pointed out that DevOps requires team members to have multiple skills and able to take multiple roles. Getting into a team like that takes time and the DevOps model works only in very mature teams.

Table 7. Golden rules for agile ERP implementations.

Interviewee ID	Golden rules for agile ERP implementations
A	<ul style="list-style-type: none"> • Significant business sponsorship • Various education, engagement, business change and consulting activities to ensure business is aware what agile means • Good toolset to support the collaboration
B	<ul style="list-style-type: none"> • Focusing on the relevant topics in standups and sprint planning • End-to-end planning and focusing to the integrations • Training on agile implementation methodology and toolset
C	<ul style="list-style-type: none"> • Having the right governance in breaking up the teams • Clear communication • Training on the agile tools • Ensuring everyone has agile mindset • Having co-located teams
D	<ul style="list-style-type: none"> • Consultants guiding and bringing agile into client organizations • Customers engaged and committed to the project activities • Mixed teams connecting different functional areas
E	<ul style="list-style-type: none"> • Bringing in a change manager to train and onboard team members • Starting the projects with enough planning in order to get resources onsite and have time to train people • Keeping agile teams as lean as possible and right mix of stakeholders and having the decision makers in the team
F	<ul style="list-style-type: none"> • Agile coaches to support and help to understand agile practices • Agile tools support the work virtually even if the teams are not co-located

6.6 Future of ERP implementations

Interviewee B thought the future for ERP implementation will be agile and that there is no other way. Without working with the hybrid-agile methodology and the best practice system customers will not be won over. The transformation from the waterfall implementation approach to agile approach is already happening as all the new ERP implementation projects are being delivered with the agile implementation approach. Similarly, interviewee C thought that agile will be the main implementation approach without any questions. Company X and other implementation partners are focusing offering only agile implementation methodology-based ERP transformations for their customers.

On the other hand, interviewee D does not completely abandon the idea of the waterfall methodology but saw that in the future there will be more of agile because agile handles the change better. With agile approach the need for change management activities becomes smaller as those will be covered automatically during the implementation process. Ideally, there is a chance to get rid of the change management and trainings.

Interviewee F thought that in the future the approach will move towards agile approach even more as customers want to obtain the value from the project early. What is being seen now is the beginning of what will be the standard for the upcoming years, as interviewee E remarked. Today enough SAP implementation programs have been run with the current implementation methodology to establish that the tools are good enough. Over the years SAP's ERP has evolved a lot but SAP has stated that they are not going to make major departures from the current methodology, solution or platform for the next 20 years. Nevertheless, unless there is a fundamental change in computing as it is known now and how data is thought about it may lead for SAP to respond and renew their products. Interviewee E remarked that how likely that is to happen is something nobody knows.

Interviewee A thought the both approaches will remain in the software development projects but there is a certain clarity in the move towards agile. When the foundation for projects have been set with waterfall with agile different layers can be built. However, the conversation will be completely different in a year or two because there will be much more insights of the topic

when time has passed. The questions customers should be asking is why not to apply agile, instead of wondering why agile should be applied. Talking about the Activate implementation methodology, interviewee A remarked that customers are asking how far they can go with the methodology, meaning they are asking can they apply the methodology to non-SAP applications. Also, there are discussion going on applying the agile methodology enterprise wide.

Interviewee B emphasized the change is not only happening in the ways of implementing because ERP implementations require consultants to have a new kind of knowledge. In the past the SAP knowledge that consultants had was mainly technical, and far less a business knowledge. However, nowadays consultants are becoming process consultants as well as they need to be able to talk about best practice processes. The new way of working with agile approach will have impact on the type of consultants implementation partners need in the future.

In addition, new solutions such as cognitive, blockchain and micro-services are becoming part of the companies' business processes. Interviewee B pointed out it is important that the best practice solutions that are offered to customers are not based only on what SAP has. The end-to-end processes are becoming a mix of different technologies. Working with different solutions, platforms and technologies is very hybrid and the only way to deal with that is in the agile way. Interviewee C pointed out that other trend in ERP implementations is that the timelines in the ERP implementations are getting shorter. The deployment of S/4HANA includes a lot of simplifications which speeds up the implementation.

According to interviewee E in the technology business there are always people who get fixated on a given technology, no matter what it is: different tools, platforms, programming language, and they want to proof that any problem they face can be solved with the given technology or tool whether it makes sense or not. Ultimately working smart, being practical and efficient is the key driver which makes to pick one methodology over another. Interviewees E highlighted that in the end the delivery executives are responsible for making sure that the client gets a good outcome and responsible for the success of the entire program. It is important to remember there are no stop points for implementations which means no matter how it was done, how good or bad it was the only thing that matters it the outcome. From what the project is being credited is

delivery on time, not exceeding the budget and meeting all the project requirements. Meeting those targets define how great the project was and, in the end, it does not matter how the project was done as long as it was done correctly.

7 DISCUSSION

This chapter focuses on presenting the discussion about the literature review and the results from the interviews. The theoretical and the empirical parts of the study are studied and discussed in order to compare them and to find the linkages between them. In addition, the chapter consists of analyzing the validity and reliability of the study and discussing on the research's limitations and suggestions of the topics for the future research.

7.1 Further discussion

The literature in this research focused on giving the basic knowledge to the topics of the research and the methods for ERP implementation and software development, presenting both agile and waterfall models. The ERP implementation methodologies are based on similar modeling as SDLCMs, but the main difference is that with ERP implementation methodology it is not meant how the system is developed but rather how it is adopted to the organization. The traditional ERP implementation projects still have many challenges that are mostly related to the implementation methodology.

While conducting the literature research not much research was available on the topic of agile in the ERP implementation projects. In the interviews it was highlighted that adopting agile into ERP implementation landscape as a topic is still new and not everyone is aware of it yet. Nevertheless, it was pointed out that in the future agile implementation methodology is seen as the main approach for implementing ERP system because it has already been established that agile tools are good enough for managing complex ERP projects. Based on the interviews it can be said that today the agile implementation approach is the standard ERP implementation methodology in the industry.

The interviews showed that agile has been considered as a tool for managing the challenges that traditional ERP implementation projects have which was supported by Wijaya et al. (2019, 514). Nevertheless, in the interviews it was highlighted that the approach is not fully agile because ERP implementation projects are complex with lot of separate moving tasks which operate in different life cycles. In every implementation there are parts that are better suited for

waterfall, but from the functional point of view the approach is agile. Therefore, the implementation approach is a hybrid which combines agile and waterfall practices, taking the best of both.

Robson (2013, 23) stated that all the planning and scheduling in the traditional ERP projects needs to be done in advance and everything needs to be identified upfront which requires a huge project management effort in continuous planning and monitoring. Creating estimations is challenging, and often traditional projects run over the budget and the schedule. While studying scaling agile software development practices into large projects, the difficulties in estimating the efforts and time the large-scale agile projects require throughout the life cycle was discovered. Based on the interviews, agile gives much more oversight than waterfall on how the project is facilitated because no longer PMO is responsible for managing schedule, issues and meetings. Instead Scrum Masters push the responsibility of those functions into each team which also results into faster outcomes.

From the interviews and Robson (2013, 22) it was learned that waterfall projects have challenges because long time will pass from the moment customers give their requirements to the moment they are implemented. In the interviews it was pointed out that because a long time will pass until the requirements are realized and the business conditions have not moved on, in the worst-case scenario it will result to the ERP system becoming automatically a legacy system. It was explained that even years can be in between the moment requirements are collected to the actual implementation, meaning the initial requirements are no longer what the customers need. Also, it was pointed out customers are no longer willing to invest to the projects where value realization takes such a long time. Today, customers are requesting faster results, better quality and more efficient ERP implementations. Stender (2002, 908) addressed that ERP implementations should be much faster than building the required functionalities from the scratch.

The interviews showed that one of the key benefits of agile is indeed the faster value realization. The work is organized in sprints and every sprint is delivering business incremental value or MVP which makes agile an effective way to get an outcome fast. Also, the interviews showed that agile results in better quality ERP system because customers are engaged early with the

implementation project activities. The ERP solution is built together with the customers who have visibility to the work which gives them a possibility to give feedback and react early. Showcasing the system enables that customers learn early how the system operates and the need to conduct trainings later on becomes less. In addition, it makes customers to question the solution and their initial requirements which results in better solution that matches with the needs of the customers. Misra et al. (2016, 40–41) supported this as it was indicated that agile would result in reduction of time-to-market for new products and improve the product quality. According to Stender (2002, 908–908) agile allows better organizational learning by users being engaged with the implementation process and results in better requirements. The system is more precisely what customers want it to be as they have knowledge how the system functions. Incremental delivery will lead to cost savings, faster deployment and reduced risks.

Ali & Miller (2017, 673) highlighted that the role of OCM in the traditional ERP implementations because the inability to answer to questions related to change management might cause to technical and administrative problems, delays in the system implementation and in the worst-case scenario the projects even to fail. Often, the challenges are related to failures in redesigning the business processes and lack of clarity what is required in the implementation. The interviews showed that the agile implementation methodology eases with the challenges related to redesigning the business processes because the design effort is smaller in agile ERP implementation projects as the work starts from the best practices. Showcasing the ERP system in the beginning of the implementation project the makes adoption of best practices easier and customers are willing to adopt standard. In addition, seeing how the system operates early affects change management and customers start to think what the impact of the standard processes to their business is to them.

According to Ranjan et al. (2016, 394) the traditional ERP implementation projects the challenges are related to people rather than technology. Similar challenges were found in the interviews while studying the challenges of agile ERP implementations. According to interviewees the challenges in agile ERP implementations are mostly related to the change management and not that there would be something wrong with the implementation methodology. Agile changes the dynamics how the projects are run, and it changes the

individual roles and the responsibilities. Therefore, a lot of effort is required in the amount of change management and onboarding in the beginning of the agile ERP implementation project.

Based on the interviewees ERP implementation projects have been mainly waterfall for the historical reasons. Originally, agile methods were designed for smaller projects and the adoption in large-scale IT projects has been slow. Because ERP implementations are end-to-end solutions the implementation methodology has followed the SAP's recommended method which has been waterfall for the historical reasons. The change in this started by customers to requesting faster solutions, and at the time SAP presented their newest ERP product they made a transition from waterfall agile implementation approach and Casanova et al. (2019) presented that today SAP is promoting agile approach for implementing their ERP.

The interviews showed that one of the enablers for implementing SAP the agile way is the change in customers' behavior and especially the willingness to adopt the standard. In the interviews it was pointed out that by adopting the standard, the design effort in the ERP implementation is becoming smaller, resulting in faster outcomes. The findings from interviews are supported by Ali and Miller (2017, 680) found that one of the factors associated with the successful implementation of the ERP system is minimal customization and standardization. It eases the workload on implementation teams and helps to avoid technical pitch falls and saves resources.

The comfort level toward the waterfall implementation methodology is one of the challenges that agile ERP implementations struggle with as the interviews showed. Senior consultants are familiar with the waterfall methodology and the tools associated with it which makes the transition toward agile challenging. In addition, the interviews showed that the customers might work in a consensus model where decisions are not made until everyone agrees, but the agile ERP implementation methodology does not work in a client culture like that. Often, clients do not have prior experience from agile in the large organizational scope, meaning they do not understand the roles and responsibilities, and how agile works. Similar findings on the challenges in scaling agile into large-scale software development were found. According to Silberbauer and Coyne (2017, 33–34) organizational structures in enterprises might support

more waterfall values which increases the complexity in scaling agile strategies within the enterprise.

Based on the interviews, consultants play an important role bringing organizational changes such as agile into client organizations. Therefore, it was suggested that training consultants to the new implementation methodologies is important. In addition, training customers need to happen as they cannot to continue to operate in the consensus model anymore. In the interviews it was pointed out various education, engagement, business change and consulting activities can be applied to ensure customers are aware what agile means to them. Also, it was suggested to bring in a change manager to help with project onboarding.

In the interviews it was found that offshoring and outsourcing has lead customers, implementation partners and ERP vendors to having problems with staffing their agile teams as agile requires co-located teams physically in the same room in order to work collaboratively. Similar challenges were recognized by Silberbauer and Coyne (2017, 33–34) from scaling agile into large projects. Distributed teams bring challenges and may lead to miscommunication, and additionally, large agile projects consist of different stakeholders where internal and external partners are working together, meaning the relationship may be more contractual than collaborative. To overcome these challenges in the interviews it was pointed projects should start with enough planning in advance to be able to bring project resources onsite, collect the right people and have enough time to train them. The financial aspects are also weighting in the cup therefore it is not always possible to have all the team members physically in the same place. Based on the interviews there are agile tools which support the work virtually even though the teams are not co-located.

The integrated nature of ERP software put breaks on how broadly agile can be applied. It is important to note that the substitute sprint may impact to the previous sprint as the interviews showed. For this reason, considering end-to-end planning and focusing on integrations is important. The finding from interviews showed that lack of integration in work may result in sub-optimizing the overall solution which is why optimizing the team sizes and having the right governance in breaking up the teams is important. According to Elshamy and Elssamadisy (2007, 46) scaling agile into large projects means teams are broken into smaller sub-teams to

ensure better communication, but it may lead unnecessary rework as teams may work inconsistency.

The role of agile in ERP implementations is remarkable and it has grown during the past years. It was found out that in the future agile will be the main implementation approach for implementing the ERP systems. Agility has become essential part of ERP implementation projects and it is not only a method for managing small software development projects. The need of faster deployment of software is not only limited to small software hence scaling agile into larger projects such as ERP implementations is needed. Also, the results from the study support that agile in ERP implementation landscape has similar challenges as scaling agile practices into other large software projects. Nevertheless, further research in this matter is needed.

7.2 Validity and reliability

Validity and reliability of a research and the research data should be examined, especially with semi-structured and in-depth interview studies, because it is an important part of the research. In this research to increase the validity and reliability of the data the aim was to find studies and articles written by different researches in order to be able to rely on the gathered data in the literature review. The topics of agile in ERP landscape, especially with the focus in SAP's ERP is relatively new, and not much research has been conducted on this topic. The available studies in this topic was reviewed and selected to this thesis as the aim was to gain as competence research as possible. In addition to the literature, the interviewees who had experience from agile SAP implementations played an important role in presenting the current role of agile in ERP implementations. The interviews gave the base for the comparison of literature versus reality.

The interviewees were selected based on their experiences and knowledge on the research topic. All of the interviewees had more than 15 years of experiences from SAP implementations and they had a solid background understanding the waterfall method. In addition, the interviewees had been engaged with agile software development projects. Semi-structured interviews gave room for free discussion and the interviewees had the possibility to guide the conversation to

the topics that was seen the most important, and to ones that research had not originally recognized. For this reason, all the interviews were different. The semi-structures interviews made the conversation rich by giving interviewees a possibility to share their insights and perspectives on the topic. Nevertheless, the results from the semi-structure interviews showed that the interviewees shared similar experiences and similarities from the results was found.

Semi-structured interviews are an effective way to get in-dept knowledge on research topics but on the other hand it means there is a risk that the answers from the interviews cannot be compared. This means when looking from the reliability that the research cannot be repeated later or by another person. In semi-structured interviews the way the interviewer presents the questions have also impact. The answers can be different based on how the question was asked and how it was understood. When analyzing the results, a lot depends how the interviewer understood and interpreted the answers from the interviews. In addition, the topic in the research is relatively new, meaning the environment may already change in a short time. For this reason, is it possible that the results of the study cannot be repeated later.

7.3 Limitations and future research

It is important to note that the research has been conducted using SAP's ERP product as a target system, and the results of the study might be different if studying another ERP system. All the ERP systems are different, and the results cannot be generalized to apply to other systems without further research. In addition, at the time this thesis research has been conducted the number of literature available on the topic is quite limited. It is important to note that critical literature in this research might be underrepresented because such literature has been limitedly available. Thus, the literature used in some parts of the thesis presents strongly vendor's point of view which might vary from general opinions. More research should be conducted on this topic in order to have a wider view on all of the relevant aspects of the topic.

The study has been conducted by interviewing the experts in Company X which is an implementation partner for implementing SAP's ERP solutions. The research might have been different if the study has been gathered from customers' perspective who are implementing the ERP system. Thus, the reader should consider is there a need to apply critical thinking to the

results of the study as each party in the ERP implementation has their own interests and views to the topic.

It should be noted that the interviewees had a similar project positions which might have led the answers to be focused on their perspective. The interviewees are mainly having positions as project manager, managing consultant or delivery executive and their experiences on the role of agile might be more focused on the view of the top management in the ERP implementation projects. Moreover, the opposing perspective might be missing because the selected interviewees are strongly promoting agile methods for implementing ERP system. For this reason, it is recommended to extend the future research to have both opposing and supporting views.

For the future, the recommendation is to study the topic of agile ERP implementations in the view of the CSFs. From this thesis it can be anticipated that agile will be the leading approach for implementing SAP's ERP system in the future. The different life cycle model changes completely the way of how the project is managed thus, in the future the focus should be more on recognizing the critical success factors in order to make the future ERP implementations successful. Moreover, the future research should focus on studying and comparing the challenges of large-scale agile projects and ERP implementation projects.

8 CONCLUSIONS

Agile in the ERP implementations as a concept is not yet widely researched. The aim of the thesis was to study the role of agile in ERP implementations to gain broad understanding what kind of value agile gives and how to successfully adopt agile practices into ERP implementation project. Based on the literature and the interviews it was found out that the agile should have and is already having a bigger role in ERP implementations.

The largest enabler for the projects to be run with agile approach is the change in customers' behavior, their willingness to adopt standard. With agile approach the work starts from the best practices which are proven ready-to-run business processes. Utilizing the best practices makes it possible to visually see the results early and minimize the design effort. Previously, a lot of effort was used to designing the system to match with the customers' business needs even when the processes already existed in the best practice solution.

Not everything in an ERP implementation project can be managed in the same way and the implementation approach is combining both agile and waterfall practices. The business side of the ERP system suits well for the agile, meaning all the design, build, code and deploy tasks for the business processes are run in sprints together with the customers. The parts of the implementation that are critical and must be performed at a specific point of the implementation project are typically better suited to be managed by waterfall. Although the standard implementation approach is a hybrid, certain factors guide the discussion if something should be managed in agile or waterfall manner.

Agile has a possibility to address the limitations of traditional ERP implementation projects where the requirements are collected in the beginning of a project and are not touched later. In agile projects the value realization is faster, and the business stakeholders are being engaged in the project activities early on. This makes the system match better to the customer's needs because they have a possibility to react early if the outcome is not something that they hoped for. Moreover, multiple activities are combined as agile ERP implementations are utilizing the best practice solution where the customer has a possibility to see how the system operates early on.

The challenges adopting agile are mostly related to the change management and not to any actual problems with agile implementation methodology itself. Agile changes completely the dynamics how the ERP implementation projects are run which causes a lot of disruption early in the project. The issues rise because often senior consultants are familiar with the waterfall implementation methodology, and customers do not know what agile means to them, or work in an organizational culture which does not support agile practices. Implementation partners and customers do not have enough qualified workforce placed in the countries where the implementation projects are happening which causes challenges as typically agile requires co-located teams. In addition, the integrated nature of ERP system causes challenges because planning is needed how to successfully manage multiple teams in a way that they stay integrated.

Because of the challenges agile ERP implementations have, a lot of effort is required from the implementation partners in the amount of change management and onboarding training in the beginning of ERP implementation project. It is important to make sure there are people who are experienced in agile. Both customers and consultants need to be trained to the agile methods and tools ahead of time. In addition, successful agile projects require good governance structure and clear communication to ensure appropriate integration across different agile teams. Having teams co-located as much as possible is important but a good toolset supports the work even when working remotely.

In the future research it is important to focus on studying more closely what kind of challenges the agile projects have and the CSFs of agile ERP implementations. The study revealed that agile in ERP implementations have the ability to address the challenges that traditional ERP implementations have. Nevertheless, it was learned that agile ERP implementations struggle with new kind of challenges. Similarities between challenges in large-scale agile projects and agile ERP implementation projects were found and the suggestion for the future research is to more closely study the challenges and CSFs of these projects in order to improve the success rate of agile ERP implementations.

REFERENCES

- Accenture. 2017 [www-document]. [Accessed 7th July 2019]. Available: https://www.accenture.com/_acnmedia/pdf-71/accenture-agile-for-sap-solutions-pov-nov17-web.pdf
- Ali, M. & Miller, L. 2017. ERP system implementation in large enterprise – a systematic literature review. *Journal of Enterprise Information Management*, 30(4), pp. 666-692.
- Alleman, G. B. 2002. Agile project management methods for ERP: How to apply agile processes into complex COTS projects and live to tell about it. In *Extreme Programming and Agile Methods – XP/Agile Universe*, Chicago, Illinois, USA. August 4-7 2002, pp. 70-88.
- Azanha, A., Argoud, A. & Antonioli, J. 2016. Agile project management with Scrum: A case study of a Brazilian pharmaceutical company IT project. *International Journal of Managing Projects in Business*, 10(1), pp. 121-142.
- Balaji, S., & Murugaiyan, M. S. 2012. Waterfall vs. V-Model vs. Agile: A comparative study on SDLC. *International Journal of Information Technology and Business Management*, 2(1), pp. 26–30.
- Bansal, V. 2013. Enterprise Resource Planning: A Managerial Perspective. 1st Edition, Pearson India, 209 p.
- Bardhan, D., Baumgartl, A., Choi N-S., Dudgeon M., Lahiri, A., Meijerink, B., Worsley-Tonks, A. 2019. SAP S/4HANA: An Introduction. 3rd Edition, SAP Press, 647 p.
- Bibik, I. 2018. How to Kill the Scrum Monster: Quick Start to Agile Scrum Methodology and the Scrum Master Role. Apress, 76 p.

Blick, G. & Quaddus, M. 2005. Benefit Realisation with SAP: A Case Study. In Lau, L. 2005. *Managing business with SAP: planning, implementation and evaluation*. Hershey, Pennsylvania. pp. 135-157.

Capaldo, G. & Rippa, P. 2009. A planned-oriented approach for EPR implementation strategy selection. *Journal of Enterprise Information Management*, 22(6), pp. 642-659.

Casanova, D., Lohiya, S., Loufrani, J., Pacca, M. & Peters, P. 2019. McKinsey & Company. Agile in enterprise resource planning: A myth or more. [web-article]. [Accessed 5th of May]. Available: <https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/agile-in-enterprise-resource-planning-a-myth-no-more#>

Chen, C., Law, C, Yang, S. C. 2009. Managing ERP Implementation Failure: A Project Management Perspective. *IEEE Transactions on Engineering Management*, 56(1), pp. 157-170.

Croituru, H. K. 2018. *Agile Office 365: Successful Project Delivery Practices for an Evolving Platform*. Berkeley, CA: Apress, 272 p.

Daneva, W. & Wieringa, R. 2008. Cost estimation of cross-organisational ERP projects: research perspective. *Software Quality Journal*, 16(3), pp. 459-481.

Davenport, T. 1998. Putting the enterprise into the enterprising system. *Harvard Business Review*, 76(4), pp. 121-132

Dunaway, M. 2012. ERP implementation methodologies and strategies. *V Readings on Enterprise Resource Planning*, pp. 46-58.

Elshamy, A. & Elssamadisy, A. 2007. Applying Agile to Large Projects: New Agile Software Development Practices for Large Projects. *International Conference on Extreme Programming and Agile Processes in Software Engineering*, Springer Berlin Heidelberg, pp. 46–53.

EurSap. 2018. How to use SAP Activate for you SAP S/4HANA Roadmap. [www-document]. [Accessed 5th of May 2020]. Available: <https://eursap.eu/2018/08/28/blog-sap-activate-s4hana-roadmap/>

Fair, J. 2012. Agile versus Waterfall: approach is right for my ERP project? In *PMI Global Congress - EMEA*, Marsailles, France. 9th of May 2012.

Frost & Sullivan. 2018. What You Need to Know about Migrating to SAP S/4HANA. [www-document]. [Accessed 5th of July 2019]. Available: <https://www.ibm.com/downloads/cas/ZEJGNYK3>

Ganesh, K., Mohapatra, S., Anbuudayasankar, S. P. & Sivakumar, P. 2014. Enterprise Resource Planning: Fundamentals of Design and Implementation. Cham: Springer International Publishing, 168 p.

Grobot, B., Mayère, A. & Bazet, I. 2008. ERP Systems and Organisational Change: A Socio-technical Insight. London: Springer-Verlag London Limited, 214 p.

Gren, L., Kristoffersson, E. & Wong, A. 2018. Choosing agile or plan-driven enterprise resource planning (ERP) implementations - A study on 21 implementations from 20 companies. In *4th International Workshop on the Socio-Technical Perspective in IS Development*, Tallinn, Estonia, June 2018, 17 p.

Gronwald, K. 2017. Integrated Business Information Systems: A Holistic View of the Linked Business Process Chain ERP-SCM-CRM-BI-Big Data. Springer Berlin Heidelberg, 177 p.

Hassabelnaby, H., Hwang, W., Vonderembse, M. 2012. The impact of ERP implementation on organizational capabilities and firm performance. *Benchmarking*, 19(4/5), pp. 618-633.

Isetta, S., Sampietro, M. 2018. Agile in ERP Projects. *PM World Journal*, 7(9), 18 p.

Jacobs, R. & Weston, T. 2017. Enterprise Resource Planning (ERP) – A brief history. *Journal of Operations Management*, 25, pp. 385-363.

Jovinic, B., Djuric, D., Devedzic, V. & Sendelj, R. 2012. Agile ERP Systems Development: A Technical Perspective. In *Proceedings of ISEC, 22-25 February 2012*, Kanpur, UP, India, pp. 71-74

Kneuper, R. 2017. Sixty Years of Software Development Life Cycle Models. *IEEE Annals of the History of Computing*, 39(3), pp. 41–54.

Kraljić, A. & Kraljić, T. 2018. Agile software engineering practices and ERP implementation with focus on SAP activate methodology. *Business Information Processing*, 330, pp. 190-201.

Kraljić, A., Kraljić, T., Poels G., & Davos, J. 2014. ERP Implementation Methodologies and Frameworks: A Literature Review. In *Proceedings of the 8th European Conference on IS Management and Evaluation*, University of Ghent, Belgium, 11-12 September 2014, pp. 309-316

Kulkarni, S. 2019. Implementing SAP S/4HANA: A Framework for Planning and Execution SAP S/4HANA Projects. 1st Edition, Apress, 248 p.

Kumar Adi, A. 2018. SAP Activate: Issues and Challenges in Large-, Mid- and Small-Scale Projects: A Guide for SAP Technical and Functional Consultants. CreateSpace Independent Publishing Platform, 128 p.

Kumar, K. & Van Hillegersberg, J. 2000. ERP: Experiences and Evolution. *Association for Computing Machinery. Communication of the ACM*, 43(4), pp. 22-26.

Kurbel, K. 2013. Enterprise Resource Planning and Supply Chain Management: Functions, Business Processes and Software for Manufacturing Enterprise. Springer Heidelberg, 359 p.

- Kuster, J., Huber, E., Lippmann, R., Schmid, A., Schneider, E., Witschi, U. & Wüst R. 2015. Project Management Handbook. Springer Berlin Heidelberg, 449 p.
- Lau, L. 2005. Managing business with SAP: planning, implementation and evaluation. Hershey, Pennsylvania, Idea Group Pub, 348 p.
- Lowson, D. Capgemini. 2019. Moving to the WoW effect – The seven Ws of SAP S/4 HANA implementation planning. [www-document]. [Accessed 10th of June 2019]. Available: <https://www.capgemini.com/2019/01/moving-to-the-wow-effect-the-seven-ws-of-sap-s-4-hana-implementation-planning/>
- Madanhire, I. & Mbohwa, C. 2016. Enterprise Resource Planning (ERP) in Improving Operational Efficiency: Case study. *Procedia CIRP*, 40, pp. 225-229.
- Measey, P. 2015. Agile Foundation: Principles, Practices and Frameworks. London: BCS.
- Misra, S. C., Singh, V. & Bisui, S. 2016. Characterization of Agile ERP. Software Quality Development. ProQuest, pp. 39.
- Moran, A. 2015. Managing Agile: Strategy, Implementation, Organisation and People. Springer International Publishing, 266 p.
- Nagpal, S., Khatri, S. K., Kumar, A. 2015. Comparative study of ERP implementation strategies. *IEEE Conference Publications*, May 1st 2015, Farmingdale, NY, USA, 9 p.
- Nerur, S., Mahapatra, R., Mangalaraj, G. 2005. Challenges of Migrating to Agile Methodologies. *Communications of the ACM*, 48(5), pp 73-78
- Ranjan, S., Pal, P., Kumar, V. 2016. Literature review on ERP implementation challenges. *International Journal of Business Information Systems*, pp. 388-402

Rizza, M. & Permenter, K. Intelligent ERP: Innovating Through the Gridlock. [www-document]. [Accessed 5th of May 2010]. Available: https://sap.2x.marketing/asset/verizon/Verizon_IDC_TECHNOLOGY_SPOTLIGHT.pdf

Roberts, J. 2016a. 5 reasons why you need an agile delivery model for SAP. [www-document]. [Accessed 5th of May 2020]. Available: <https://www.basistechnologies.com/blog/5-reason-why-you-need-an-agile-delivery-model-for-sap/>

Roberts, J. 2016b. So, you think Agile can't work with SAP? 7 common myths debunked. [www-document]. [Accessed 5th of May 2020]. Available: <https://www.basistechnologies.com/blog/7-common-myths-about-agile-for-sap-debunked-blog/>

Robson, S. 2013. Agile SAP - Introducing flexibility, transparency and speed to SAP implementations. IT Governance Ltd, 216 p.

Rolland, K. 2016. Scaling Across Knowledge Boundaries: A Case Study Of A Large-Scale Agile Software Development Project. In *Proceedings of the Scientific Workshop Proceedings of XP2016*. ACM.

SAP Documentation. 2020. The Three-Tier System Landscape. [www-document]. [Accessed 5th of May 2020]. Available: https://help.sap.com/saphelp_nwmobile711/helpdata/en/de/6b0da2f34d11d3a6510000e835363f/frameset.htm

SAP Help Portal. 2020. Landscape recommendation. [www-document]. [Accessed 5th of May 2020]. Available: <https://help.sap.com/viewer/c3c5ec585ee248228ddb6c3f08073ea9/7.2.04/en-US/0a8f92e7b4d549a1bf1732ecc2cf4100.html>

SAP Support. 2020. Extended Innovation Commitment for SAP S/4HANA Clarity and Choice on SAP Business Suite 7. [www-document]. [Accessed 18th of April 2020]. Available:

<https://support.sap.com/en/release-upgrade-maintenance/maintenance-information/maintenance-strategy/s4hana-business-suite7.html>

SAP. 2018a. SAP Activate Methodology Overview. [www-document]. [Accessed 4th of March 2020]. Available:

<https://cdn2.hubspot.net/hubfs/2605195/Whitepapers,%20Checklisten%20zu%20verschiedenen%20Themen/SAP%20Activate/SAP%20Activate%20Methodik.pdf>

SAP. 2018b. The Journey to the Intelligent Enterprise: An End-to-End Approach from Value Discovery to Value Delivery Aligned to Customers' Business Priorities. [www-document]. [Accessed 18th of June 2019]. Available: <https://www.sap.com/uk/products/s4hana-erp/implementation.html#pdf-asset=5c5d9d05-087d-0010-87a3-c30de2ffd8ff&page=1>

SAP. 2019. Join the SAP S/4HANA Movement: Unlock the value of the age of intelligence. [www-document]. [Accessed 5th of August 2019]. Available: <https://www.sap.com/documents/2019/01/c0006f86-357d-0010-87a3-c30de2ffd8ff.html>

Saunders M., Lewis, P., Thornhill A. 2016. Research Methods for Business Students. 7th Edition. Harlow, Essex: Pearson Education, 741 p.

Schnitter, J. & Mackert, O. 2010. Large-Scale Agile Software Development at SAP AG. *International Conference on Evaluation of Novel Approaches to Software Engineering*, pp. 290-220.

Schwaber K. & Sutherland, J. 2017. The Scrum Guide. The Definitive Guide to Scrum: The Rules of the Game. [www-document]. [Accessed 18th of June 2019]. Available: <https://www.scrumguides.org/docs/scrumguide/v2017/2017-Scrum-Guide-US.pdf>

Scrum.org. 2019. The Scrum Framework Poster. [www-document]. [Accessed 2nd of July 2019]. Available: <https://www.scrum.org/resources/scrum-framework-poster>

Silberbauer, A. & Coyne, B. 2017. Agile for Dummies. 3rd IBM Limited Edition, 68 p.

Singh, V. 2017. *Manage Your SAP Projects with SAP Activate*. Packt Publishing, 204 p.

Sommerville, I. 2016. *Software engineering*. 10th edition. Boston: Pearson, 816 p.

Standish Group Report. 2015. *Chaos Report*. [www-document]. [Accessed 2nd of July 2019]. Available: https://www.standishgroup.com/sample_research_files/CHAOSReport2015-Final.pdf

Stender, M. 2002. Outline of an agile incremental implementation methodology for enterprise systems. *Americas Conference on Information Systems (AMCIS)*, 130, pp. 906-917.

Upadhyay, P. & Dan, P. K. 2008. An Explorative Study to Identify the Critical Success Factors for ERP Implementation in Indian Small and Medium Scale Enterprises. In *International Conference on Information Technology*, Bhubaneswar, India, 17-20 December 2008, 5 p.

Upadhyay, P. & Dan, P. K. 2009. A Study of Identify the Critical Success Factors for ERP Implementation in an Indian SME: A Case Based Approach. *Communications in Computer and Information Science*, 31, pp. 185-196.

Wijaya, S. F., Prabowo, H., Kosala R. R., Meyliana. 2018. Agile Methods for ERP Implementation: A Systematic Literature Review. *IEEE Conference Publications* pp. 571-576.

Wijaya, S. F., Prabowo, H., Kosala R. R., Meyliana. 2019. An Agile Implementation Model for ERP. *International Conference on Information Management and Technology (ICIMTech)*, pp. 513-518.

Zouaghi, A. L. 2012. Aligning Key Success Factors to ERP Implementation Strategy: Learning from a Case Study, 12 p.

Zwicker, R. & de Souza, C. 2005. *SAP R/3 Implementation Approaches: A Study in Brazilian Companies*. In Lau, L. 2005. *Managing business with SAP: planning, implementation and evaluation*. Hershey, Pennsylvania. pp. 198-220.

Appendix. Interview themes.

Interview for Master of Science thesis.

Interviewer: Hanna Lohva

Preface

- Research study: The role of agile approach in ERP implementation
- The interview is anonymous
- The interview will be recorded with the permission of the interviewee
- Interviewer will not share any confidential information
- Any information where a company, interviewee or a project could be recognized will not be included to the thesis
- Focus:
- Discussion about experiences from projects which have been delivered with agile approach. Target system: SAP ERP

Themes

- Interviewee background and experience
- Agile and waterfall delivery approaches for ERP delivery projects
- SAP & Agile
- Most suitable implementation approach for ERP system
- The benefits, drivers and value of agile approach
- The drivers, value and reasons to use waterfall approach
- Business problems or other issues with introducing agile into ERP implementation
- Tackling the problems and adopting agile into ERP implementation
- Future of ERP implementation approaches
- Open comments and suggestions