Agile transformation in large organisations – a framework for project management setup

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A submission presented in partial fulfilment of the
requirements of the University of South Wales / Prifysgol De Cymru
for the degree of Doctor of Business Administration

January 2023

Acknowledgement

My sincere thanks go to Professor Hefin Rowlands, University of South Wales, for his continuous academic supervision, coaching, guidance, and motivation in all phases of the dissertation process. Especially his long experience in the supervision of dissertations, and his deep knowledge about qualitative research methods, supported me very strongly in the creation and refinement process of this dissertation.

Further, I want to thank Professor Christian Greiner, University of Applied Sciences Munich. He was a highly appreciated discussion partner, with regard to the content, structure, scientific work, and general topics in writing-up the thesis.

I also want to thank every single person, who was willing to support this dissertation as an interview partner. I much appreciated the invested time, and, furthermore, the open, direct, honest, and trustful interview.

My heartfelt thanks go to my parents and family, who strengthened me in my decision to write a doctor thesis, and who always supported me in any phase of the process, from the first draft to the final version.

Writing a doctor thesis in parallel to a full-time employment is not always easy. I therefore also want to thank my friends, colleagues, and supervisors for their constant and continuous support during the last years in all parts of my life.

Abstract

Motivation

Many hierarchically organised companies are facing the challenge to transform their working model from a sequential project management approach to an iterative, agile project management approach, to be able to react flexible on changing requirements in a VUCA world.

Focus

This dissertation focusses on **agile transformation in large organisations** and aims at the creation of **a framework for project management setup** which covers relevant critical success factors for project management and explains the transformation process from sequential to agile project management.

Approach

Critical success factors, identified in an extended literature review, were used to design a case. Key element of this case is the description of a complex IT project that could be conducted in a sequential, agile or hybrid manner. Semi-structured in-depth interviews were used to analyse, how experienced project managers in large organisations would approach such a project. Data was collected by interviewing ten people, and data was analysed using means of thematic analysis.

Results

As a result, success factors and their interdependencies could be identified, and served as basis to develop a new decision support framework, the 'PSIL framework'. The key success factors which have been identified during data analysis, were clustered into the four categories 'project characteristics', 'project manager and team members', 'organisational structure and processes', and 'external factors', and served as criteria for the vertical axis. For the evaluation of these success factors regarding their characteristics in sequential and iterative models, a result of research was that a further differentiation became necessary. Therefore, the four different approaches 'pure sequential', 'sequential light', 'pure iterative', and 'iterative light' have been identified. As a basis for the PSIL framework, 18 decision support matrices (Tables 5 – 22) with interdependencies were developed to best support large enterprises to perform a successful agile transformation.

Practice

From the practical perspective, this framework can be used by large organisations as a powerful tool. With this, they are supported in the application of sequential and iterative project management methods in hierarchically structured organisations by creating the best suitable agile working model, based on the given frame parameters.

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Declaration

I certify that, except where specific reference is made, the work described in this thesis is the result of the candidate's research.
Neither this thesis, nor any part of it, has been presented, or is currently submitted, in candidature for any degree at any other University.

Christian Schneider
24. January 2023

1 Introduction

1.1 Rationale and need for research

In a volatile world, it is more and more necessary to react flexible on changing requirements. To do so, many companies currently go through a transformation process from a traditional working model to an agile working model. In the past, this transformation was mainly done in manufacturing or IT / software enterprises. Today, more and more enterprises from other sectors decide to transform into the agile world. As every change management process, also the transformation process from traditional project management to agile project management is related to huge efforts in all parts of the enterprise.

Currently, there exists no guideline for large enterprises for a successful transformation process from a conventional organisation into an agile organisation. The steps towards an agile organisation are complex, as many different functions of an enterprise need to be analysed and adapted to the new working model. Usually, it is not possible to just take an existing working model and implement it one-to-one. Adaptions to individual processes, organisational requirements, etc. are mostly necessary to be able to perform the change process successfully.

1.1.1 Agile transformation in the automotive industry

Many companies, especially in the IT branch, are already working agile using Scrum or other agile methods. It reaches from small start-up's up to large, multi-national companies like Google.

Google, for example, already started in 2008 to develop software following Scrum and eXtreme programming, and applied the agile manifest to a large organisation (cf. Woods (2008)).

The Boston Consulting Group published a study in 2016 describing "Five secrets to scaling up agile" (Burchardi, et al., 2016). One year later, they asked in a survey about the boost in performance through new organisation design. The result was sobering as 73% of the respondents stated that it is important to be agile, but only 50% answered that agile principles and agile management structures were established. (Roghé, et al., 2017)

In the study of the Boston Consulting Group, as an example, can be seen, that enabling companies to be really agile is not easy, and more than just the implementation of Scrum needs to be done, e.g., accelerate decisions and processes, reduce hierarchy levels and support collaboration (Burchardi, et al., 2016).

As another example, Bosch invested 800 million Euros in the project “next generation workplace” in 2015, where new software, tools and working environments were introduced. With this measure, they intended to improve their agile working organisation. (Nagel, 2015) In 2018, three years later, Bosch tried new concepts for collaboration like “working out loud” and Continental created a new office building for working in open spaces (Polchow, 2018).

Creating collaborative working space with table soccer and scrum boards is only one part, the transformation to agility requires more: individual responsibilities for all employees, motivation to leave familiar, well-established paths, and create a culture that enables faults. (Bretting & Dunker, 2018)

It can be seen, that more and more large enterprises in the automotive industry are following this path to agility. Volkswagen, for example, started with agile pilot projects in the IT division and then started to transfer the knowledge and findings from the pilot phase to the whole affiliated group. (Bretting, 2017) Poth, et al. (2019) described in their paper a scalable agile approach as it was applied to the Volkswagen Group IT.

So far, there is no large company in the automotive industry which fully completed the change process from sequential project management into an agile approach throughout the entire company.

As another example for the automotive industry, in 2018, Klaus Straub, former CIO of the BMW Group, wanted to radically transform the BMW Group IT. He set the target to fully transform all processes and methods from sequential project management into iterative, agile project management. (Bretting & Dunker, 2018) As a measure to reach this target, the responsibility of one department for the entire process of development, test and operation (DevOps) was established. Therefore, the BMW Group IT started focusing on redefining the processes and creating new collaborative models, internally within the company with all business units, and externally with its partners. (Bretting & Dunker, 2018)

To create a good and positive working environment, which enables collaboration and working in interdisciplinary teams, the BMW IT-Headquarters in Munich was step by step remodelled following new interior design rules to be prepared for agile product development. (Bretting & Dunker, 2018)

1.1.2 Factors to innovate enterprises

In the IT sector, several models of the dynamic use of resources exist. The most common and widely used concept is the agile software development approach using the Scrum framework. It enables the efficient interaction of internal and external resources based on the common responsibility for a product. (Sutherland & Schwaber, 2016)

Kotter for example states that "companies must constantly seek competitive advantage without disrupting daily operations." (2012, p. 47)

Agility helps companies to be innovative. Schumpeter defined innovation as a process of "creative destruction" (Schumpeter, 1939). He distinguished between inventors who only generate ideas, and entrepreneurs who generate innovation by implementing and introducing new ideas into market (Wylant, 2008). To bring an idea to market, McFadzean et al. (2005, p. 353) suggest companies to split the innovation process into the five different phases "idea generation, research design and development, prototype production, manufacturing, marketing and sales". Further, the product itself has to be considered to evaluate its success or failure and the transformation process of the whole enterprise needs to be conducted.

But beneath the innovation process itself, change management is one of the key factors to make or keep enterprises innovative. Stolzenberg & Heberle (2009) for example define, that change consists of three aspects: change in organisational structure, operational structure and in personal behaviour and interaction of people. All these factors are influenced by each other and therefore they suggest to set up an overall change management. From the beginning, associates and management should work together on developing and understanding the vision, establishing open communication as well as to identify involvement and qualification of each affected person. Bullinger et al. (2009) and Ellebracht, Lenz & Osterhold (2009) also state that the early involvement of people is essential for change processes to be successful. The decision on how far their involvement makes sense and which on methods fit the best, for the organisation has to be taken individually per case, depending on organisational and environmental factors.

Agile ways of working are one factor in organisation design to boost a company in the direction of becoming a top performer. Following a study of the Boston Consulting Group, there are five more factors (enabled by agile methods) whereof two are coming from the agile context: flat management structures and focus on collaboration and people. (Roghé, et al., 2017)

The most important factor to become a top performer is agility. It can be reached by large enterprises by changing their organisational and operational structure, as well as their people's behaviour. The process is exhausting and can only be successful if all employees become part of this project and support the change process. The change in the mindset of all involved people, associates and managers, is the most difficult and most important part of agile transformation (Heckendorf, 2018)

For start-ups it is easier than for large organisation to work agile, as there exist no established processes, hierarchical structures and habitudes. If large enterprises want to become successful in agile transformation, they have to consider several criteria, e.g., management support from the top, start transformation process with pilots to examine possible ways of change and to avoid failure for the entire enterprise, and to ensure that all organisational structures support the change. Furthermore, success has to be measured in a way that aligns with agile methods, considering that agile transformation never ends as the transformation is a continuous improvement process. (Burchardi, et al., 2016)

As a conclusion, it can be said, that agile transformation can only lead to a successful new organisation design if it is properly accompanied with a coherent change management, people's support and a detailed plan.

1.2 Research aim

This dissertation looks at agile transformation of large organisations and how agile transformation of large organisations can be supported successfully. Therefore, the aim of this dissertation is to provide a framework, which supports decision-makers in large organisations to find the best project management setup for their specific context. To do so, the key success factors for project management were analysed regarding their relevance and influence on choosing the right project management approach. This is essential for enterprises that want to perform a transformation process from a classical sequential project management approach towards an agile, iterative approach.

In order to reach the aim of this dissertation, the following research steps were defined and served as a guideline during research process:

1. *Conduct a critical literature review on project management approaches, agile transformation and success factors for projects as the basic main factors in order to derive a model for an agile project management approach for primary research.*

2. *Identify a suitable research design to gain as much data as necessary to find criteria for a successful agile project management approach.*

3. *Analyse the acquired research data concerning its contribution to derive a model for decision-makers to choose the right approach.*

4. *Derive a framework from acquired data to support large enterprises in their process of the definition of an agile project management approach.*

1.3 Structure of the dissertation

Chapter 1 describes the rationale and need for research, the research aim, the steps to reach the aim, and gives an overview of the structure of this dissertation.

In **chapter 2**, a critical literature review is performed. As a starting point, software development paradigms were analysed as they serve as a basis for customising the project management approach. Afterwards, literature on agile transformation in large organisation was reviewed, and an overview about change management in the agile context is given. The chapter continues finding success factors for projects, using an agile or sequential approach. The chapter concludes with the description of research gaps and the research questions were formulated based on the literature review.

Chapter 3 describes the research methodology of this dissertation. It starts with the philosophical approach of the research and describes the research design. The research is based on semi-structured expert interviews. A reference project case study in form of a scenario served as a basis to obtain comparable data in the context of specific problem-solving processes. The criteria for the interviews described, afterwards and the chapter concludes with addressing the ethics of this research.

The analysis and discussions of the collected data is described in **chapter 4**. The four elevated success factor categories from the literature review were used to cluster the chapter in sections: project specific factors, factors related to the project manager and team members, factors regarding organisational structure and processes, and external factors. Afterwards, the chosen project management approaches by the interviewees were analysed and further observations are described.

Based on the results of the previous chapters, **chapter 5** describes a decision support framework for decision-makers in large organisations. The success factors for projects were taken as a basis to derive a model, in which the success factors serve as the main topics to be analysed. The characteristics of these main factors were analysed and described for the four different approaches: ‘pure sequential’, ‘sequential light’, ‘iterative

light', and 'pure iterative'. The chapter concludes with the description of an example of a decision support framework from the industry, the PSIL framework, and a first validation of the framework.

Chapter 6 summarises the results of this dissertation, answers the research questions and describes the contribution to practice and contribution to knowledge. As a contribution to knowledge, success factors for an agile transformation in large organisations are described. The contribution to practice is a framework for decision-makers in large organisations which supports them to find the best agile working model for their needs. It also contains an example of a hybrid model for large enterprises. This dissertation concludes with the limitations of study and an outlook to future fields of research.

2 Literature review

2.1 Introduction

In this chapter, the existing literature for the field of research was examined.
It first gives a short overview about the two different approaches of project management in the execution of IT projects. To do so, the existing software development paradigms and models were described in **section 2.2**.
Afterwards, in **section 2.3**, literature in the field of agile transformation of large organisations, especially regarding challenges and requirements during transformation process, was analysed and evaluated regarding its relevance and contribution to the aim of this dissertation. In addition to the agile transformation, also the adjoining topics 'agile organisation design' and (classical) 'change management' were analysed regarding their relevance for this work.
As an enabler for decision-makers to distinguish between the different project management approaches, a decision support framework should be derived in this dissertation. The subsequent **section 2.4** provides the necessary critical success factors for projects in different approaches.
In **section 2.5**, all research gaps were summarised, and the research questions, that guided the researcher through the next steps of the model creation process, were derived.
The final **section 2.6** concludes with a summary of the results of the literature review.

2.2 Software development paradigms and models

In this section, the different existing paradigms and models for software development are described. This is an essential basis for the definition and derivation of factors for successful agile transformation from conventional, sequential project management paradigms to iterative, agile models.

2.2.1 Sequential models (waterfall model)

To be able to analyse and describe the agile transformation process from sequential to iterative project management, the basics of the sequential software development approach are briefly described in this section.
The waterfall model was first described for the IT in 1970 by Royce, who defined that each phase has to follow the previous one to the end. (Royce, 1987) The waterfall model

was adopted many times over the years regarding different requirements (cf. for example Petersen, et al. (2009)). Independent of the version or adaption of the sequential model, they all have in common that at the end of each activity stands an approval document.
The phases of the basic model are: system requirements, software requirements, analysis, program design, coding, testing and operations (Royce, 1987). For details cf. Figure 1.

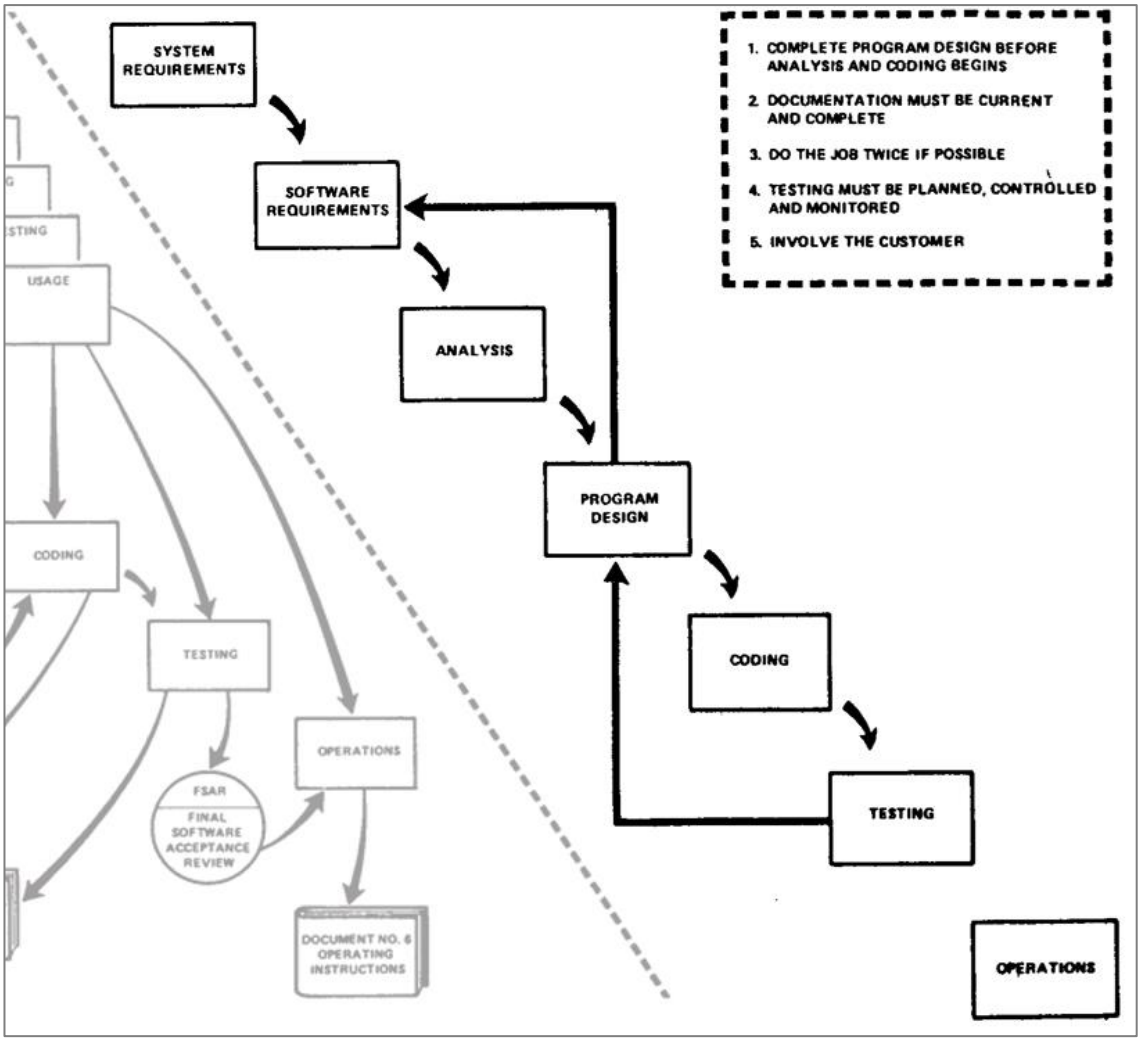

Figure 1: The waterfall model, adapted from Royce (1987, p. 338)

The waterfall model was enhanced by Royce with release cycles, which formed the bases for the spiral model of Boehm (1988). Boehm improved the waterfall model in a way which enables projects to return to previous phases whenever necessary.
The also used V-Model is a derivation of the waterfall model, which focusses on "verification on the left hand side of the V and validation on the right hand side" to ensure that all requirements are tested by defined people. The model is used, e.g., in German authorities as the standard project management model. (Childs, 2019, p. 36)

An advantage of the sequential models is, that you can exactly plan and control the process as well as having a clear picture of the costs. On the other hand, you are very inflexible in changing requirements. (Royce, 1987)
The biggest challenges of these models are that the interaction with the user or customer takes only part in the requirements analysis phase and in the testing phase. In between – and in large projects this can be a very long time – the software development takes part without involvement of the customer.
Therefore, many solutions fit exactly with the requirements from the analysis phase, but may not satisfy the customer's needs as they may have changed since.

2.2.2 Iterative models (agile models)

In the 1990's, the first steps towards agile software development were made. As a first representative, Kent Beck described an agile approach in his book about eXtreme programming (Beck, 2003). In 2001, the "Manifesto for Agile Software Development" which had the goal to uncover better ways of software development, was signed by many agile visionaries. Beck, Cockburn, Schwaber, Sutherland, to name just some, initiated with their manifesto the age of agile software development (Beck, et al., 2001).
The agile manifesto states that agile software development should focus on four core values (Beck, et al., 2001):

- "**Individuals and interactions** over processes and tools
- **Working software** over comprehensive documentation
- **Customer collaboration** over contract negotiation
- **Responding to change** over following a plan"

Based on these principles, which completely changed the thinking in software development, Schwaber and Sutherland created the agile framework Scrum. (Sutherland & Schwaber, 2017) Scrum is a framework which provides an incremental and iterative approach with the target to control risk and optimise predictability within software development projects. Therefore, roles, artefacts and events are defined in the Scrum guide.
There exist three roles: scrum master, product owner and dev team.
The scrum master supports the team with organisational and methodological know-how and removes impediments wherever they occur. The product owner is responsible for the definition and prioritisation of requirements to maximize the value of the outcome in the product backlog. The development team (dev team) is self-organising and codes the prioritised backlog items from the sprint backlog. Outside the official roles there are

stakeholder, e.g., interface partners or further user groups of the system, whose interests also have to be considered in the planning and implementation process. The product development is done in so-called sprints, which can be described as circles. Each sprint consists of the sprint planning, daily scrums, sprint review and sprint retrospective. The dev team develops items during the sprint with the result of a product increment, which contains all created backlog items. Details can be found in the Scrum Guide. (Sutherland & Schwaber, 2017). For an overview see Figure 2.

Scrum requests from all involved people more self-discipline than in the waterfall model. On the other hand, it also enables the product owner to easily change priorities based on changed business needs or legal requirements.

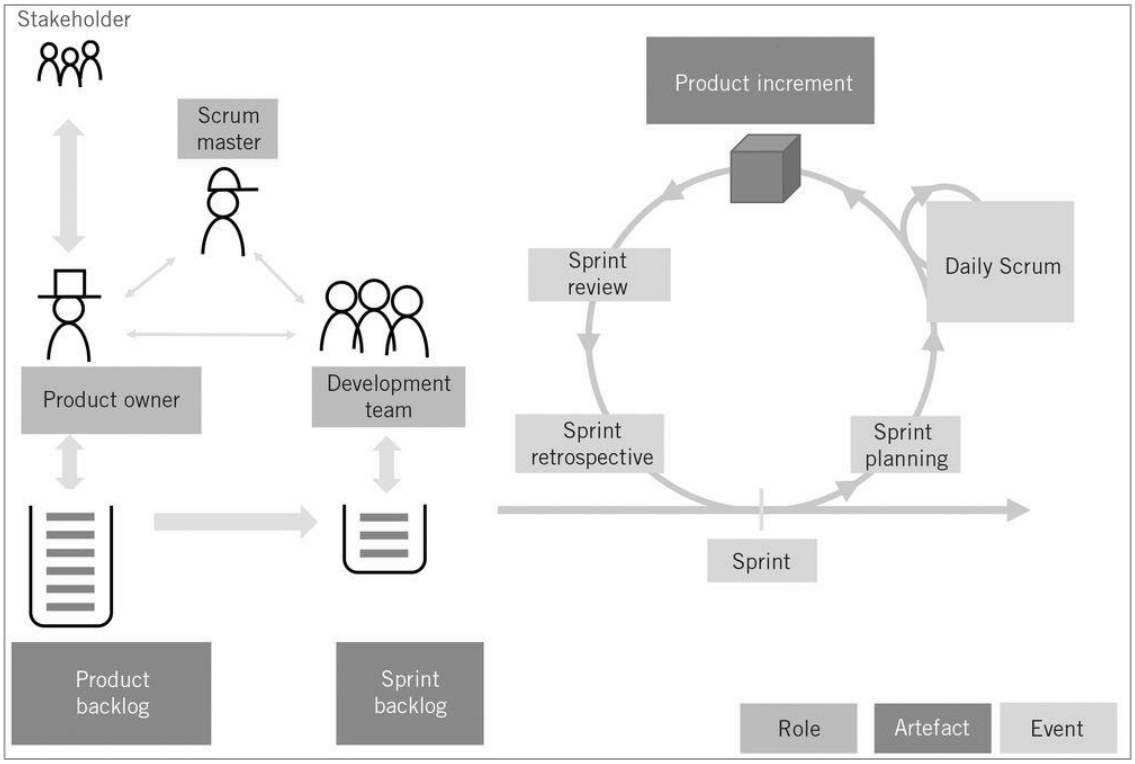

Figure 2: Overview of roles, artefacts and events of Scrum (Pfeffer & Berchez, 2017, p. 54)

Besides the most commonly used framework Scrum, there exist many more.

One, that is often combined with Scrum, is Kanban. The term KANBAN was first used by Taiichi Ohno (1988) to describe just-in-time processes at the car manufacturer TOYOTA. The Collins English Dictionary (2019) defines Kanban beneath “a just-in-time manufacturing process in which the movements of materials through a process are recorded on specially designed cards”, as 3rd definition related to the use of the word in the

IT world as “a workflow-management process, used especially in software development, in which work to be done is broken down into a series of tasks recorded on a chart”.
In the software development field, the Kanban approach was first described by David J. Anderson (2010) and then further used and developed by many authors and companies. They all have in common that all tasks are separated and visualised on a so called “Kanban Board”, to give all parties an overview of the progress of the tasks. Further, it gives the development team and all other participants the opportunity to self-reliant pull tasks and assign themselves. (Anderson (2010), Stoica, et al. (2016))
An enabler for agile work in large enterprises is DevOps, a portmanteau word combining development and operations, which enables companies to look at software in its entirely. It means that the responsibility for the development through testing to maintenance up to operations are in one hand – contrary to conventional responsibility thinking in boxes. (Fröschle, 2017) Gartner categorised the DevOps model in 2013 as “on the rise” (Riti, 2018). As an example from the industry, Google is using the DevOps model to continually improve their software, they call this model “site reliability engineering” (Beyer, et al., 2016). The next step following DevOps would be BizDevOps, which adds the business part to the existing DevOps responsibilities to bridge the gap between IT and business units, e.g., by forming interdisciplinary teams which are commonly responsible for a specific product, project or service. (Urbach, et al., 2019)
Another aspect of agile project management approaches is that effort estimation works differently than in conventional projects as the packages are smaller, and estimation needs to take place more often and discussions are usually helpful to better understand the requirements. For the estimation of efforts, planning poker is very common. Using this technique, every team member gets a set of cards with different size values. Most commonly, the values are Fibonacci sequence (1, 2, 3, 5, 8, 13, 21) to reach a clear distinction between the values. Every team member estimates the effort with these story points. Afterwards, the team discusses the values that lay on the table and has to find a consensus on the one final value which is then set. (cf. Cohn (2012), Moløkken-Østvold, et al. (2008)). The use of T-Shirt sizes for the estimation and evaluation of efforts is another method, among others. (cf. Davis (2013))

2.2.3 Delimitation of other models

This dissertation takes the waterfall model and different variations of agile methods as a basis to describe the agile transformation process. The V-Model (German Directive 250,

1992) was not further described, as it is based on, and similar to, the waterfall model (Childs, 2019). In the agile section, the most common methods were described: Extreme Programming, Kanban, Scrum, and variations of Scrum regarding scalability. Further methodologies, like Feature-Driven Development (FDD), Lean, Dynamic Systems Development Method (DSDM) and Crystal are not part of this dissertation. Their relevance for this dissertation is to be seen as minor relevant, as the agile transformation process focusses on a general change from sequential models towards iterative models. Therefore, the differences between several models in details do not play a significant role in this dissertation.

There exist also further Scrum frameworks, e.g., "Large-Scale Scrum" (LeSS), "Scrum of Scrums" or the "Scaled Agile Framework essential" (SAFe) (Kalenda, et al., 2018) and further agile programming methods like "Extreme Programming" (XP) (Dybå & Dingsøyr (2008), Erickson, et al. (2005)). This dissertation does not focus on possible usage of frameworks, as the aim of this work is to draw a framework to support companies to decide whether iterative or sequential project management methods are more suitable for their specific case, independent on the concrete methods used to scale agile or concrete sequential methods.

2.3 Agile transformation of large organisations

This dissertation aims at providing a framework for companies who want to perform an agile transformation in IT project management. To do so, aspects from conventional, iterative management methods need to be considered as well as aspects from the iterative, agile approach. This dissertation looks at literature for change management processes from the agile point of view and shows concepts of change management that fit to the agile world. However, for the derivation of a success model, aspects from classic change management are considered as well.

The first step in the literature review was to find topics in the field of "agile transformation", which may contribute to help understanding existing agile transformation processes. Further, open topics for future research, and methods to perform an agile transformation in the field of software delivery, were analysed. Here, it was mainly focussed on literature related to research in large organisation.

2.3.1 Agile transformation

This dissertation aims at finding success factors for transformation of project management in large enterprises. The section focusses on literature about agile transformation in large organisations as the starting point for further fields of research.

2.3.1.1 Narrowing of the search field

As the term “agile transformation” is widely used in very different branches, industries, contexts and topics. Therefor it was necessary to find key words to filter articles which may contribute to this research. As a result, articles from several areas, which are not relevant for this dissertation, were excluded.

First, articles that are addressing agile transformation in the field of agile manufacturing transformation processes based on Taylorism, and other optimisations in production environments were excluded. Second, when looking for large scale transformation with the intention to find literature about large organisations, many articles concern optimisations and scale effects within the supply chain or focus on large scale effects in production environments. Therefore, the term large scale was also excluded from the literature review.

Third, there exist also many articles about digital transformation, meaning how companies may transform their manual, offline processes into digital, automatised processes. These articles are not relevant for this dissertation, as they focus on the change in the digital work environment from conventional working models to the digital working model and were therefore also excluded.

Fourth, also articles about companies from production and engineering field that already have an agile setup in place, were sorted out as they focus on different kind of agile transformation, which is not suitable for this dissertation, e.g., transformation in engineering techniques like the optimisation of testing cycles of engine components, can’t be applied to agile transformation of general projects in the information technology.

Finally, search also resulted in articles about ‘enterprise architecture’, which refers to enterprise system setup, IT infrastructure setup in organisations, and definitions of application architecture and target solutions. Literature on this topic does not contribute to fulfil the goal of this dissertation, and was therefore also excluded.

2.3.1.2 Success factors for agile transformation

When looking at agile transformation, the most relevant part is the research about success factors of agile transformation. Dikert, et al. (2016), performed a systematic literature review on challenges and success factors for large-scale agile transformation. They found that about 90% of analysed papers were experience reports. From this practical perspective, they derived the success factor categories "management support, choosing and customizing the agile model, training and coaching, and mindset and alignment" (Dikert, et al., 2016, p. 87).

In detail, their work named 11 main success factors for successful agile transformation: management support, commitment to change, leadership, choosing and customizing the agile approach, piloting, training and coaching, communication and transparency, mindset and alignment, team autonomy and requirements management (cf. Dikert, et al., 2016, section 4.3). But when looking at Dikert, et al., it has to be considered that they focussed on large-scale software development units within software development companies or within large organisations up to 20,000 employees only. They excluded all enterprise-related organisational transformation processes and formulated the investigation of possibilities to include enterprise functions like purchasing, marketing, HR, etc. as one topic for necessary further research (Dikert, et al., 2016). Further, they stated that academic literature on agile transformation is very rare, especially when it comes to the agile transformation of large enterprises and further case studies were also addressed as a field of future work.

Another paper from Arbussa, et al. (2017) described the business model renewal process to an agile enterprise in the small and medium enterprises context (SMEs). They stated that SMEs have better chances for successful agile transformation than large enterprises as they are less bureaucratic and have bigger resource fluidity than bigger enterprises. Therefore, their case study only focused on SMEs and does not consider large organisations.

De Waal (2018) looked at "high performance organization" (HPO) transformation and described the main success factors, noticing that there is a lack of academic research on success factors for agile transformations at large scale. He further gave as limiting factor that only his transformation model was tested, and no other HPO transformation models.

In Harvard Business Review, Rigby, et al. (2016) looked at the situations and conditions under which agile methods work and how. They described also factors that are favourable

or unfavourable for agile methods, but they also do not describe a "plan" for agile transformations.

On the practitioner level, Stephen Denning published several papers on opinions and steps to make a whole organisation agile, e.g., Denning (2019), Denning (2016b), Denning (2016a), Denning (2018d). He gave advice on several steps that should be done to become agile, which could be used as a basis for further research, but there is no scientific method behind his results.

One of the few papers that looked at large scale organisational transformation was written analysing IT development companies in Spain, wherein 'large' is relative, concerning the general size of Spanish IT enterprises (Jovanović, et al., 2017).

When looking at special transformation cases, there exists literature on the introduction of DevOps as one method to transform a software development company into an agile organisation (Colomo-Palacios, et al., 2018) and papers about the measurement of DevOps (Forsgren & Kersten, 2018).

2.3.2 Agile organisation design

In contrast to the more practical research on agile transformation, most papers about agile organisation design are written on a theoretical basis. Winby & Worley (2014) for example created the "Adaptive Work System (AWS) model", a new model for agile organisation design and management processes, which can help enterprises to continuously stay innovative and verified it using two case studies. In an earlier study, Worley & Lawler (2010) already created a diagnostic framework for the analysis of the agility of a company. Aligned with this, Ganguly, et al. (2009) defined metrics to evaluate the agility of an enterprise by defining three metrics: market share metrics, responsiveness metrics and cost-effectiveness metrics.

A more practical description was created by Sherehiy, et al. (2007), who applied existing knowledge from agile manufacturing to an entire enterprise and defined measures for workforce agility and for agility as a whole. They aimed at finding out if an organisation is already set up flexible or agile by consolidating empirical research in these fields.

Hinkelmann, et al. (2016) further created a meta model to describe the essential alignment of business and IT in the continuously changing world. Lowry & Wilson (2016) linked the IT service perception within a company to IT agility in a theoretical model.

In the agile organisation design, also further factors were investigated, e.g., the contribution of entrepreneurial orientation of a firm to increased job satisfaction (Kattenbach &

Fietze, 2018). Further, also the contribution of an agile IT as a key factor to become an agile organisation was analysed (Morgan, 2004), and the solution proposals of how to get from operational agility to organisational agility, were worked out from a practitioner level (Denning, 2017c).

2.3.3 Change management

Managing change is essential for all enterprises to survive in today's competitive world. This section looks at change management from different perspectives.

2.3.3.1 Classic change management

The research on agile transformation and agile organisation design also brought several links to change management, which shows its relevance and necessity for successful transformation processes. Similar to agile transformation research, also change management research had to be done excluding articles from manufacturing and production areas, as the change in these disciplines is mostly focused on changes in manufacturing processes, rather than on changes in business processes.

There exist many different change management models, like the three-step process model of Lewin (Lewin, 1975), the eight steps model of Kotter (Kotter, 1996), which is based on Lewin, or the five phases model of Krüger (Krüger & Bach, 2014), which was derived from Kotter. Kotter further revised his model of steps in 2012 based on new challenges to adapt on agile organisation requirements using eight so called "accelerators", which reflect activities to transfer strategy into practice. To do so, he created a construct for network organisations, which then runs parallel to the hierarchical organisation structure to be able to faster react on changing requirements. (Kotter, 2012)

The eight accelerators "to create a sense of urgency around a single big opportunity" after Kotter (2012, p. 52) can be found in Figure 3:

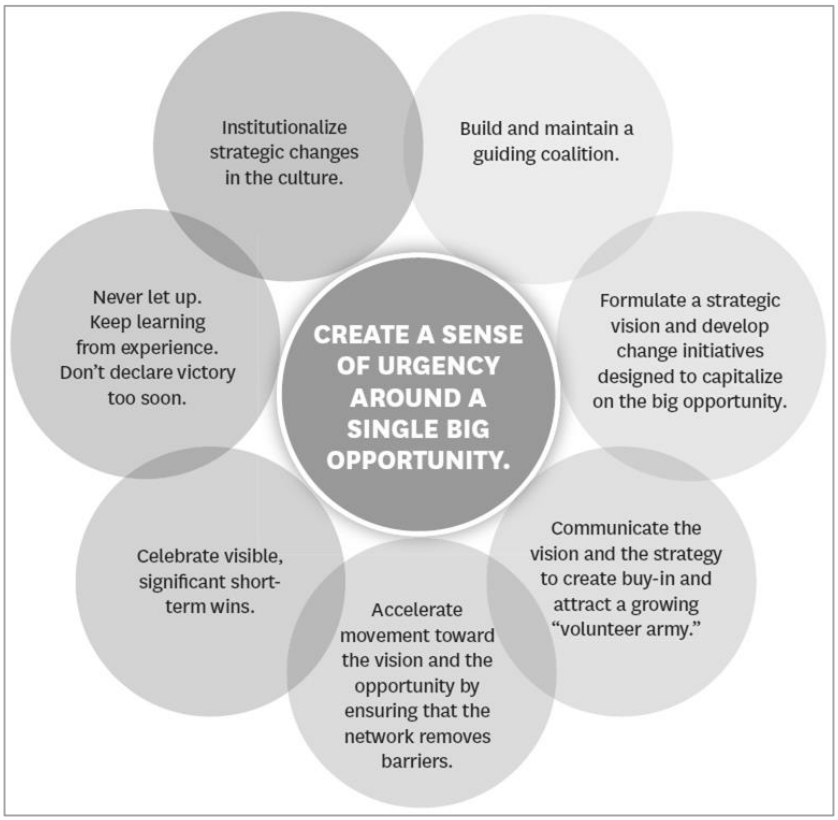

Figure 3: The eight accelerators for change (Kotter, 2012, p. 52)

Further, there exist several change management approaches, like the model of the learning organisation, or the model of complexity of dynamic systems (cf. Stacey (2002), Goncalves (2012)), just to name a few.

Despite the different approaches that are reflected in the change management models, the tasks for managers in change processes are similar in all models. There is fundamental agreement in the literature, that certain factors are considered basic ingredients for successful change. Particular emphasis is placed on the following factors:

Communication with affected people, development of goals and visions, involvement of all affected employees as early as possible and holistically, motivation, willingness, capability and qualification for change in management level as well as among employees.

2.3.3.2 Change management and leadership in agile organisations

Agile methods focus on the self-control of the teams, based on self-responsibility and the abandonment of hierarchies. Therefore, change management in agile organisations has to focus on culture, people, business processes and leadership. Schoemaker, et al. describe in the California Management Review "Six leadership disciplines needed for VUCA"

(Schoemaker, et al., 2018, p. 28). They are: “anticipate, challenge, interpret, decide, align, learn” (Schoemaker, et al., 2018, p. 28) and have to be conducted continuously in a circle. Further, there exist many papers describing on a theoretical level how managers should behave or be. Matzler, et al. (2015) for example argue that, to create innovation success, self-esteem is a positively related factor. Further, core issues that leaders are facing in an agile or volatile environment, as well as appropriate skills and competences leaders should bring, are described on a theoretical level, e.g., by Sheppard, et al. (2013), and as examples from industrial evaluation research, e.g., by Chambers, et al. (2010).

Besides the changes in leadership, also organisational learning has to be reviewed. Worley & Mohrman (2014) created a holistic model for disruptive change management, they call “engage and learn model”, which has no beginning and no end as it is an ongoing process that can be started any time from any point. Annosi, et al. (2018) further described learning processes in agile software development, which are more specific than the model of Worley and Mohrman.

One aspect that is mentioned in many papers, is the cultural change that has to be performed when transforming an organisation into an agile one. Vantrappen & Wirtz (2018) described the implications of change on organisational culture, and Jabri, et al. (2008) highlighted the communication as one of the main topics in culture that needs to change.

2.3.3.3 Summary change management in the agile context

There exist several change management models in the conventional project management disciplines and organisation models. There also exist models for agile organisation design and possibilities on how to measure the agility of an organisation. Literature on agile transformation basically also describes change management models using the terminology and prerequisites of an agile organisation design. The core disciplines of agile transformation and from established, conventional change management processes are merely the same.

Change management processes are described on a high level, but there is no concrete detailed model of how to transform a hierarchical organisation into an agile one. Kotter therefore suggested a concept of a “dual operating system” (Kotter, 2012, p. 47), which combines the hierarchy with an (agile) network.

The elements that are necessary for agile organisation design and for successful change management processes are described and can be used as the basis for a new model for change, but there exists no detailed model for agile change.

2.3.4 Research gaps in agile transformation

The literature review on agile transformation showed that there exist many articles about general topics like change management, agility, and organisation design. But as soon as the search is limited to transformation of large enterprises, results get narrowed to a very limited set of papers. The literature on agile organisation design and the transformation of organisations is mostly focused on manufacturing (lean production) or software development companies. The review also showed that, beside research on agility in manufacturing, most of the other cases are focussed on the agile transformation of software development companies.

Dikert, et al. (2016) for example state that there is a need for further research on success factors and challenges in non-software development enterprises as a contribution to agile transformation in theory and practice.

In terms of the definition of success factors also exists a gap. The research is basically done on quantitative level or with selected cases in the software industry. Chow & Cao (2008) for example state that organisational factors are not critical for success of projects but they are self-questioning this fact as they also state that all analysed companies were very open to new, agile approaches, and therefore this point could not be generalised.

→ *Research Gap A:*

Missing empirical studies about critical success factors for agile transformation of enterprises outside the software development industry and outside manufacturing (lean production).

There is another research gap in finding case studies of agile transformation in large, non-IT enterprises. Further, most of the research papers do not contain any analysis on the integration and inclusion of business areas, finance controlling, purchasing, IT, R&D and HR management as a holistic approach. Dikert, et al. (2016), for example, state that further cases studies in "enterprise agile" are necessary, focussing on the analysis of the obligatory integration of non-development functions within an organisation into agile structures. Stettina & Hörz (2015, p. 151) for example also see further research demand in finding "the best governance structure for an agile organization" and in the answering of the question on "How to enable strategic management in agile portfolios".

Further, Serrador & Pinto (2015) found that in many large enterprises there is still planning, etc. done on a long-term basis, which leads them to the point, that further research on hybrid method usage is necessary for the future.

→ *Research Gap B:*

Missing research on how general business functions of hierarchical enterprises like HR management, governance functions, purchasing, finance controlling, etc. may be fully integrated into a successful agile model.

As the agile organisation structure aims at individual responsibility whereas conventional organisations have usually hierarchical structures, it is also a big challenge for HR departments to individually develop people. Current literature does not give a broad overview of what needs to be done to enable organisational learning and individual qualification as motivation of people. There are some articles on "new leadership", but they have to fit into organisation context, people's needs and corporate culture.

The definition of roles within an agile organisation is a big challenge, especially when a transformation from conventional, hierarchical organisations into agile organisations takes place. Jovanović, et al. (2017) for example see the transformation of traditional roles into agile roles as one of the future research fields. Stettina & Hörz (2015, p. 151) also see the "interplay of practices across functional roles" as a field of research.

→ *Research Gap C:*

Missing concepts on roles transformation from hierarchical to agile organisations. To enable the creation of an agile culture, HR-processes are necessary to successfully enable and qualify people (associates and managers) to understand and fulfil new requirements and processes.

Based on these findings, especially from but not limited to change management literature, it can be said that a step-by step model which describes in detail the used agile models and methods, the topics of project management, change management, success factors and the application of norms on agile aspects is not existing in the literature.

→ *Research Gap D:*

Missing step-by-step change management model to successfully transfer large enterprises from a conventional, hierarchic organisation into an agile organisation.

2.4 Success factors for projects

This dissertation aims at finding a project management framework to best support organisations in their agile change management process. Therefore, critical success factors for projects from the literature were determined in this section. In chapter 4, the results of the data collection (interviews) will be compared and discussed with the results from this section.

2.4.1 Critical success factors in general

Critical success factors in projects have been analysed for years. The first remarkable definitions are from Pinto, Slevin and Prescott from the 1980s. Pinto & Slevin (1988a) state that it is critical for projects to satisfy the client by completing a project within given time, performance and costs. They also applied a project assessment tool to enable benchmarking of project performance and linked the project success factors with factors from organisational change. Later, they detailed the critical success factors to 14 which reflect in 60% of project success (Pinto & Slevin, 1988b). Pinto & Prescott (1990) then grouped them into tactical and planning factors for project success and stated that some factors can be influenced by the project team, and others are given by the environment.

Belassi & Tukel (1996) took the individual critical factors for project success and put them into a framework as they state that not every factor itself has influence on project success or failure, but they have in combination with others. They clustered the critical success factors into four categories to enable users to better examine them regarding their influence on success. The four categories are: “factors related to the project, factors related to the project manager and the team members, factors related to the organization, and factors related to the external environment.” (Belassi & Tukel, 1996, p. 143) They created a framework which shows the dependencies between the different success factors as can be seen in Figure 4.

In parallel, Shenhar, et. al. (2002) further refined success factors for more technical projects by clustering them into organisational and project specific success factors. All 48 variables were evaluated regarding their importance depending on the complexity of a project and the uncertainty of project specifications. As organisational factors, they defined the organisational structure, resource sharing, project management autonomy and the project team. As project specific factors, documentation, design reviews, management policy, formal contracts, and customer participation are named. The result, which factors

are critical for success in complex / uncomplex projects with certain / uncertain requirements was not evaluated or tested by the authors.

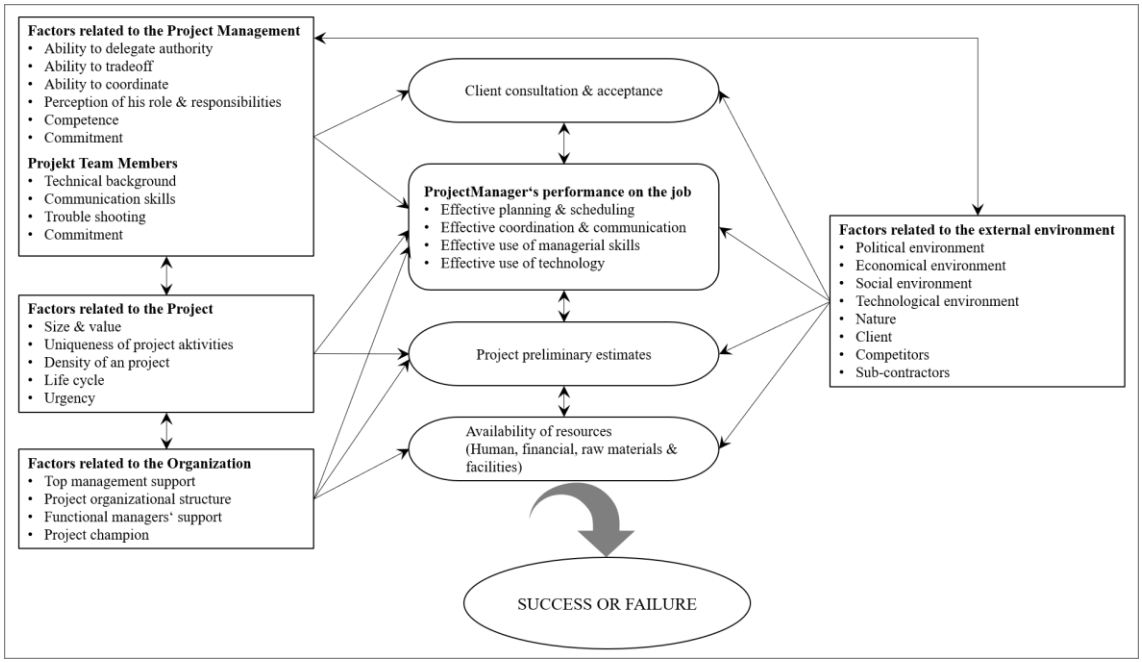

Figure 4: Critical factors for success or failure in projects (Belassi & Tukel, 1996, p. 144)

2.4.2 Critical success factors for agile projects

In addition to general success factors for projects, critical success factors for agile projects were analysed. Chow & Cao (2008) analysed critical success factors in the agile environment. They found in their quantitative study, that only six factors out of 48 have a direct influence on project success, contributing to fulfil the requirements in regards to quality, scope, timeliness and costs. The factors are: team environment, project management process, agile software engineering techniques, customer involvement, delivery strategy and team capability. These six factors are also reflecting the content of the core values of the agile manifesto (cf. section 2.2.2). One remarkable result of this quantitative analysis is that organisational factors and project dimensions do only have minor influence on project success, whereas technical topics and people play a strong role.

Müller and Jugdev found that there is a difference between factors that impact project success ("interactions of personal, project, team, and organizational success") and factors that influence project success ("competences and quality of teamwork, but also project scope, cost, and time management") (Müller & Jugdev, 2012, p. 768). They also stated that there is always a kind of subjectivity when looking at project success from different views, depending on the individual role or focus of the evaluating person. For different project types, success may be measured differently.

The competencies of the team can be taken as granted the same way as in conventional projects. More than in waterfall projects, the motivation to work in self-organised teams, with high commitment to the team and project, is crucial for a team to be successful. (Binder, et al., 2014)

Serrador and Pinto (2015) also did a quantitative analysis to find out if "agile methods work better than traditional approaches for achieving project success". The research question was answered in the affirmative. In their research, complexity and team experience also do not play a role as critical success factors, but the quality of the vision and goals do have an impact on project success. They further stated that there are many large enterprises that still do kind of hybrid approach in terms of planning, etc. and that further research will be necessary in this context.

2.4.3 Critical success factors in the norms for project management

Norms and standards are also a good source for generalised criteria or factors for a specific topic. Especially norms or standards from large organisations as the ISO, IEEE or BSI, just to name a few, orchestrate and develop their guidelines in close cooperation with representatives and experts from different organisations. (IEEE Standards Association, 2022) All results are constantly reviewed and approved by specific boards and committees. (International Organization for Standardization (ISO), 2022)

As a guidance for enterprises to successfully implement and conduct projects, the ISO 21500 standard can serve (BSI, 2012). The ISO 21500 norm for project management describes that project objectives and requirements of the project sponsor, stakeholders and customers need to be fulfilled. To do so, appropriate processes need to be chosen. At the same time, the project scope needs to be defined and managed within the given constraints and by the obtaining of commitment and support from the project sponsor, customer and all involved people. For all that, an appropriate approach needs to be chosen and defined to best adapt or develop the plans and product specifications to the project requirements and objectives. Possible process and subject groups, inputs and outputs of all project management phases are also described in the norm (BSI, 2012, clauses 4.2 and 4.3).

The ISO 21500:2012 generally describes the key concepts of project management as they can be applied to all projects, independent of size, environment, and organisational structures.

The definition from clause 3.3, for example, describes, that processes should be systematically aligned, and deliverables are requested for each phase of the product life cycle.

For this point, the agile approach does not deliver as many documents as the waterfall approach, but with the artefacts and meetings that are defined, e.g., product backlog, regular retrospectives, etc. (Sutherland & Schwaber, 2017), all goals of project management can also be reached. Customers, sponsors and other stakeholders are integrated into these processes from the beginning and at any time wherever their contribution is necessary. Binder, et. al. (2014) stated here that stakeholder expectations can only be met if they are simple and focus on clear, defined results. They mapped the agile manifesto with criteria from ISO 21500 and came to the result, that the content from ISO can be mapped to the criteria from the agile manifesto, whereas the fulfilment of the targets, if it is followed strictly, is independent on the chosen approach, but project scope must be revised for each circle. (Binder, et al., 2014)

The ISO 21500 further gives guidance on project management for all involved parties in projects, the BSI applies them to UK in BS ISO 21500:2012 (BSI, 2012, p. 9):

"In order for a project to be successful, the following actions should be accomplished:

- select **appropriate processes** […] that are required to meet the project objectives
- use **a defined approach** […] to meet the project objectives and requirements
- comply with requirements to **satisfy the project sponsor, customers and other stakeholders**
- define and manage **the project scope** within the constraints, while considering the project risks and resource needs to provide the project deliverables;
- **obtain proper support** from each performing organization, including commitment from the customers and project sponsor."

In addition of the above-named norms, also established standards like "A Guide to the Project Management Body of Knowledge" (PMBOK) and the attached "Agile practice guide" may serve as 'grey literature' for success factor derivations.

Binder, et al. (2014) already tried to mix the agile model with the ISO norm in form of a 'cocktail model' as they called it, where elements from both worlds were combined on a high level.

2.4.4 Research gaps for critical success factors

The literature review revealed two research gaps in the field of critical success factors.

First, it showed that the application of the project management definitions from ISO 21500:2012 to agile models is also possible, as the norm does not define an approach to fulfil the requirements and recommendations of this norm. But it is more difficult, as the

descriptions need to be transferred to the roles, process steps, inputs and outputs of the agile model. From this, the following research gap was derived:

→ *Research Gap E:*
Missing detailed hybrid model of a combination of waterfall and agile methods to fulfil ISO 21500 project management guidelines

This section further showed that literature does not give a unique solution for critical success factors for projects. Most of the authors have in common stating that customer satisfaction is the top goal. The project should be completed within given time, performance and costs.
The opinions about which success factors lead to competitive advantage, and which do not, are different based on different authors, case studies and papers. Further, the analysis of which factors are critical for success in complex or non-complex projects with certain or uncertain requirements, are often not evaluated and described as further fields of research by the authors.
The analysis of critical success factors in agile projects focusses on factors related to the team environment, project management processes, agile software engineering techniques, customer involvement, delivery strategy and team capability. Some authors state that organisational factors and project dimensions do only have minor influence on project success, whereas technical topics and people play a strong role. But they also state that success is always subjective and depends on the point of view, from which project success is looked at. Others state that complexity and team experience also do not play a role as critical success factors, but the quality of the vision and goals do have an impact on project success.

→ *Research Gap F:*
Missing determination, categorisation and evaluation of critical success factors depending on different kind of projects, requirements, environments and organisations.

2.4.5 Framework for project success

As described in this section, there exist several different opinions about which factors in project management, and especially in agile project management, are to be seen as critical success factors and about which factors influence project success in general. The controversially discussed and evaluated factors were clustered into the categories from Belassi

& Tukel (1996) as they fit best to group all relevant aspects from the different sources. (cf. Figure 4) The critical success factors for (agile) projects can be grouped by "factors related to the project, factors related to the project manager and the team members, factors related to the organization, and factors related to the external environment." (Belassi & Tukel, 1996, p. 143)

The factors of this literature review were consolidated in an overview which is shown in Figure 5:

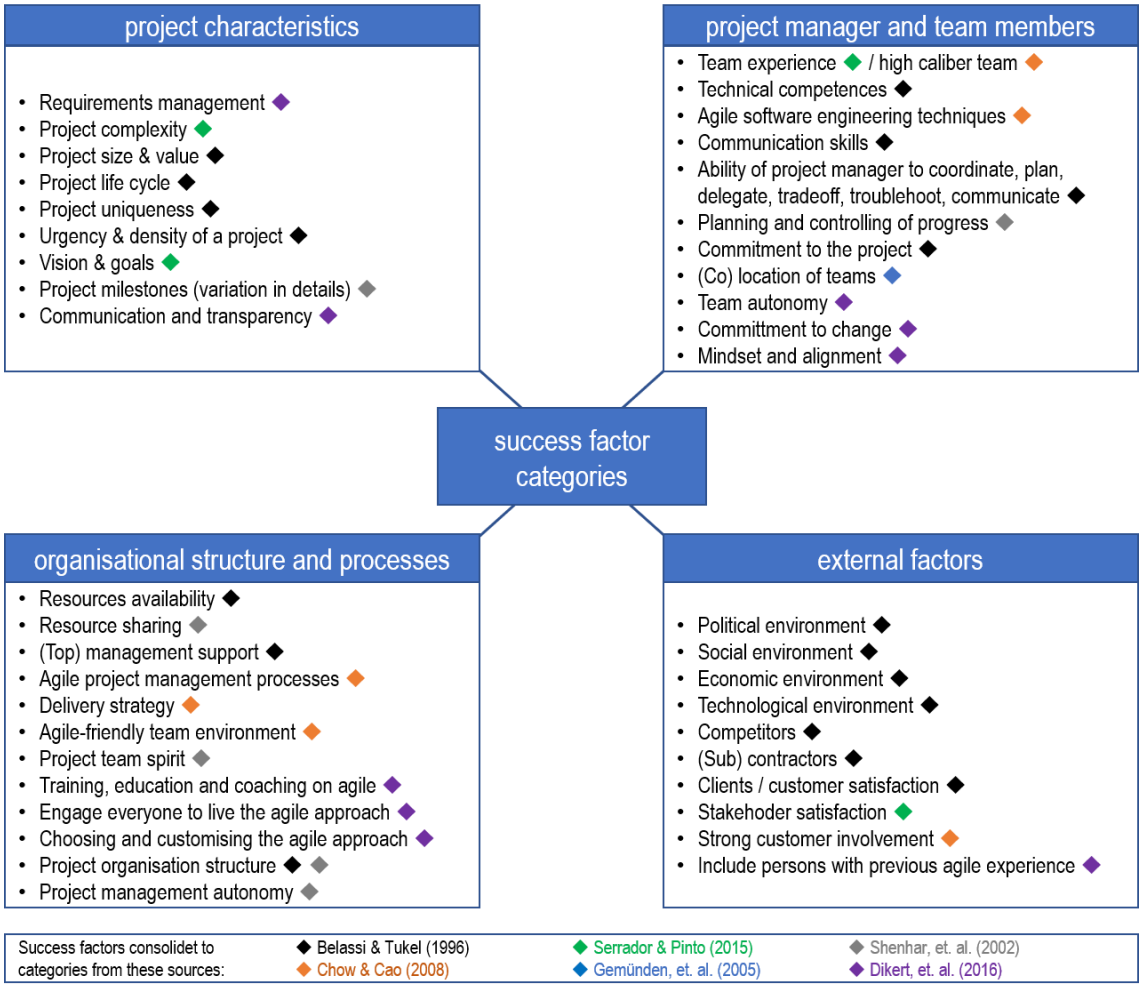

Figure 5: Consolidation of critical success factors from extended literature review, including references marked with coloured diamonds.

The *project manager and project team* setup is important for its performance. For that, team capability and team experience play a role as well as project leader competences and software engineering techniques. Further, for teams to become agile, commitment to change, agile mindset and alignment with agile processes are factors to be considered when analysing project success factors. Team autonomy and (co) location of the team are further factors that are controversially discussed in the literature. Additionally, the projct manager should have the ability to follow project management guidelines, have general

management skills like planning and scheduling topics as well as troubleshooting competences. To be in the situation to deliver the results as expected by the customer, project estimates must be done properly to fulfil timelines.

The *organisational context*, in which the project is located, also has influence on the project success. The organisational structure, governance, project management autonomy, team environment, and team spirit play a role as well as top management support for a project, availability of resources, and the coaching and training of everyone in the organisation on agile methods and agile thinking, and willingness to become agile. The delivery strategy, to satisfy all customers and stakeholders, is also important in this context. Regarding project management methodologies, the used iterative approach or sequential approach should be analysed in regard to necessity to be adapted to the specific context.

From the *project* perspective, size, value, uniqueness, urgency, and complexity are controversially discussed regarding their influence on project success, especially in regard to differences in the use of a sequential or iterative approach. The presence of a common vision and common goals of a project may also be success factors, especially when it comes to a common understanding of all involved parties about measures to reach the goals. Good requirements management, e.g., by the product owner, as well as communication and transparency, are factors for success of a project from the project side.

Finally, also *external factors* have influence on project success. Political, social, economic and technological factors are influencing project success as well as competitor situation in the market, customer involvement and requirements handling from customers, and with (sub) contractors, are factors to be considered when setting up projects. Further, the inclusion of persons with previous agile experience from outside the company may help succeeding in transforming an organisation.

2.5 Research gaps and research questions

The aim of this dissertation is to provide a framework which supports decision-makers in large organisations to find the best suitable project management setup for their specific context.

Therefore, in this section, the research results from the literature review are analysed regarding research gaps and recommendations of authors for the necessity for further research. The revealed research gaps were analysed in regard to their potential to contribute

to answer the overall research question and their contribution to fulfil the target of this dissertation.

2.5.1 Critical success factors for agile transformation of organisations

> *The first Research Gap (A) can be summarised as missing empirical studies about critical success factors for agile transformation of enterprises outside the software development industry and outside manufacturing (lean production).*

This dissertation looks at a specific, dedicated area within a multi-national enterprise. A broad empirical study is not focus of in this dissertation. The company is located in the automotive industry and research is done in the field of IT projects, including all business units. This dissertation may contribute to find specific critical success factors on agile projects in a large organisation outside lean production and outside the software development sector. Through the selection of interview partners also from software development partners, experiences from this field may be transferred to a "general" company.

2.5.2 Integration of general business functions into agile models

> *The second Research Gap (B) can be summarised as missing research on how general business functions of hierarchical enterprises like HR management, governance functions, purchasing, finance controlling, etc. may be fully integrated into a successful agile model.*

As already described, this dissertation looks at IT projects within a large enterprise, from the beginning to the end. It therefore also aspires to generate holistic insights and data about agile processes, including business functions within the enterprise, like purchasing processes, roles within the projects, coaching, possibilities for trainings, etc.
This dissertation may bring up factors that need to be considered when transforming an organisation from a hierarchic one into an agile one.

2.5.3 Concepts for role transformations

> *The third research Gap (C) can be summarised as missing concepts on roles transformation from hierarchical to agile organisations. To enable the creation of an agile culture, HR-processes are necessary to successfully enable and qualify people (associates and managers) to understand and fulfil new requirements and processes.*

Cultural change may be essential for an agile transformation to be successful. This dissertation aims at finding out what the critical success factors are for a project team to work. During the interviews, there will be set a focus on investigating on team skills, hard

skills, soft skills, team setup, etc. With that, this research gap may be filled based on the practical research.

2.5.4 Step-by-step model for agile transformation of large enterprises

> *The fourth Research Gap (D) is revealed as the missing step-by-step change management model to successfully transform large enterprises from a conventional, hierarchic organisation into an agile organisation.*

This dissertation will deliver a specific framework for an agile working model. The framework, which should be developed in this dissertation, may serve for future researchers to test it in a broader context and to derive a general step-by-step model. For the development of a general step-by-step model, there is further quantitative research necessary.

2.5.5 Evaluation of critical success factors depending on specific parameters

> *The fifth Research Gap (E) is revealed as the missing determination, categorisation and evaluation of critical success factors depending on different kind of projects, requirements, environments and organisations.*

In this dissertation, the critical success factors from literature, will be used as basis for the interview to find out which factors are critical in which cases to enable projects to be successful. In this context, the factors are questioned, based on a hierarchic organisational structure, which uses the waterfall approach as well as based on agile projects in an agile organisation. The results may contribute to fill the gap of which factors are critical for success of projects in the different situations, projects, environments, etc. In future research, a test of the generated framework can be done focussing on different situations, projects, etc.

2.5.6 Hybrid model to fulfil ISO 21500 standards

> *The sixth Research Gap (F) is revealed and can be named as the missing detailed hybrid model of a combination of waterfall and agile methods to fulfil ISO 21500 project management guidelines.*

Besides the critical success factors from literature, also aspects from ISO 21500 project management guideline were used as a basis to analyse, if and how they are relevant, essential or needless, following the two approaches (sequential and iterative). The aim is to derive a framework for managers to decide for the best approach for their company.

Future research can then focus on testing the framework against norms or other project management guidelines.

2.5.7 Derivation of research questions

The research gaps were evaluated regarding their relevance for this dissertation and the feasibility to fill the gaps with the results of this dissertation. This dissertation may contribute to fill three of six gaps.

This dissertation is focusing on getting results from a specific setup in a single multinational enterprise. With that, the research gaps A, B, and C can be covered and filled in this dissertation. As a result of filling these gaps, decision matrices and a framework based on the success factors, roles transformation, and the integration of hierarchical functions into an agile organisation should be derived.

This framework may then serve as a basis for further research, and to answer the remaining three research gaps. Based on the model of this thesis, the definition of a general, detailed, step-by-step model for agile transformation of large organisations can be derived and tested (D), the dependencies of critical success factors and their characteristics in the different project management approaches based on varying project specific parameters can be explored (E), and the analysis of the fulfilment of ISO 21500 norm with hybrid approaches can be analysed and proved (F) in future work.

The research gaps, that are addressed and filled in the dissertation in form of a decision support framework, are shown in the following Figure 6:

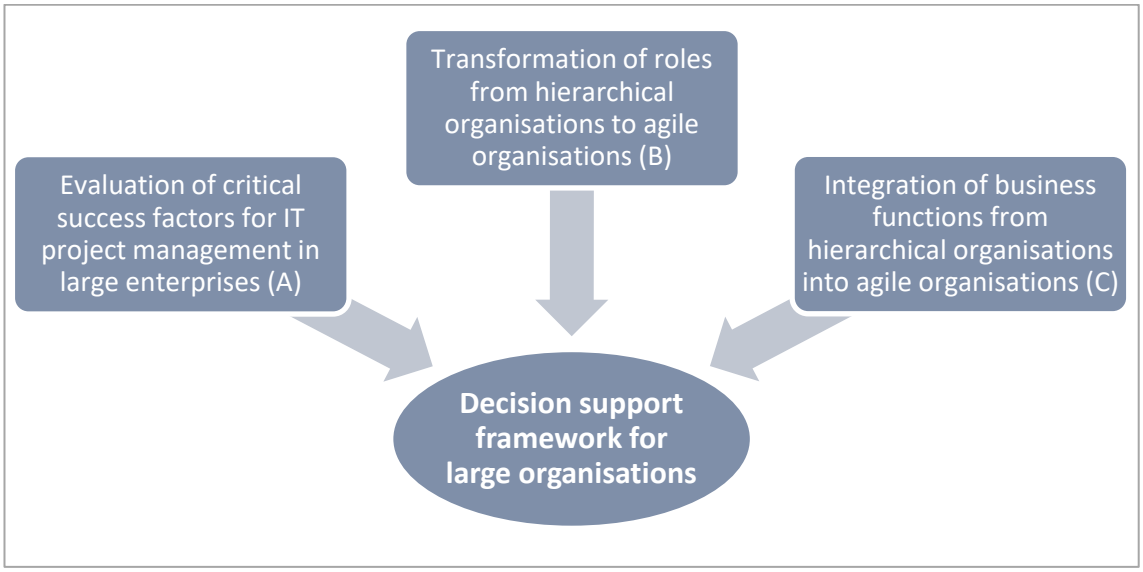

Figure 6: Main focus of this dissertation: Development of a decision support framework based on evaluation of critical success factors for projects, considering transformation of roles, and integration of business functions into agile organisations.

Based on the three research gaps that are covered in this dissertation, the following three research questions were defined.

Research question 1:

> *What are the key success factors for the execution of IT projects in large organisations focusing on factors related to the project, to the project manager and the team members, to the organisation, and to the external environment, and how did they contribute to successfully completion of projects?*

This research question aims at finding factors that are important for IT projects to work, independent on the chosen project management approach, knowing that all interviewees already have their experience in sequential project management (mostly waterfall approach) and in iterative project management (agile approaches like Scrum). The interview and the scenario were also structured in a way that all aspects were covered. As a result, possible hybrid models should be derived.

Research question 2:

> *What were the biggest challenges that had to be taken in the context of agile transformation in large organisations in terms of roles and responsibilities and how did the set-up work or fail?*

This research question aims at finding out which challenges had to be managed by the involved project team members in the process of the transition from conventional organisation setup to the agile project setup. It focused especially on roles and responsibilities as well as decision-making authorities, self-responsibility and flexibility in reacting to changing requirements in the agile context.

Research question 3:

> *What are the special challenges in large hierarchical enterprises that need to be changed to enable efficient project management following the iterative / agile approach and how could they be resolved?*

The third research question aims at business functions within hierarchically organised enterprises that need to be considered to enable agile working models within the company, e.g., purchasing process, HR processes, trainings, etc. These functions are essential for large enterprises to run, but adaptions are necessary compared to the existing sequential approaches.

2.6 Summary literature review

This chapter gave an overview about existing literature on agile transformation processes and change management processes towards an agile organisation. Further, the most common software development paradigms and project management models (waterfall model and agile project management models) were analysed, as they serve as a basis for the further work on the generation of a hybrid project management framework. As a core of this chapter, critical success factors of IT projects in all kinds of approaches were analysed, and a set of success factors based on the results from the literature was derived. This set serves as a basis for setting up the methodology and data collection process.
As a result of this chapter, the research gaps were pointed out and research questions were derived. In short, the research questions aim at finding key success factors for successful IT project management in large organisations, to find ways for the transformation of roles from hierarchical organisations into agile organisations, and to define possibilities for the integration of business functions from hierarchical organisations into agile organisations. Figure 7 illustrates the derivation of the research questions from the research gaps (RG).

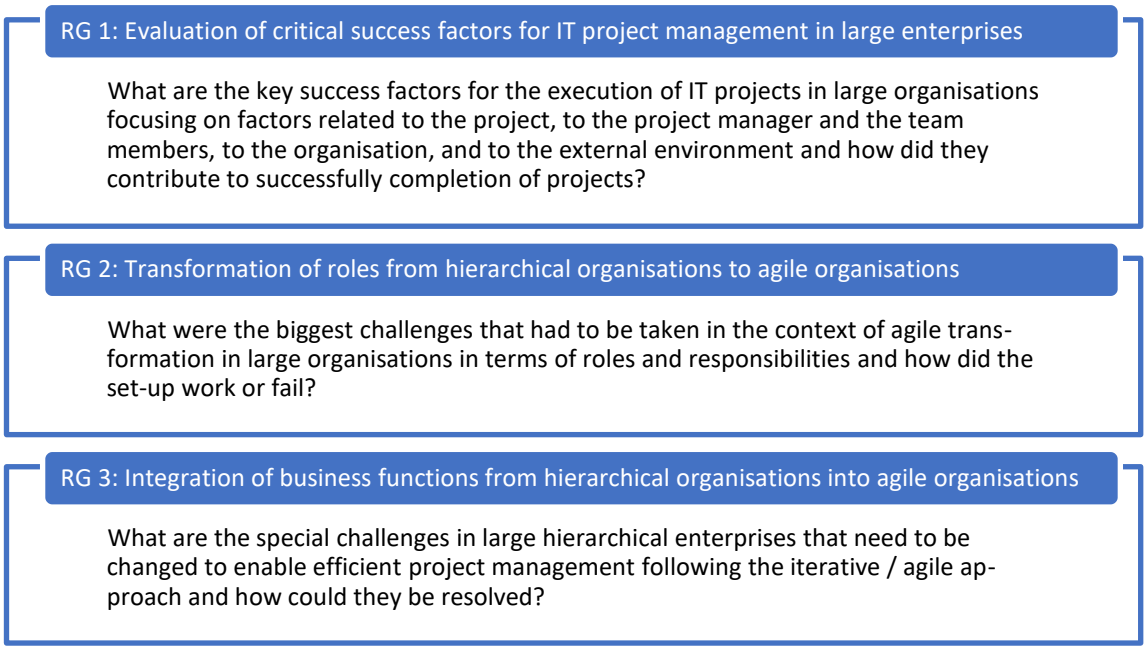

Figure 7: Derivation of research questions from research gaps (RG)

3 Research methodology

3.1 Introduction

This section describes the research methodology of this dissertation.
It starts with the description of the researcher's philosophy of critical realism with a subjectivist ontology (**section 3.2**). The research approach is inductive and is described in **section 3.3**. **Section 3.4** continues describing the research method, which follows the qualitative approach. The research design is laid out on the research method and takes a case study approach based on a scenario as the core for data collection. **Section 3.5** describes the scenario and case study in detail, to further explain the meaning of the chosen approach for answering the research question. **Section 3.6** details the semi-structured in-depth expert interviews as chosen data collection method. With the case study, the scenario, and the expert interviews based on it, insights into the experience and suggested progress of the interviewees about how the project should be worked out could be received. The data analyse is using a qualitative coding thematic nodes is described in **section 3.7**. The chapter concludes with research challenges (**section 3.8**) and ethical considerations (**section 3.9**).

3.2 Philosophical approach

3.2.1 Ontology

The ontological assumption describes the nature of reality as it is seen by the researcher. (Collis & Hussey, 2003) It considers, if the researcher is looking at the world and the researched area from an objective viewpoint with an external, neutral view (objectivism), or if he is examining and taking into account perceptions and consequent actions of people (subjectivism). (Saunders, et al., 2009).
The author's ontology is **subjectivist**. He does not accept the world as objective, because everything has to be seen in a specific context. For this dissertation, and to answer the research questions, it is necessary to see the application of agile theory in practice. The theory is objective, but the implementation in practice is always depending on the circumstances, on the context in which the people act and react, and on the project in which the actions are done. For example, in the eyes of the author, decisions that are taken within a project, are always depending on the circumstances, requirements and prerequisites of this specific case.

In this dissertation, all positions, attitudes and actions are related to the environment of the people and their role in the organisation. None of the statements can be assumed to be context-free.

3.2.2 Epistemology

Apart from the general research philosophy of the researcher, the method of knowledge acquisition is relevant for the definition of the philosophical approach.

Epistemology is concerned with the method of knowledge acquisition and with the question of what is acceptable knowledge in the research field (Saunders, et al., 2009). It also defines the relationship of the researcher to the researched topic (Collis & Hussey, 2003).

The research questions in this thesis ask for the criteria which make an agile transformation successful in large enterprises. This is regarded on the example of a large enterprise in the automotive industry. The view, which the author gets, is a subjective one, delivered from perceptions of employees and managers within the company and from suppliers. The researcher is part of the investigated organisation. Therefore, the researcher is interacting with the people in the researched field and distance is minimal.

The epistemological philosophy of the author can be described as **critical realism**. It means that the "knowledge of reality is a result of social conditioning and cannot be understood independently of the social actors involved in the knowledge derivation process" (Saunders, et al., 2009, p. 115).

For this research, it is essential to understand and interpret the meanings that individuals attach to objective statements. It is different, if a manager from a supplier makes a statement or an internal employee states a fact, as it comes from different environments and perspectives. Therefore, a multi-level study is important to get a detailed view about the researched topic. Each level (e.g., organisational level, level of groups, level of individuals) "has the capacity to change the researcher's understanding of that which is being studied" (Saunders, et al., 2009, p. 115).

Therefore, in this research, experts from management level and employee level from IT departments, business areas, and first tier suppliers are interviewed to get a broad in-depth view of the research field.

3.2.3 Axiology

Axiology looks at values and their role in research choices. The difference can be made between value-laden and biased vs. value-free and unbiased. (Saunders, et al., 2009)

This research aims at getting in-depth information from interviewees about how they would do a project and about success and failure of agile methods. Therefore, personal interaction between the researcher and the researched personnel has great importance. With this, the research is always **value-laden and biased**. As the researcher is an employee of the company which is researched, the proximity to the data is given and in-depth data collection is possible. It is important for the research to get detailed information of the feelings and experiences of the interviewees. Therefore, a close relationship between the researcher and the interviewees helps to collect authentic data.

3.3 Research approach

There exist two research approaches: inductive and deductive.

In this dissertation, the **inductive approach** is chosen by the researcher, to best answer the research question.

The inductive approach takes the empiric level as a basis, data is interpreted and condensed with the aim to developing a theory based on the collected qualitative data (Döring & Bortz, 2016). The data is processed from specific data to general theory. The inductive approach is suitable to answer research questions as they make it necessary to understand the meanings people attach to statements. To reach this, qualitative data is collected in an unstructured or semi-structured way to keep the possibility to change the focus during the research process. As there is no need to generalise the results, the researcher is freer in his approach. (Saunders, et al., 2009)

The research questions are pragmatic ones, as they search for opinions of the selected experts on the issue of success of agile change. For this reason, a flexible structuring of the questions based on expert level and progress of research is chosen.

Figure 8 illustrates the chosen approach:

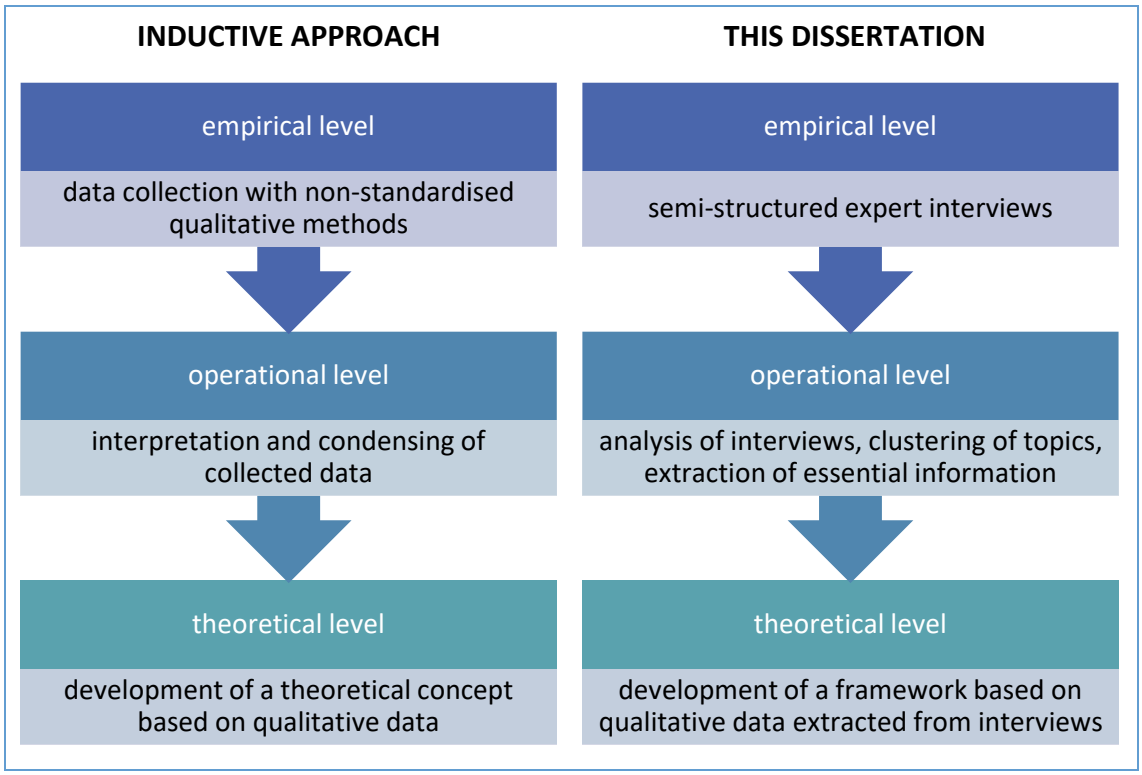

Figure 8: Inductive approach used in this dissertation (based on criteria from Döring & Bortz (2016)

3.4 Research method

The research philosophy (critical realism) and the selected research approach (inductive) are the basis for the definition of the research method. In this section, the research method is described in detail.

The possible research methods are quantitative, qualitative and mixed methods. The differences between the different approaches in several aspects can be found in, e.g., Holloway & Wheeler (2004).

For this research, the **qualitative approach** supports the answering of the research question best. The research aims at understanding the success factors of agile transformation in the large enterprise in which the researcher is employed. The research has the target to derive a reference framework for other companies. To get the necessary information, experts for semi-structured interviews are selected. During the research process, research questions can be adjusted or added. With this, the characteristics of qualitative research of Creswell (2014) are fulfilled. For this research, only the qualitative approach is suitable for answering the research questions.

Table 1 shows concrete details about the focus of this dissertation:

Qualitative research method in this dissertation	
Aim	▪ Exploring employees' experiences in, and usage of, sequential or iterative project management methods in real projects
Approach	▪ Focus on usage of sequential and iterative project management methods in IT projects in the context of a large enterprise
Sample	▪ Experts in the field of IT and business ▪ Small Number of people ▪ Interview-questions may vary during progress of research
Data collection	▪ In-depth, semi-structured expert-interviews based on experience of interviewees and reference project as case study scenario
Analysis	▪ Thematic analysis of the results based on the main topics from literature: project characteristics, project manager and team members, organisational structure and processes, and external factors
Outcome	▪ A model for successful application of agility in large enterprises
Relationships	▪ Researcher is employee of investigated company ▪ Research is related to projects of researcher
Rigour	▪ Trustworthiness and authenticity based on well-chosen experts

Table 1: Criteria for qualitative research method in this dissertation

To gain the necessary information on how transformation can be successful for large enterprises, insights and in-depth experience knowledge from people working in the field of software development projects are necessary.
The researcher decided to choose a qualitative research approach.
It is often very easy to find success factors, factors for failure, challenges during transformation process, etc. This dissertation aims at finding not only facts like "what is the most common success factor", but insights about why and how projects, change and transitions are successful or fail. With further information on how failure could have been avoided or who or what was essential for a project to be successful, a broader framework as a decision matrix may be derived to supply other enterprises with a tool to choose the best project management approach for their specific needs and to enable successful transformation processes.

The interviews are therefore set up consisting of two parts: an open part, in which the interviewees are asked to talk about their own experiences in project work, and a part which is led by the reference project as part of the scenario in the case study, to which questions are asked. In the more structured part, which investigates the scenario, it is

taken care that it still leaves open space for interviewees to express their own feelings, thinking, and problem-solving approach without constraining them into a specific direction or project management approach.

The research aims at finding the best solution for projects to be done, either following a sequential model like the waterfall approach, an iterative, agile approach or something in between (hybrid model). Therefore, it is necessary to get answers from the interviewees which are comparable in a way that chosen problem solving approaches, timing, challenges and the general project management behaviour can be placed side-by-side. To do so, a scenario in form of a reference project for the development of a complex IT-system is described. With this project brief as a guideline, all interviewees from different business areas are enabled to talk about their experiences and show how they would resolve this dedicated problem.

Interviewees are also set in the position of a project lead who can set up the project team, define the project timeline, and set all parameters to make the project successful from their perspective, ignoring any limitations of resources, time, budget, etc. to enable the description of an ideal type project progress.

3.5 Research design

The research design reflects the framework of this dissertation and describes the research method and research strategy which is chosen to best answering the research questions (Saunders, et al., 2009). This research aims at enhancing existing models and therefore, new knowledge should be created based on information acquired in this work.

In line with the critical realism as philosophical approach, and the inductive research approach, the chosen research design is **explanatory** based on the case study approach. (Yin, 2003)

3.5.1 Case study approach

In this dissertation, the case study approach was chosen as research strategy. Eisenhardt (1989, p. 534) defined case study research as “a research strategy which focuses on understanding the dynamics present within single settings.” This research focusses on the understanding of different behaviours, processes, actions, advantages, and disadvantages in project management methods. Yin (2003, p. 1) stated that “case studies are the preferred strategy when ‘how’ and ‘why’ questions are being posed” and that a case study “investigates a contemporary phenomenon within its real-life context, especially when

the boundaries between phenomenon and context are not clearly evident." (Yin, 2003, p. 13) This dissertation was written in the context of the change process from a sequential project management approach, e.g., waterfall approach, to an iterative project management approach, e.g., Scrum, within a large enterprise in the automotive industry in Germany. This specific setting reflects the single case for this research.

This dissertation further aims at deriving a framework for large enterprises as a guideline to choose the right project management approach to best support their agile transformation. The case study will contribute to the aim to generalise and expand existing theories or frameworks, which is covered by a case study. (Yin, 2003)

3.5.2 Reference project as scenario

This research was performed in an exemplary division within a large organisation. The division is responsible to supply software tools for international processes in the HR and general services area.

The interview consisted of two parts. The first part focussed on current and past experiences of the interviewees as project team members in projects which followed sequential and/ or iterative projects management approaches. For the second part, a specific scenario was developed to enable interviewees to describe their individual procedures, measures, and solutions, to best complete the project.

The concrete definition of the scenario was important for the researcher to be able to compare the given answers and to evaluate them.

Therefore, for the scenario-specific part of the interview, a reference project, described in form of a project brief, was defined. This reference project contains real requirements from the researcher's work environment, combined with fictional requirements to make the project appropriate to get required contributions from interviewees to answer the research questions. The interviewees received the project description upfront and were asked to read through it and prepare for the interview. The approach, to use a scenario, is suitable to answer the research questions as the researcher is looking for communalities across different expert areas. Kosow & Gaßner (2008, p. 11) define that "The aim behind scenarios is to generate orientation regarding future developments through an observation of certain relevant key factors. […] Its true function consists in directing attention to one or more specific, clearly demarcated segments of reality." That is exactly how the scenario supports the case study: in providing basic parameters, frame conditions, requirements, challenges, etc. to lead the interviewees to think in the same direction. Kosow &

Gaßner (2008) further differentiate, based on existing concepts, into four different goals a scenario may attain. In this dissertation, the communication function of a scenario is used to stimulate a discourse in which they help to "promote a common, shared understanding of a problem while also promoting an exchange of ideas and the integration of different perspectives concerning a topic." (Kosow & Gaßner, 2008, p. 19)
Ramirez, et al. (2015, p. 72) further argue that "scenarios broaden the scope of study from the specific research question to also include its context", which is essential for the model derivation to ensure a concluding concept in this dissertation.

3.5.2.1 Basic requirements for the reference project

For the creation of a reference project, some criteria must be fulfilled to generate value for the dissertation.
First, the reference project must be described as if it was a real project. The embedding in the context of a problem which is common in the real world or comparable to problems that everybody is used to from the real life, independent from their role in the job, makes it easier for all involved people to quickly understand the problem and to feel comfortable with the situation. The approach, using a reference project, helps interviewees to transfer the requirements from the interview into experiences they made in the past in the private or professional environment as well as decisions they would take in their personal or professional life.
The project description has to be done in a way, in which as it is common and well-known for all interviewees. This makes it easier for them to get a feeling on the requirements and the context, in which the problem occurs. Therefore, the author decided to define the project description in form of a project brief, as it is used in the project prioritisation process in the large enterprises for many years.
The level of details of the reference project brief must be weighed up. On the one hand, the project should be described in-depth with many details to make the answers of all interviewees comparable as they have a common understanding of the problem that needs to be solved. On the other hand, the description should leave room for interpretation as the reader should not be pushed into a specific direction, as the research aims at finding the best solution for the case from the viewpoint of each individual person. Especially, a pre-determination of the used project management model (sequential or iterative) should be avoided. Therefore, e.g., the timing is defined very loosely to provide space for interpretation and structuring of the project progress and design.

3.5.2.2 Intention of the reference project

The reference project is described in form of a project brief, as it is common within the company for all new projects. A project brief is the basis for all new projects. The project brief is written by the requester and defines all required functions of a new system or system enhancement. After the initial hand-in, the specification is done in coordination between the requester and the responsible IT project responsible to ensure that all requirements are understood and finally defined in detail. With that, a first cost estimation can be done by the supplier, and an internal effort estimation regarding internal resources, capacities required from interface partners, possible scheduling in the release management, etc., can be done by project manager.

The project brief described in this dissertation followed all these steps and contains all necessary information for estimation and resource planning, as it would have been prepared for the internal prioritisation process.

In this dissertation, the interviewees are confronted with a project for the creation of a completely new IT system in the context of parking permits. With the new system, the internal parking administration will be enabled to administrate parking permits on all premises, they are responsible for. These are all company-owned or rented parking spaces like parking garages, underground parking or car parks on company premises. The administration has to grant parking permit for company cars and privately owned cars. As a speciality, they also have to deal with all special parking permits, like parking for disabled people, parking with electric cars, parking for board members, visitor parking, etc.

All requirements to the new system can be also found in Table 24 (project brief) in Appendix 1.

3.5.2.3 Reference project development

The reference project was described in a way to support four main categories of success factors from literature, which are influencing project success: project characteristics, project manager and team members, organisational structure and processes, and factors from external environment.

Further, it also reflects the roles and rights definitions to see if there are differences or challenges based on the chosen approach.

Finally, also aspects related to the integration of other, supporting functions within a large organisation were addressed, e.g., HR involvement for trainings, purchasing department for contracting, etc.
With these focus points, all aspects of the research questions were represented and given answers were valid to contribute to their answer.

Project characteristics

The scenario requested the interviewees to create a new workflow within the company's digital workflow system, in which every associate can request a parking permit. Parking permits can be requested for employees and managers. In the request, there must be differentiated between private cars of employees, where license plate information has to be entered manually per request; and company cars where license plate information comes from the 'car pool management system'.
The costs of a parking spot have to be withheld with monthly salary. Therefore, every associate pays a fix price per month, independent of the number of parking permits he has (background: he can only park in one spot at the same time). For all associates (employees and managers), the costs have to be settled with salary (interface to HR system). The costs may vary per parking object and user group.
All parking permits can be booked on several media: vehicle specific access cards (for company cars), personal ID-cards (for private cars) and via QR-Code in an iOS App. To reflect the mobile setup of QR-codes, an iOS App on company iPhones needs to be created. QR-codes then can be scanned to prove permissions at the gate.
For the system, two bi-directional interfaces need to be set-up: all parking permits have to be sent to the global access system and limitations of parking permits from global access system have to be transmitted back. Secondly, an interface to the HR management system and payroll needs to be set up for cost withhold.
Within the new system, a role- and rights management model needs to be designed and set up. At least the following roles need to be considered: employees without a company car, company car users, vehicle administration / parking administration, plant security, and HR controlling. Parking permits are charged based on real permissions to enable fair trading of all associates.
The project brief contains much information, but not all. Therefore, the project manager must clarify all open issues to ensure that the customer, in this case the business

department as requester, gets what it expects to be able to fulfil the tasks it faces in its daily business with the new system.

The project description contains several complexities which need to be considered by the project team, some are obvious, some are hidden.

The obvious challenges are that there have to be set up two technical interfaces, one to the access management system, the second to the HR management and payroll system. One information in this context is hidden in the notes, where it says that the coordination with the interface partner has to be done during the project. This means, that it may be a risk if there are requirements which cannot be fulfilled, if the release management doesn't allow new features to be implemented, etc.

Another requirement is, that the system must be available at all German sites at the end of the year. It doesn't say that it must be rolled out or even be used by all locations at the end of the year. The wording leaves room for interpretations, as it can be understood differently. If interpreted loosely, it leaves space for communication, set up of parking objects, etc. in the following year and gives the project team some freedom in planning the go live. It is further unknown, if the system language is German only, or if English, as the second company language, also has to be supported from the beginning. This is also an option for prioritisation to postpone English language support to a later enhancement level.

Further, it is unknown if the request is aligned and coordinated with all other locations. The hint can be found in the requester field, which is not the national or international parking administration but the one from the headquarter.

The period of one year for the completion also leaves room for interpretation. It only says that the system and all interfaces must be there. It doesn't say if everything needs to be automatised and if all media, especially the iOS App with the QR-Code functionality needs to be in place as well. This is an optional buffer integrated to see if project managers take this chance to be flexible in the planning.

As part of the project, the business requirements, as well as the technical requirements, have to be discussed and clarified to enable the development of a system which fulfils exactly the requirements of the business. This is described in the start criteria. Then, the system has to be developed, tested, released into production and maintained during project lifecycle.

Project manager and team members

The project team consists of a project manager from business side, and of a project manager from IT side. Additional necessary staff needs to be defined and allocated based on availability by the responsible person or via product prioritisation board.

Organisational structure and processes

The generation of the new workflow for parking permits is requested by the board member responsible for HR and from the works council. With the workflow, equal treatment and payment of company services like provisioning of parking spaces and promotion of the use of public transformation should be ensured. A concept for compliant treatment of the different corporate social benefits and their weighting is currently in preparation.

External factors

With the new digital workflow, it needs to be secured that all requests, approvals, and offset against salary are documented audit-proof. All data must be collected, stored, and deleted conformal with European ‘General Data Protection Regulation’ (GDPR) and all other applicable laws and internal regulations. The contracting of the implementation to an external partner must follow the corporate guidelines of call for tenders to remain competition and avoid dependencies from single providers.

Summary

As can be seen, the case was carefully designed, the project framework is clearly set with many details, but leaves concretely several points where project managers are flexible in the design and planning of the project. It also gives all options regarding the chosen project management approach, as both, a sequential model as well as an iterative, agile approach or something in-between are possible thanks to the loose requirements regarding functionality provisioning and timing for provisioning.

3.5.2.4 Possibilities for different use of project management approaches in the scenario

The case study and scenario are defined in a way that the interviewees can independently decide how they would do the project.

The case study gave the interviewees much space to decide individually for each aspect if a sequential approach or an iterative approach is more suitable from their point of view to best solve the problem.

The following Figure 9 shows exemplary that all aspects of the case study from the project brief can be worked on by the interviewees by using methods from sequential project management approaches, from iterative project management approaches, or by using methods from both approaches:

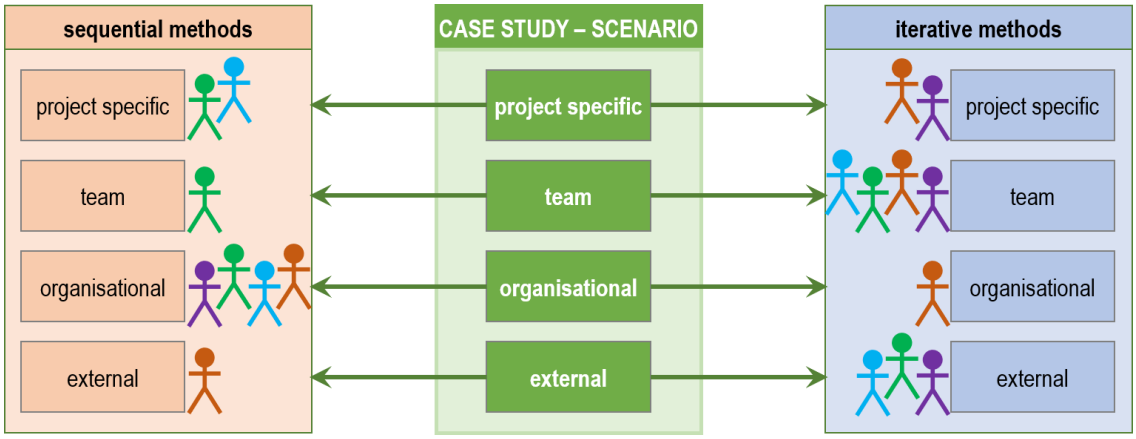

Figure 9: Case study was designed carefully to allow interviewees to work on the scenario using their favourite method, from sequential to iterative approaches, including possible switching methods in the different categories that needed to be considered.

3.6 Data collection method

In this dissertation, data is collected using semi-structured in-depth expert interviews. In this section, the data collection method is described by explaining the expert selection, interview guideline and interview transcription.

3.6.1 Semi-structured in-depth expert interviews

Qualitative data is often collected using expert interviews, it even became “the predominant method of data collection in qualitative research.” (St. Pierre & Jackson, 2014, p. 715) Interviews are used to gain authentic insights into meanings and feelings of people without influencing them by the literature and keeping them as a basis for the foundation of knowledge. (St. Pierre & Jackson, 2014) In this research, opinions and reflections can be gained as well as feelings, fears, and subjective impressions of interviewed people from suppliers, associates, and management, from business departments and IT departments, about the general change from sequential model to an iterative approach.

Semi-structured interviews are chosen as the research has a given general topic on which the researcher wants to gain information from the interviewees. Leading questions are prepared and asked, follow-up questions are also prepared to ask them when necessary or

leading to more detailed results, but in general the interview is an open talk. (Rubin & Rubin, 2012)

With the qualitative research approach, open questions contribute to get deep insights of the thoughts and opinions about the situation and it enables the interviewees to point their personal thinking and feelings.

The next section describes the process to choose the best experts for the interviews.

3.6.2 Experts as interview partners

The aim of this research is to gain information from people from a broad range of functions, experience levels and backgrounds. As approach, the purposive sampling method was used to select the people which can most contribute to the posed questions. (Brewerton & Millward, 2001)

The interviewees were therefore chosen out of resources within the large enterprise, in which the author of this dissertation is employed, and from a first-tier IT supplier which is experienced in planning and conducting software development projects for customers from various industries.

The supplier was chosen as the most suitable out of several candidates as he fulfilled several criteria that are in the eyes of the author helpful to get deep insights into answering the research question best: the chosen supplier is an owner-managed small software-development company which already exists for more than 30 years. The company structure has low hierarchies and therefore all associates are involved in the planning and performing of projects, including the managers and the newest associates. The partnership to the authors' enterprise lasts more than 20 years, and with that, it is the company with the longest partnership of all possible companies to be asked. To answer the research questions, it is important to get information from different people's point of view, get insights from their experiences and opinions in the context of successful projects as well as their approach on solving a specified problem. All asked people of the supplier were willing to serve as an interviewee, which was really helpful as information from the people who already work in the company for 20 years is as much valuable as the information from younger professionals with about 5 years of experience as their information background from recent studies at the university is different from people working in the same company for many years. Another aspect that made this company a valuable interview resource is that they also have other customers from different fields, e.g., a supermarket, chain for which they supply software for cash register systems, customer loyalty systems,

and general IT systems to support business processes in several areas of their business. With this background, and experience in several projects in several branches, answering the interview questions and contribution to answering the research questions is ensured. Two managers and owners of the company were willing to participate in the interview and they also explicitly encouraged all of their associates to participate in the interview. Further, they also encouraged them to be honest in answering the questions, especially in cases where negative experiences are asked as they see it as a learning effect for all participating parties. Thanks to the long-term relationship between the two companies and also the associates of both companies, a good level of trust is present and supports good results in terms of honest and detailed answers and experience reports.

The internal interview partners were chosen in a way that all roles that are involved in projects are represented. Additionally, to get a very broad and depth in the answers, people who already covered several roles in their career were chosen as experts. For example, a former project manager, who is now responsible for personnel management within an IT-department, was asked as well as an associate who was a former personnel manager and project manager who is now an overall responsible product manager. On the other hand, people from business units were asked to get the insights from their perspective on how the business requirements are reflected in the delivered software. For the end users, who will use the software in practice, it is essential that the software generates a benefit for their daily work. People from business units were also chosen to find out, if change management was done well, or if there exist aspects that could be improved from their point of view.

Another criteria for choosing the interviewees was the duration of their belonging to the enterprise and experiences they had in several departments and in terms of education.

The interviewees within the supplier were chosen the same way as the internal interviewees, focussing on getting the best and mostly possible depth into the answers.

The following Table 2 shows in an overview the chosen interviewees, including function, roles, company assignment, and professional experience. The acronym was chosen to be able to easily assign citations to them in the data analysis chapter.

Acro-nym	Function	Role(s)	Company	Professional experience
E1	Manager	• Agile master • Disciplinary supervisor • Project manager • Requirements engineer • Managing director	Software development company	30 years
E2	Manager	• Disciplinary supervisor • Project manager • Requirements engineer • Managing director • Developer	Software development company	28 years
E3	Associate	• Project manager • Requirements engineer • Developer, focus user interface development	Software development company	6 years
E4	Associate	• Project manager • Process designer • Developer, focus data engineering	Software development company	19 years
E5	Associate	• Agile master • Quality assurance • PMO • Key account to customer	Software development company	20 years
I1	Manager IT	• Agile master • Disciplinary supervisor • Former project manager • Former requirements engineer	Large DAX enterprise	25 years
I2	Manager IT and Associate	• Product owner • Project manager • Budget responsible • Dev/Ops team member	Large DAX enterprise	23 years
I3	Associate IT	• Project manager • Requirements engineer • Dev/Ops team member	Large DAX enterprise	31 years
I4	Associate Business	• Project manager • Dev/Ops team member • Project management office (PMO)	Large DAX enterprise	6 years
I5	Manager Business	• Product owner • Project manager • Budget responsible • Dev/Ops team member	Large DAX enterprise	16 years

Table 2: List of interviewees, functions, roles, and professional experience. Acronyms are chosen for easier reading, where I stands for internal person, and E for external person.

The expert fields are chosen as mentioned above to ensure in-depth data collection from all fields (IT, business, suppliers). Further, a differentiation is done between employees and managers to gain expert knowledge from different views on agile method application. It was not determined that the interviews were limited to these ten people, but after having done the interviews, answers repeated themselves and saturation was reached.

3.6.3 Interview guideline

The questions for the interview were structured in five sections. All questions focussed on finding answers of questions related to the success of agile transformation.

3.6.3.1 Section 1 – Background of the interviewee

The first section aimed at getting background knowledge of the interviewees' experiences to be able to put responses into context of knowledge and the field of action, in which the interviewees are working. For the research, it was very interesting to analyse if people who are working longer in their job are more or less flexible to adjusting their way of working compared to the ones who are relatively new in their job. Further, advantages or disadvantages of new ways of working may be seen more or less depending on the experience and habits on how projects are done or were done in the past.

3.6.3.2 Section 2 – Project success

In the second section, interviewees were asked to give their general definition of a successful project and about criteria for project success. The data gathered from the individuals were compared to success definitions from the literature to see if they match or where the differences are based on people working on "real" projects.

3.6.3.3 Section 3 – Experience from a successful project

In this section, interviewees were asked to tell their experiences based on a successful project of the past. The questions aimed at getting details on the project size, involved people and the fact why the project was successful. To provide guidance on the answers, supporting questions were asked if necessary. They focused on getting insights into the role of the interviewee as well as if and how he or she could fill this role, what concrete factors lead to success, e.g., team spirit, trust or his/her personal contribution to the success. Further, potentials for improvements were questioned to find out if the faults were

recognised by the interviewees and to see if the source of the problems may be narrowed down to the root causes.

3.6.3.4 Section 4 – Experience from a non-successful project

In this section, interviewees were asked to tell their experiences based on a non-successful project of the past. As it was done for the successful project, the questions here also aimed at getting details on the project size, involved people and the fact why the project was unsuccessful. To provide guidance on the answers, supporting questions were asked, if necessary, also in the section of failed projects. They focused on getting insights into the role of the interviewee as well as if, and how, he or she could (not) fill this role, factors for failure, e.g., missing team spirit, missing trust, or the lack of possibilities to personally contribute to make the project successful. Further, potentials to avoid failure and to provide support for improvements were questioned. The aim of this was to find out if the faults were recognised by the interviewees and to see if the source of the problems may be narrowed down to the root causes.

3.6.3.5 Section 5 – Change of perspective

In this section, the interviewees were asked to change their perspective in both described projects (successful and non-successful project).

Firstly, they were asked to put themselves into the role of the customer to evaluate if the customer would praise or criticise the procedure and the project as a whole. With this change of perspective, the objectivity was forced to tease out the sources of success or failure based on the results. Interviewees from business functions were asked to look at the project from an IT perspective to find out if there were also problems they would have faced as responsible person from IT side.

Secondly, the interviewees were asked to consider, if the project would have gone better or worse if they would have had more or less experience as they really had. For example, a senior manager was asked if he would have done the project the same way when he would have done it as a young professional instead of being in the job for years, or the other way round, what he would do differently now than at the beginning of his career.

3.6.3.6 Section 6 – Questions about the case

To make the results about progress, behaviour, prioritisation, etc. comparable, the reference project served as the common basis to answer questions about project work.

If there was anything unclear about the reference project, interviewees were given the possibility to ask questions about it at the beginning of this section.
The questions in this section focused on finding criteria for project success and the project management solutions the interviewees would follow.
The section started with the request for a definition about criteria for this reference project to be successfully completed. This question aimed at finding out if the general criteria for a successful project, which were given in the second section, matched with the criteria they gave to this specific project.
Afterwards, the procedures on how the project would be structured, planned and worked on, were asked. Also challenges and specific requirements that may become a risk were asked as well as factors for failure or success.
Further, project management and project leader tasks were given to the interviewees. In this role, the interviewees were asked to tell how he or she would staff the team and why and how communication would have been done and to whom.
As a last question in this section, the interviewees were asked what the sticking points are to get the team to support this project, as the team is one of the most essential factors to make a project successful based on literature.

3.6.3.7 Section 7 – Self-assessment on roles

In the last sections, all interviewees were asked to do a self-assessment about several criteria that are essential for agile transformation.
They were asked, in which role they see themselves within a project (project manager, development team, agile master, …), where they see their major field of competence (sequential, iterative, hybrid), their opinion on responsibilities for project success (team, project lead, project environment, …) and last about the dependency of success on the chosen project management approach. These answers were used to compare their self-assessment with the behaviour of how they described the structure, roles and procedures to fulfil the reference project.

3.6.4 Interview conduction

The interviews were done in person, face-to-face. For each interview, there was a timeframe from about 60 - 90 min defined. The time limit was kept in all interviews.
The interviewer took notes for the answers of each question and interviews were recorded additionally to enable transcription and to ensure data evaluation afterwards in detail.

3.6.5 Interview transcription

All interviews were transcribed and documented as basis for further evaluations. All interviews were performed in German language, as all interviewees were German native speakers. With doing the interview in the native language of the interviewees, it was ensured that the interview was fluent, interviewees were safe on the language and told extensively and precisely about their experiences. Doing the interview in English would have maybe led them to give shorter answers as the vocabulary may be missing or interviewees may not feel comfortable in a foreign language. Further, due to missing vocabulary, the wrong words may be used and the intended meaning may be distorted.
To avoid this, all interviews were translated afterwards into English language, and all evaluations were done using the English version of the interviews. The interviewer ensured that the translation was properly done and that all words and meanings from the original interview were transferred properly into the final English version of the interviews. As a second approval, the transcribed interviews in German and English language were sent to the interviewees to doublecheck from their point of view it the translations were done appropriately.

3.7 Data analysis

The research approach is inductive as a model should be developed (see section 3.3). To get there, a hybrid qualitative data analysis process was followed. (Saunders, et al., 2009) The researcher decided to start with the deductive coding approach to define some main themes from the theory that then needed to be investigated based on results from the interviews (Yin, 2003). With this basic setting, a thematic analysis was done showing references and relationships between these aspects. To do so, topics that needed to be evaluated from the view of the researcher were defined upfront (‘top down’). These deductively described topics were then enhanced by topics that came up during the coding of the interviews. Through the explorative approach using the case study and expert interviews on the specific case in the large enterprise, new categories and sub-topics were found and the inductive coding approach (‘bottom up’) was followed. (Yin, 2003)
As supporting tool, the computer aided qualitative data analysis software (CAQDAS) program NVivo was used to support the analysis of the collected data. All interviews were imported into an NVivo project and all relevant paragraphs and statements were assigned to one or more topics (nodes). The nodes were clustered hierarchically by topics, using

parent nodes and child nodes, to thematically structure the results. (Auerbach & Silverstein, 2003)

3.8 Research challenges

As the interviews were recorded, there could have been some interviewees who do not agree on this recording. In these cases, the data evaluation could have been done only based on the results that were noted manually. In this dissertation, all interviewees agreed on the recording and saving the audio files until the dissertation was completed.
Another aspect that may always occur is that the questions asked would not lead to the expected results. In this case, a second round of interviews may have become necessary. In this dissertation, the research questions led to very good results related to the research goal and the contribution to the final decision framework. Therefore, no second round of interviews became necessary. A key to success was the conducting of a pre-interview to ensure that the asked questions were properly formulated to reach the target and to answer the research questions.

3.9 Ethics

This section describes the research ethics that were observed in this research.
For the interviewees, a participant information sheet (informed consent) was created based on the proposal of Saunders et. al (2009) and contained the following information. This information sheet was provided to all interviewees:

The nature of the research

The purpose of the research is to find out, which factors enable successful agile transformation. The research is undertaken by Christian Schneider, without any help, sponsorship or funding. As interviewees, few people from the investigated company and from first tier suppliers are asked to participate in in-depth interviews to help answering the research question.

The requirements of taking part

During the research, qualitative data is collected by expert interviews.
The necessary time for the interview will be approximately 1.5 hours, potentially there will be a follow-up interview with a maximum duration of 30 minutes.
The interviews will be done in person and the collected data will be evaluated afterwards.

The implications of taking part and participants' rights

The participation in the research is voluntary. Every participant has the right to decline to answer any question or even set of questions. If the interviewee accepts, the interview is digitally recorded but every interviewee has the right to stop or withdraw recording at any time. All data will be kept confidentially and anonymity of participants will be assured.

The use of the data collected and the way in which it will be reported

The data will be anonymised and used for research reasons only. The basic data will not be accessible for any other person during research. The results of the research project are published in the dissertation and basic data will be stored anonymously with the author. After completion of the dissertation, all basic data will be deleted.

Contact for questions about the research

All interviewees have the possibility to contact the researcher at any time for questions about the research.

3.10 Summary research methodology

The aim of this dissertation is to create a framework for decision-makers to choose the best suitable project management approach.

In this chapter, the research methodology on which this dissertation is based, was described.

In order to acquire the necessary data, the research methodology focussed on getting data from experts via in-depth semi-structured interviews. The interviews were supported by a case study based on a scenario.

Table 3 shows an overview of the used methods.

Topic	Characteristics in this dissertation	Description in this dissertation
Focus of research	Analysis of success factors for execution of IT projects in large organisations	Investigation of expert opinions for managing IT projects, independent of project management methods
Philosophical approach	Ontology: Subjectivist	Implementation of project management theory in practice
	Epistemology: Critical realism	Attachment of meanings to the execution of projects as project lead based on own environment and context
	Axiology: value-laden and biased	Researcher is part of the large enterprise and personal relationship between interviewees and researcher is given
Research approach	Inductive	Inductive research aims at generating new insights into project management execution by interpretation of collected data
Research method	Qualitative approach	Exploring experiences of experts in usage of sequential and iterative project management methods in real projects
Research design	Single case study and scenario	Explanatory research to derive specific criteria from existing models based on case study and scenario approach
Data collection method	Interviews	Semi-structured in-depth interviews with experts from different organisations with different functions, experiences and backgrounds
Data analysis	Qualitative coding	Collected data is analysed by hierarchical and thematic structuring into nodes using NVIVO software

Table 3: Overview of the methodology used in this dissertation

4 Data analysis and discussion

4.1 Introduction

The aim of this dissertation is to determine the key success factors for an agile transformation in large enterprises and to develop a decision support framework. As stated in section 2.5, three research gaps are addressed in this dissertation: evaluation of critical success factors for IT projects in large organisations, transformation of roles from hierarchical organisations to agile organisations, and the integration of business functions from hierarchical organisations into agile organisations.

This chapter intends to fill the gaps based on the data analysis. As a basis for data analysis served the success factors from literature (Figure 5) and the results from the interviews. The success factor categories from literature review were analysed and compared to data from interviews (cf. Figure 10)

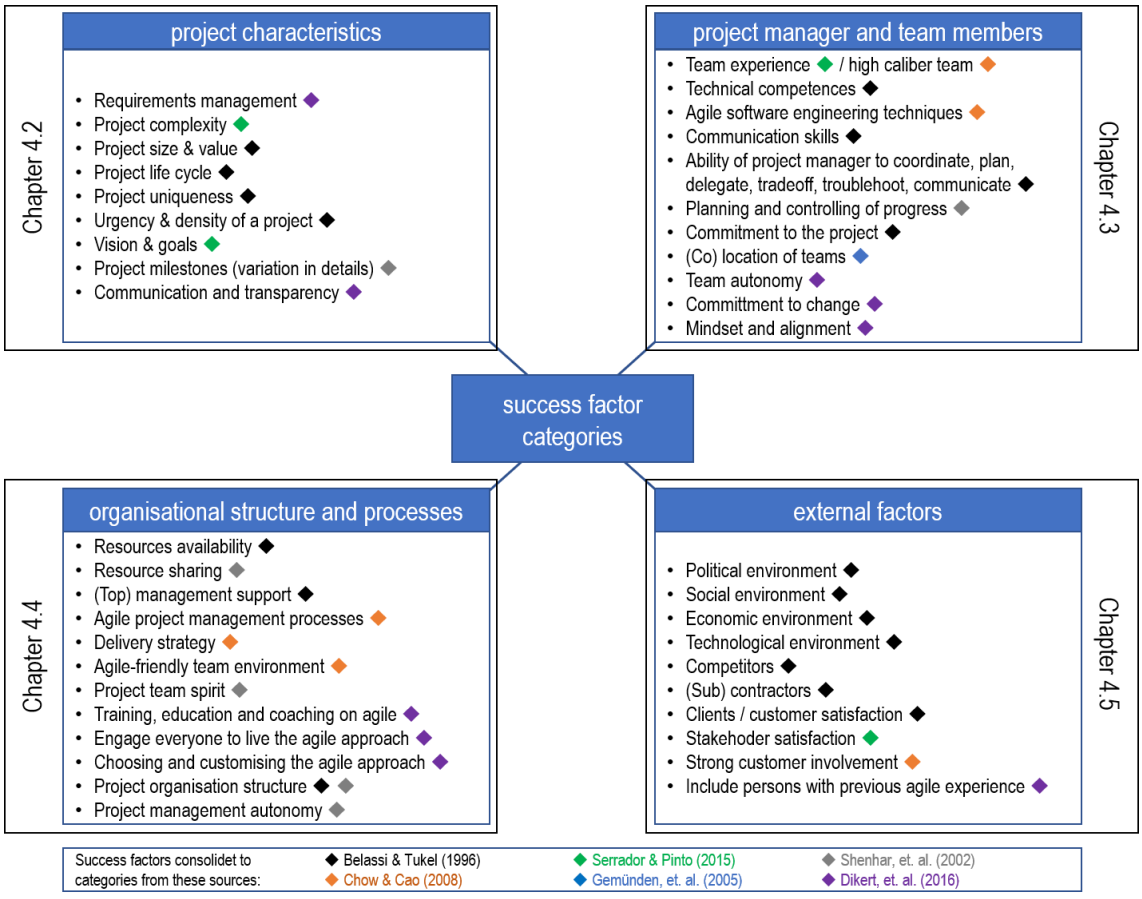

Figure 10: Assignment of critical success factors from literature to data analysis sections 4.2 to 4.5

The structure of the success factor categories reflects also the structure of this chapter.

Section 4.2 analyses success factors for agile projects related to project characteristics. In here, experiences of the interviewees from the past are reflected as well as opinions, procedures, and behaviours based on the answers of the interviewees to the questions related to the scenario.

Afterwards, the factors related to the project manager and project team members were analysed (**section 4.3**). Here, also the ideal type of a team, team qualification, and soft skills were questioned. Further, individual approaches to find a solution for the problem definition of the scenario were described.

In **section 4.4**, success factors related to organisational structure and processes were described. This section also addresses the second and third research gap, as the roles and functions are part of the organisational aspects, and therefore their filling is reflected in this section.

As the fourth and last category, in **section 4.5** the external factors that influence the success of a project were analysed and evaluated based on the interviewee's responses and the context in which this dissertation was written.

The scenario also aimed at finding out which approaches the interviewees would implicitly choose, without being asked explicitly about it. The results can be found in **section 4.6**.

Section 4.7 describes further observations of the researcher during data collection.

In the final **section 4.8**, the results of the analysis were summarised and the success factors framework from literature (section 2.4.5) was updated based on the results of the previous sections 4.2 - 4.6.

4.2 Project characteristics

When looking at project management methods, the projects themselves are the basis for any chosen approach. The first group of factors is therefore related to project characteristics. Interviewees were asked about their definition and importance of a project vision, project scope, project success, and project goals in the context of sequential and iterative approaches. Further, relevance of project complexity, size, value, urgency, and uniqueness of requirements within a project for choosing the right approach were evaluated. Another aspect that is relevant for choosing the best suitable project management approach, is the process of requirements engineering. The requirements management and requirements engineering differ significantly in the sequential approach and the iterative

approach. With this, also provisioning of deliverables differs between the approaches, and also communication of results must be handled differently in the sequential and iterative approach.

This section describes all relevant aspects named by the interviewees in relation to their general experiences and concrete action plans in the context of the scenario.

4.2.1 Project success, scope, goals, and targets

The interviews aimed at finding what the interviewees see as their success definition, based on their experiences in project management. It focused on the question, what elements are seen by interviewees as success factors, and, consequently, what the main points, that should be reached when doing an IT project, are. The question regarding the success criteria for an IT project was asked twice: in the beginning of the interview as a general question, and later again in the concrete context of the scenario. The answers of all interviewees were mainly the same, for the general question and for the scenario. For the scenario, there was mainly just added some context to the concrete case, but the success definition itself remained the same in the core.

4.2.1.1 Project success

First, the interviewees were asked about their understanding of project success in general, and for the specific scenario. From most of the interviewee's opinion, the reaching of targeted results in given budget and time are essential for project success:

> *"A project is successful when it is completed, the customer has all his requirements implemented and the software is running without any problems." (E4)*

I2 enhanced that the requirements fulfilment is an essential factor for project success:

> *"A project is successful, if the solution developed together with the requester reflects what the requester or the stakeholders had in mind." (I2)*

For I3, it is further essential that the changes in objectives are constantly controlled and that reactions on changing requirements can be handled:

> *"Depending on the scope of the project, it is possible that the objectives may change during the project or have to be adapted to new circumstances." (I3)*

In addition to the reaching of the hard targets, the satisfaction of the customer and the involved stakeholders (internal and external) is necessary to conclude a project successfully based on the interviewee's opinion:

> *"If the requirements of these three parties [customers, internal and external stakeholders] are fulfilled to a certain extent, then one can speak of a successful project." (E1)*

→ From the interviewees point of view, a project is successful, if all requirements are implemented in time and budget, if the right requirements are implemented, and all involved parties are satisfied.

With this common understanding of project success, it can be stated that the target group was chosen properly. The understanding of the basic factors for project success is the same at all interviewees and reflects the success definition from literature.

In the literature, researchers agree to a large extent that every project has to fulfil targets in terms of costs, time, quality and scope (Chow & Cao, 2008), and with this, the opinion of the interviewees and the researcher's selection of interviewees is validated.

4.2.1.2 Project scope, goals, and targets

In addition to the same understanding of the definition of a successful project, a common understanding of the project scope, goals, and targets is necessary. Without a common understanding of the goal, the goal can't be reached, and the project therefore can't be finished successfully:

> *"Everyone involved in a project must have the same understanding of the vision, scope and goal of the project. In large organisations, like ours, it is further usually necessary to define the overall target of a project, before the project itself starts to be able to get the funding." (I2)*

It is therefore necessary to invest time in the beginning of a project to be able to come to the point, where everyone in the project has the same understanding:

> *"Therefore, initial workshops and requirements definitions are usually helpful. Large projects are often split into an evaluation or exploration phase, in which the goals and main targets are worked out, and an implementation phase for the development of the concept, programming, testing and roll-out of the software." (E3)*

From the interviewees' experience of past projects can be said that the investment of a one- or two-day workshop on the derivation of a common target picture and to set the project scope is helpful to effectively and efficiently achieve the targets, independent on the chosen approach:

> *"When you sit together, ideally in person, and take the time to discuss the needs of each individual customer and stakeholder, the results are usually much better than if you do not invest the two days for this initial workshop." (E3)*

Also from management perspective, this initial kick-off was named as very important for projects to become successful:

> *"I encourage my associates to invest the time in the beginning of the project to get a common understanding of all involved people about the targets. With the old waterfall approach this was much more common than now with the agile approach. But I still think it is essential to not produce systems which are available quickly, but no-one can use them because they do not solve the problem as they should." (I1)*

When a sequential approach, like the waterfall approach, is used, it is more likely that the scope and long-term target is clear after the first workshops, as all topics of the project must be defined in the beginning and all requirements have to be clear after concept phase. But also here, the points that are clear in the beginning must not be exactly what the customer really wants at the time when the solution is provided:

> *"But in practice, also in the waterfall approach, changes in the requirements will come up due to changing parameters in the environment, corporate strategy, etc. and then we need to react. This is now much easier with the agile approach because requirements are defined in smaller packages." (E5)*

A manager of the supplier explained that usually they did not fully follow the sequential project management model in the past as they always needed some flexibility to react on changing targets and requirements:

> *"When we used the waterfall approach, we did not use it as it was described in theory due to our experiences in the past. We always agreed with the project lead, wherever possible, to define several levels of implementation, in which we could already react to upcoming changes of the scope during the project."*

Parallel to the implementation side, also from customer side there is the need to adopt targets to changing parameters:

> *"Especially for large projects, which have a duration of a year or longer, adoptions to new requirements from the organisation like budget cuts, new legal requirements, etc. need to be possible." (I2)*

It is therefore necessary to constantly review, if the vision and goal are still correct and support the reaching of the targets. In iterative approaches, like Scrum, the retrospective can be used for reviewing it, in the waterfall world, project milestones can be used:

> *And I have to admit that we were often just reacting, and did not continuously revise and compare the vision and scope with the defined and changing targets. With the retrospectives that we got with the agile approach now, this became much better, and the need for requirements changes became more transparent to all involved people." (I2)*

When all the open issues were discussed, it is crucial to commonly (re)assess the project target. The project target has to be SMART, which stands for specific, measurable, achievable, realistic and time-specific. (Drucker & Nelson, 1977) If everyone in the team has a common understanding of the processes and targets, then direction is clear and targets may be reached.

→ A clear vision and scope of a project is essential for project success, independent on the chosen approach.

→ Revision of the vison, scope and goal is necessary, independent on the chosen approach.

4.2.2 Project complexity, size, value, urgency, uniqueness

For a project to be successfully completed, complexity must be managed:

> *"Complexity may come from complexity of the business process, from the number of interfaces, number of stakeholders, urgency of the project, value of the project for the company and uniqueness in terms of unknown processes, technologies, etc." (E2)*

Therefore, it is helpful to control complexity by trying to reduce it structuring the requirements into packages:

> *"With reduced complexity, risks can be better evaluated, and topics are prepared to be (re)prioritised in regards to fulfil the goal, which itself may also be adjusted due to changing environmental factors." (E1)*

E3 summarised the structuring of the requirements into packages to a point; he suggested grouping of requirements by functionalities that enable early indication if the developed software reflects what was expected by the business, or if adjustments need to be made:

> *"The first package should solve the problem to a large extent, so that you can get some experience with the subject matter early on, and at the same time, we create something for the business unit. So that they can have a look at first results and say whether it is going in the right direction or if adjustments are necessary. If you succeed in reducing the complexity and pick around 80% of the topics that you can handle with about 40% effort, and concentrate on them, it is almost guaranteed that the project will be a success." (E3)*

E4 further described how requirements could be categorised and prioritised:

> *"If you try to postpone the things that have little risk and little benefit to a later point, as they can be done very easily at the end of the project, as well as the topics with high risk and little benefit, which may not be needed in the end, you make a big step towards a successful project." (E4)*

In terms of differences between following an iterative or sequential approach, there are the same criteria to be considered to prioritise topics, the difference just lays in the time during the project where the customer acknowledges the result of this prioritisation process:

> *"In both approaches, you need to prioritise topics in regards of their effort, risk and value. Following the waterfall approach, the detailed project plan in the beginning should consider these aspects. Following the agile approach, the constant planning of sprints should cover the evaluation of topics based on these three factors." (I3)*

Another aspect that was named several times was the handling of urgent and unique topics, independent on the time during the project where they come up:

> *"The most critical topics within a project are, on the one hand, very special requirements that need much time for analysis, estimation, and also implementation, mostly topics that are very complex or very new to us, also new technologies. On the other hand, also very urgent topics may be critical for project success, as they need to be done instantly, what often leads to instant re-planning of the current implementation phase. The worst thing is, when both come together." (E3)*

Further, the value of such urgent or independent topics was questioned by a manager:

> *"From the past, I can tell that the most challenging, and to be honest also most frustrating topics, were supposedly 'extremely important issues' that needed to be prioritised because without them, 'the software would be useless'. Such requests really always bring complexity in the project, and in most of the cases, the requirements were first not that important, and second not that time critical as they supposed to be." (E1)*

- → Reduction of complexity helps to bring large projects to a successful end.
- → Agile approaches support reducing complexity by the requirement of smaller stories and constant user story refinement and re-prioritisation.
- → Estimation of effort and value helps focussing on the essential topics.

In case of complexity management, iterative methods like Scrum give a good guidance on the complexity of topics. With the setup of story sizes and maximum capacities in one story, the people involved are automatically forced to focus on the essential things and cluster complex functionalities in smaller elements. Estimation methods, like planning poker as a tool to evaluate complexity of a topic, support project teams to manage complexity (cf. section 2.2.2).

4.2.3 Requirements management, target management, business processes

For the fulfilment of the project goals and to bring projects to a successful end, requirements management and target management is essential.

4.2.3.1 Requirements management and understanding of business processes

As already described, reduction of complexity and clustering of topics to defined packages is one key to success. Independent on the chosen approach, requirements must be clear to all involved project team members to a certain time in the project:

> *"At the beginning of a project, all requirements had to be collected and documented, when we used the waterfall approach. To do so, the core team usually discussed the current and future business processes and documented the results in a requirements concept. That means, that first of all you start a workshop with all involved people, i.e., developers, people from business departments and IT departments, key users, etc. After that, you have a rough picture of the problem that needs to be solved, that's what you can concentrate on for now." (E4).*

When the business processes are clear, then the technical requirements for the new system are discussed and a technical concept will be derived:

> *"Then we take a look at the technical side of things without involvement of the business department: are there any technical hurdles, if so, you have to tackle them as early as possible, because they can actually occur failure of a project and it will be expensive if it happens very late." (E3)*

I2, a product owner, also named a kick-off workshop as essential for a successful project to tackle down the initial requirements:

> *"Usually, the requirements are specified by either the business department or in best case together with the IT department. To generate a common understanding of the business processes and targets of a project, conducting workshops together with the chosen supplier and the core team is a good option. In this workshop, also the decision if a system will be used locally or globally should be taken, as it has an influence on the setup of the project to satisfy all customers and their requirements. Ideally, this workshop is done before implementation starts to clarify all open issues." (I2)*

These views are typical in sequential approaches, where all the requirements, constraints and technical details are analysed upfront, contrary to iterative approaches, where you look at requirements step-by-step. For the detailing of the requirements, further activities should be performed in the early phase of a project:

> *"In addition to a workshop with the whole team, also smaller workshops may be helpful to clarify details. In these in-depth workshops, requirements may be discussed either from business side, from technical side or both. If there are complex interfaces to be developed, a deep-dive into the interfaces is usually helpful to define*

> *the technical design related to the business requirements. In this context, also workshops with interface partners may help to define the technical target design."*

In general, a common understanding of business processes is essential for projects to be successful:

> *"If business processes are not properly understood by everyone in the team, it is a factor for failure of projects. It starts from just 'not analysing' the processes in detail, underestimating complexity and missing common understanding of the target. In these cases, there is just the idea of the solution without really understanding and documenting the processes that should be covered with the new IT system." (I3)*

E4, for example, described the problems that occurred, based on experiences of a specific project that failed in his professional career:

> *"The processes were not described, but a lot of graphical user interface proposals had been painted. The technical concept only consisted of user interface masks and some buttons that had some, not further specified, functions. They were also described somehow, but the concept lacked the common thread, a consistent concept from A to Z." (E4)*

E5 also reported from a failed project in his professional career, where the reason of failure laid in missing requirements management and clarity about the processes:

> *"The requirements were very imprecise, e.g. 'I think xyz might need this and that' and not 'we definitely need xyz'. Because of the uncertainty, too much was mumbled in, such as 'we might need this', and one did not limit oneself to the essential, the known requirements. That's what made it so complex, and this complexity led to a failure of the project." (E5)*

From the supplier side, the release manager confirmed that her task it getting more difficult, when customer requirements are too complex so that the result can't be used in the end:

> *"In cases where processes are not clearly defined, or too complex to be implemented, the projects either get delayed, functionalities are stripped down to a feasible minimum, or parts of the software will never be finished. From my personal experience, I can tell from a requirement to create a very complex report. Here, a reduction of complexity to three or four queries or reports, instead of creating one large report, would have helped a lot; not only for our developers, but also for the customer, as the reports were way too complex to be used by the employees and managers. And my job was very difficult here as well as I had to deal with an unsatisfied customer who received what was specified, but this was nothing he could really use." (E5)*

A developer also confirmed, that besides the lack of understanding of the processes, it is always the risk that complex processes, interfaces, dependencies to other systems, and processes which are underestimated in the beginning or during runtime, may also lead to failure of the project:

> *"There can always come up technical problems that you did not foresee, mostly with complex or new interfaces. […] Dependencies on interface partners are always a risk or a challenge, because you often cannot influence the performance of interface partners. And interfaces to new, unknown systems are always a project risk." (E4)*

As can be seen, a common understanding of the processes by all involved parties is essential for going into the same direction and to get the requested and expected results, independent on the chosen approach, but it definitely needs to be done in both approaches. When some processes are unclear in the beginning, the agile approach may be more suitable, if all processes can be described in the beginning, both approaches may lead to good results. A manager explained that the transformation from the sequential model to the agile approach brings opportunities and threats in this context:

> *"With the transformation to the agile approach, we are now more flexible in terms of the time when the processes need to be defined thoroughly. We can now start with basic processes and enhance process descriptions during project runtime, which helps us to deal with limited resources. On the other side, we sometimes remark that some processes are more important than we thought in the beginning, which then leads to higher efforts in process descriptions, or, worst case, to a more extensive redesign of the system. And not to forget the threat that process definition is poorly done due to missing resources or other topics that seem to be more important." (I1)*

Some interviewees stated that, in their experience, constantly changing requirements lead to disturbance in the project team and constantly re-planning does not support focused target fulfilment. I1 stated that in an unsuccessful project there were huge problems due to this fact:

> *"Constantly changing requirements, new priorities, new markets, shorter timelines, new functionalities, always introduced with the highest pressure, and this has actually led to a lot of frustration on the IT side." (I1)*

In this context, also unrealistic time planning and inappropriate staffing of the project team, including the occupation of the roles with the wrong people, may cause failure of projects. I5 gave an example from an unsuccessful project:

> *"Well, the first problem was that the entire core project team had no idea about the existing business processes. In the end, almost all of us had been hired directly from university and most of us had no knowledge from the field, where the software should be used. This meant that we could not really identify the customer's wishes*

and needs from our point of view. The second problem was that our "specialists" were so specially selected that even the core need was not clear. In the end, we developed the system completely overlooking the customer's wishes, and we didn't even know it." (I5)

4.2.3.2 Target management

Besides the missing common understanding of the processes, the mostly named factor for failure in projects is the missing common understanding of the project targets:

"If there is a common understanding of the requirements, the project work is more target oriented and leads faster to the successful system implementation. If there are different, even diverting goals in a project, the project cannot be finished successfully and leads to failure or at least problems in keeping the defined project parameters like time, budget, etc." (I3)

Diverting goals are a risk independent on the chosen approach:

"Diverting goals or ideas about the target are a risk. When the waterfall approach is chosen, this may be recognised earlier than in the agile approach, where the definition is done step-by-step, but you have to be very sensitive to find this out early. Often, the diversion in goals turns out when testing starts or when enhances of the processes are contradicting different user groups." (E1)

In addition to diverting targets, challenges that were not known or foreseen from the beginning may potentially lead to a point where the target needs to be adjusted. In the scenario, for example, the timeline for completion of the entire project was set with one year, which lead E3 to his assessment:

"In this case, it needs to be evaluated, if all interfaces and all functions are essential to go live within one year or if, e.g., the mobile app can be provided later to be able to reach the milestones in this tough schedule. When developing an app which is inhouse-hosted, unknown challenges may always occur. Further, these extra efforts for the app may contraindicate the finishing of components in the web, which has a broader value to the users." (E3)

To do so, project scope and targets may have to be revised constantly, independent on the chosen approach.

The target management and expectations management plays a big role, especially when projects are done in large organisations, where planning processes may be more bureaucratic than in smaller enterprises:

"In large organisations, as in our company, planning is usually done on a yearly basis, as budgets are to be approved for the financial year of an enterprise. Therefore, basic requirements need to be known far before their implementation. Without a rough concept and cost and manpower indication, no project will be prioritised." (I1)

Even if a company wants to implement an iterative project management approach, some kind of a rough concept must be done to be able to prioritise a topic for the financial year. In this context, not only financial aspects play a role, but also capacities in terms of how many people from different departments and from external sources are needed to manage a project.

A product owner therefore usually starts with an exploration phase to narrow down the requirements to an estimable status:

> *"Usually, it is helpful to start large projects with an analysis phase to get a more detailed view on the requirements. If a project is prioritised, its specification can start using the waterfall approach or the agile approach." (I2)*

A point that was already mentioned above is the availability of resources. This is an important aspect regarding target management:

> *"The availability of resources is necessary to ensure proper process definitions, implementation and testing of the system. The availability periods vary depending on the chosen approach. In the waterfall model, many resources from process specialists are needed mainly in the beginning, and, in the end, in the agile approach, they are needed constantly for story refinement throughout the entire project but less concentrated to a specific point. It all has its pros and cons." (E2)*

4.2.4 Characteristics and provisioning of deliverables, change requests and user acceptance

4.2.4.1 Characteristics and provisioning of deliverables to users

One of the most challenging topics during the transformation from sequential to iterative methods is the change in delivery of software components to end users. While there is a defined point where the software as a whole will be provided following the sequential approach, there is no such point in the iterative approach:

> *"In the agile approach, it is recommended to define an MVP [minimum viable product], which contains the first version of a software product that is independently usable for a specific target group. Based on this, further improvements and enhancements will follow in the next sprints. We decided in our first agile projects to run in sprints, but to build functional bundles which were then released as 'functional enhancement releases' to the end users." (I4)*

The difference between the sequential and the iterative approach is most obvious when looking at the implementation and testing of software:

> *"In the waterfall model, all relevant requirements are specified before implementation starts. After implementation, the testing phase follows and the approval of the software as a whole is done by the business department based on the concept after which we developed, and the resulting test concept This is, or better was, a*

straight forward process in which the customer could really evaluate if he got what he requested." (E4)

The difference in the iterative approach is, that not the entire final software will be provided, but only selected functionalities:

"Following the agile approach, implementation and testing phase are performed for each user story. This means for us, that testing is more intense in each phase, and we always have to look into detail which features are provided in this sprint. This is sometimes difficult, when complex functions are split into several stories and then provided over a longer period. This is also sometimes difficult to explain to our end users." (I4)

But testing and communication is not only challenging on the customer side, also from the supplier side, quality assurance needs to be adjusted:

"With every new piece of software, all previous functions must be retested if it touches the previous development. To ensure lasting and stable good quality, it is therefore essential to have a good test manager, and all involved people have to ensure testing capacities and need to be motivated to actively perform the tests for every single sprint. This was easier before." (E5)

→ In sequential approaches, the implementation of the entire project starts after approval of the system proposal, and testing phase starts after implementation is fully completed.

→ In iterative approaches, requirements are prioritised for each sprint, implemented, and finally tested.

4.2.4.2 Change request process

Changes in the requirements are always a challenge for all involved parties. As already described in section 4.2.3, requirements management as such is already challenging to keep the target in sight and to keep the project on track.

Change requests can be handled more easily in the iterative approach, as the specification of topics takes place in shorter cycles and new requirements can easily be prioritised by the product owner:

"In the waterfall approach, extensions or adaptions of an IT system are not that easy to do. If adaption requests come up during implementation phase, they usually cannot be realised in the ongoing implementation. Same with extensions, which need to be defined as a next performance level of the software.
Here the agile world offers more flexibility. As stories and sprints are defined on a two-weekly to four-weekly basis, new requirements or changed requirements can be covered in the next sprint." (E2)

For the product owner, this means more flexibility, but also additional efforts to constantly review the product backlog and attached resources:

> *"I like the new role of the product owner as I am now able to reprioritise topics in short term to keep the target focused while adapting the product development to changing requirements at the same time. But in this context, I also have to strictly monitor budgets and capacities, which was a one-time job in the waterfall approach." I2*

→ Change requests can be handled more easily and quicker in the iterative approach than in the sequential approach.

→ Efforts to constantly track progress are higher in the iterative approach than in the sequential approach.

4.2.5 Communication and target group acceptance

As described above, the provisioning of software is completely different in an iterative approach then in a sequential one. Further, sequential software development will not work for all target groups. Therefore, also communication must be adjusted on the changed conditions:

> *"The question of the communication of the first go live of a new software product is always a difficult one to answer as there is a continuous development of functionality. In the past, we usually communicated the MVP to a group of pilot users to receive their feedback." (I5)*

When more functions enhance the software, also the user group can be expanded, and communication based on the new features and users can be launched:

> *"Communication makes sense if essential functions enrich the product, new users are addressed or new interfaces or system components like an app for mobile devices are launched. If only minor improvements are released, there is usually no active communication necessary. But communication should always be discussed in the project team" (I3)*

The definition of the MVP is also an interesting discussion as the focus group plays a big role here:

> *"When you supply software for a specific small (expert) user group, you can start with a small MVP as tolerance for iterative enhancement is usually given as many of the users are part of the project team. But when we supply software for many users, e.g., software that is used in a large enterprise by every single associate, then the definition of an MVP is more a 'maximum viable product'. Here, all necessary functionalities must be provided at the beginning of the use. Otherwise, the tool will not be accepted." (E1)*

→ Communication of new software deliveries is strongly depending on the end users.

→ Acceptance of iteratively provided results depends on end user focus and end user requirements.

4.2.6 Evaluation project characteristics

The results from the interviewees were compared to the key success factors from literature for project characteristics category. As a result, it can be said that, from the authors point of view, the factors can be summarised into the two newly created categories: 'requirements management' and 'expectations management'. The success factors from the literature have been clustered and rewritten based on the results of the interviews.

The factors 'project size & value', 'project uniqueness', 'urgency and density of a project' are grouped to the cluster 'requirements management'. This cluster was further enhanced by the new aspect 'establish constant requirements refinement & change request process', as this is an essential outcome from the interviews to make projects manageable.

The factors 'vision and goals', 'project milestones', and 'communication and transparency' were added to the cluster 'expectations management'. It became clear, that one of the main success factors related to a project is, that every involved person in the project has the same understanding and expectations about the required product. Aspects related to the change request process were not found as such in literature but played a major role in the interviews and was therefore also added.

The factors 'project size & value', and the 'project lifecycle' did not play a major role in the perspective of the interviewees and were therefore not transferred into the new figure and were therefore crossed out.

The summary of the development of factors for project characteristics during research process are show in Figure 11:

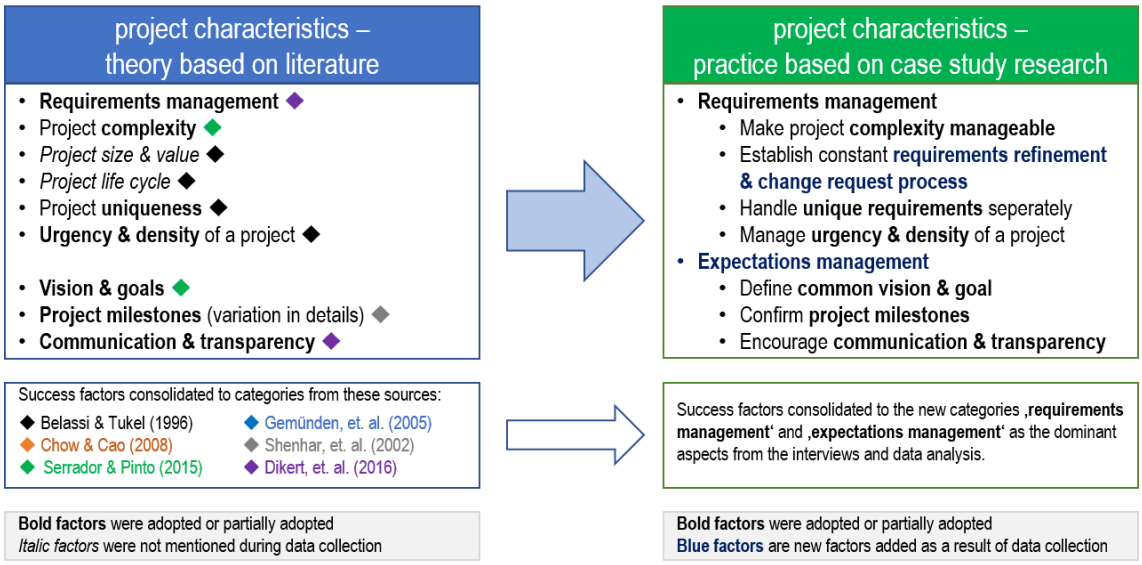

Figure 11: Results of data analysis of success factors related to project characteristics: Clustering of relevant factors in 'requirements management' and 'expectations management'.

4.3 Project manager and team members

The second group of factors is related to the project team that needs to work with the given project management method.

Having a successful project team is an important factor for successful projects. For a project to work, the necessary roles must be staffed with the right people, chosen especially for the requirements of the project. But in addition to the selection of people with the proper competences, the soft skills of the people play an important role in setting up the team.

The team is as good as the sum of its team members. Therefore, a harmonious team consisting of team members with the right competences is key to success.

The following sections describe criteria for a successful team.

4.3.1 Team roles

Independent on the chosen project management approach, functions or tasks that need to be covered in projects are the same. Depending on the chosen approach, roles and responsibilities which cover all of these functions are different, and assignment of tasks or responsibilities must be clear to all involved people in the project.

Setting up the project team starts with the definition of required competences. With the staffing of the team, also roles and responsibilities must be clear to everyone. When starting a project, business processes, targets and requirements from business side must be

clear and the people who are familiar with them are to be considered as the right people for the team:

> *"Therefore, it is essential to identify all people that are responsible for the current business processes, and, if processes change by the introduction of a new IT system, also all future business process responsible persons need to be identified and included into the project. This is essential in each project to get detailed information about the processes." (E4)*

As responsibilities may change with the introduction of a new system, e.g., because business processes are simplified, enhanced, merged, or split, the new people responsible for the final system should be known and integrated into the project team in an early stage. Depending on the chosen approach, the roles of the chosen model need to be occupied and all involved people need to have the resources to fully support the project:

> *"Only with a detailed insight into business processes and demands, you will be able to create a solution that fits with the requirements, and which is able to satisfy the customer's needs. It is further essential, that the business responsible is available at all times, whenever necessary." (E3)*

A difference between the sequential approach and the iterative approach is the necessity of the project team members, and with that, also of the different roles in the different phases of a project. E1 summarised the difference as follows:

> *"The availability of all project team members at the right time is essential for a smooth project procedure. When we used the waterfall approach, the availability of all team members in the beginning of the project was essential. This phase was usually really extensive and time-consuming for all involved people. After the initial phase, only the development team had to work, afterwards the customer had a peak for testing the entire system.*
> *With the new agile approach, you usually only have an initial workshop, and afterwards the availability of the team members depends on the sprint planning and the topics that are prioritised. This makes it easier to have the right people available at the right time." (E1)*

The quality of the team is essential for project success. Therefore, in the process of setting up a team, experts for the relevant topics should be chosen properly to ensure qualitative good work and enable project success. The manager E1, for example, stated:

> *"First and foremost, people are involved in the success. If the people, the team, are the right ones, the chance for success is very high." (E1)*

Out of the given answers to the question how to best staff a project team, a manager's statement summarised the necessary staff as follows:

> *"Depending on the complexity of the project, at least one process specialist from every involved business unit must be part of the project. Without a process specialist, who can explain the need for a new system and the daily challenges that are*

> *faced, a project cannot deliver the expected results, as expectations are unclear." (E2)*

In terms of the organisation of the project team for the scenario, E1 and I2 for example would define the team as follows:

> *"We would have to break this topic down into smaller work packages, and for these work packages I would try to get the appropriate experts here." (E1)*

> *"I need technical competences and process-related competences. Ideally, I would involve those who are still in the functions today and who have the appropriate standing in the process." (E2)*

On the IT-side, the picture is similar. All participants said that it is necessary to have one person in IT who brings the threads together:

> *"Dependent on the complexity, especially regarding interfaces to other systems, it is also helpful, if not necessary, to have an IT-specialist for this specific interface in the team. Dependence on interface partners is further always a risk or a challenge, because you often cannot influence the supply of interface partners. And interfaces to new, unknown systems are always a project risk. Therefore, specialists on both sides help to reduce the probability of occurrence of the risk." (E4)*

Further, specialists from IT are necessary to evaluate the feasibility of the requirements related to software development on the one hand, but also in regards to the architectural setup of a project in large enterprises' given infrastructure. Based on the scenario, E1 described the necessities as follows:

> *"Since this is a complex topic, and not an easy project, I would make sure that at least two very experienced developers are involved. Gladly all with experience, but at least two who take a certain leadership role among the developers and avoid design mistakes there. Experience is important, and by experience I don't just mean technical experience with the programming languages, but rather professional and process experience." (E1)*

From the customer perspective, early involvement of the external development partners and proper setup of the development team was mentioned as necessary:

> *"If programming is done externally, you need to involve the external partner at an early stage into the project to ensure that the requirements are understood from the beginning and that possible solutions are presented, or at least potential risks are questioned early in the project phase. The programming team should also be stable and not too big." (I2)*

From the supplier perspective, the expectations of early involvement were also demanded:

> *"One reason for success is that we are involved at an early stage and are involved in all phases of the project, and we do both, conception and implementation. Often it is also separated, which is not so good. […] We have a very low fluctuation; our*

> *core team has been together for years. If someone leaves, then it is rather the freelancers who are not so deeply involved." (E4)*

Beyond the core team, all stakeholders, interface partners, key users, etc. have to be involved in the project at the right time to ensure commitment to the project, project support and sense of belonging to the team:

> *"It is further risky for project success not to involve all team members or interface partners of the project at the right time. On the one hand, stakeholders or key users which are involved very late in the progress, may miss the goal and will not identify themselves as fully integrated team members. Late integration of the developers also may lead to a misunderstanding of the problem that needs to be solved and then the solution does not fit with the expected results." (E4)*

In addition, also other roles and responsibilities in a large enterprise, e.g., sponsors or committees, should be involved at the right time:

> *"In large organisations, it is also essential to early include all decision-makers like works council, data protection, budget committee etc. to avoid discussions at the end of the project." (I1)*

As E4, also I3 represented the opinion that the most challenging aspect in the setup of the team is to find the right time to involve additional people into the project:

> *"If you include experts too early, you may lose track as the requirements may become too specific and too complex, on the other hand if you include them too late, they may be frustrated as they were not asked earlier." (I3)*

By the frequency of opinions about this topic can be seen that it is relevant for interviewees from the different areas. E4, for example, further stated from the developer's view:

> *"For me, one success factor is, that we, the development team, are always involved early in the concept phase, in order to identify really difficult requirements at an early stage and to be able to approach them in an optimal way." (E4)*

→ Necessity to identify and nominate all relevant people to staff roles.

→ All relevant roles in a project need to be staffed, independent on how they are named and independent on the chosen approach.

→ Early involvement of relevant team roles is a factor for success.

4.3.2 Team characteristics and team leaders

In all successful projects reported by the interviewees, a well-functioning, harmonious team was named as one of the main factors for success:

> *"First and foremost, people are involved in the success. If the people, the team, are the right ones, the chance for success is very high." (E1)*

E2 supported this opinion, that people are important for successful projects, and further emphasised that a well-rehearsed team is a success factor:

> *"The team was set up the same as we had done several different projects before. Our internal team consisted of six developers responsible for the different systems, and on customer side, there were also the same people acting. I think I can claim for us, that the communication was good, the results were good, every requirement was implemented as the customer requested it, and, last but not least, we had much fun developing this software." (E2)*

E4 added that the constancy and specialisation of a team is very important:

> *"In our team, everyone has his own strengths, and everyone is specialized in a certain area, but not limited to that. We have a very low fluctuation and develop our associates in additional fields. I would say the core team has been together for years and therefore knowledge is high. I can really name this as a huge success factor for making successful projects." (E4)*

In addition to the people themselves, personal relationships, trustful and open discussions, and mutual understanding of the problems, support projects to be successful:

> *"Actually, the personal relationship and positive atmosphere between all team members made this project to a successful one. You can discuss difficult topics on a professional level, but there is still a personal level, on which agreements are taken. Also, if something doesn't work well or if there are difficult situations, you can openly discuss it and find a solution which is satisfactory for everyone involved in the project." (E5)*

From the customer perspective, the communication within the team contributes to a large extent to project success. A project manager reported of a project which failed due to missing strategy, focus, management support, etc. This were reasons which the team itself had not in its own hands. Nevertheless, he stated that the team performance was still good:

> *"There was a willingness to perform, everyone was very young and motivated, and even if you often stressed each other out during the project, we were still very good friends with the people. So, we had a strong capacity for suffering, and made the best out of it. In summary I can say: 'the only good thing in the project was the great team'." (I5)*

A manager from customer side further stated that the team and a common target was the key factor for a project from the past to become successful:

> *"The special thing about the team and the cooperation was on the one hand the commitment, and on the other hand the trust. Furthermore, everyone had the same goal in mind, which was also quite good. It was a totally colourful and diverse team; I don't think that many people have already worked together in such a special constellation." (I1)*

I3 also stated that the success of a former project was lying in the common understanding of processes of the entire team, and in the commitment of everybody in the project team to a common target:

> *"In the beginning, we all sat down together in a two-day vision workshop to define what we wanted. After this workshop, it was clear to all of us what we wanted. We had a common goal, we really committed ourselves to this goal. This workshop really resulted in more than we had all expected and it also gave us a clear line of orientation for the entire project. After this we were one team! And in this great team, process definitions were very easy. Every formulated requirement was questioned regarding its contribution to the overall goal, by anybody. So, there was no need of moderation. Everyone just enjoyed working within this great team." (I3)*

All interviewees have all in common, that they see a need for a project manager, independent on the chosen approach. E1 for example stated from supplier side:

> *"In addition to all experts that we need to have in a project, we definitely need one person which is responsible for the overall topics. Ideally, from my perspective, it is a project manager from the IT department who brings all experts together and who also coordinates all internal discussions. As we have one project leader per topic, I would also need a project leader from customer side. In the past, a good project lead was usually a key to success."*

Also, from the perspective of the large enterprise, the need for a responsible manager is there:

> *"When we start a project, we always have one person who is the main contact for the project. I need it from our side to have one person to ask for the progress of a project, also in the new agile world. The team works independently, but I need that one person. Further, I also want to have one responsible person from business side to discuss open topics or also to escalate topics. Finally, I also request a single person from the development partner, which is, by the way, also a requirement from our legal department to have a designated person from supplier and requester side to ensure contract conformity." (I2)*

→ As can be seen from the results above, a harmonious team is one key to success.

→ Independent on the chosen approach, there is a need to have responsible people for a project.

4.3.3 Team size

The team size plays a role for success or failure of teams as communication is very important within a team. Usually, it is easier to communicate in smaller teams than in larger teams. A project manager reported about a successful project, where the team had just the right size:

> *"There were one or two contact persons per plant from business side, from the IT side, there were two responsible persons, and we had one service provider with a*

> *flat hierarchy. Our developers mainly worked on our project, and they also worked with us on the problems. We also did not have long meetings that got out of hand, and communication between developers, business and IT was usually done directly by phone or video conference calls. Our dailies took place every day, but usually they only lasted a few minutes. With these measures, efficient work was ensured." (I2)*

Small teams are considered to be more efficient than larger teams, as the coordination of the tasks is easier and the work within the team is more efficient than in larger project teams:

> *"A small team also helps to concentrate on the core requirements of a project, instead of having too many detailed, specific functions" (I2)*

In all projects that failed, the interviewees named the fact, that the project and team were too big, as one reason for failure:

> *"There were too many different requirements, special requests and even diverting targets. I think that the project team should have been reduced to a quarter of its size. It was way too big. Every year, I tried to enlarge it to be able to handle the exponentially growing requirements, but this was the wrong way. There were way too many people involved, especially on the business side." (I1)*

The best practice core team size was named as four to seven by the interviewees, one of the interviewees summarised the setup, as it was explained by almost all interviewees, as follows:

> *"One or two experts from IT side, one or two experts from business side, one or two people from the development team, one person to steer the communication between all involved parties. Thats it. This core team should then be extended by the relevant experts in the current phases, e.g., an IT architect has to be consulted in the beginning, interface partners when interfaces are discussed, specialist for user interfaces, or database modelling during implementation, etc." (E3)*

I5, a business specialist, for example defined the perfect team size as follows:

> *"I would determine the necessary number of project team members together with the IT project manager. I think the team does not have to be too big. You would need one specialist per subject area, one or two specialists on the IT side, and additionally experts per interface 'on demand'." (I5)*

E4 described that beyond the team, stakeholders have to be involved at the right time. But he also referred to the risk that the team should not become too big:

> *"On the other hand, if too many people are involved too early, there is the danger of getting too many conflicting requirements, which all have to be evaluated regarding their relevance to reach the target. The team must not become too big." (E4)*

→ Core team size should be between four and seven people.

→ Experts should be involved at the right time for best contribution to the project success.

4.3.4 Trust

Additionally, to the named facts above, also the interpersonal factors play a big role for the success or failure of a team:

> *"In my eyes, trust within the project team, including stakeholders, is essential for project success." (E2)*

Trust in each other was furthermore named as a factor to be able to efficiently work together within a team:

> *"If you can rely on each other, tasks are done with high quality in the confirmed time and no, or few, rework has to be done. For this, a constant good communication between all involved parties helps to ensure that the project target is clear for everybody and that deviations from the original plan are remarked early and can be corrected if necessary." (E1)*

Also from developers' side, trust was named as one essential factor for efficient team work:

> *"Trust is very important to me, because I rely on other colleagues and trust them that they do their job properly and that they make their contribution. And I know my colleagues so well that I know how well their work is done. So, there are colleagues where I know that it is not done so well and there, I have to do the appropriate follow-up work." (E4)*

For the trust within a team or cross teams, low fluctuation and a harmonious team is helpful. If a team is harmonious, it is more resistant and capable of suffering in high pressure phases or when things are not working as planned:

> *"Trust among colleagues is important. So, if it matches on the relationship level, then a project basically runs more harmoniously, you can say it usually runs better. If you get along well with the people in the project, and people help each other and don't escalate issues all the time, then I think you will reach the goal better and faster." (I5)*

> *"Trust is very important for me, because only then the cooperation works well." (I4)*

Openness within the team makes it more efficient, and double work can be avoided. Missing trust, or even worse abused trust, or a bad team mood, affect the failure of projects.

With a disharmonious team, the risk of high fluctuation and dwindling know-how comes along:

> *"You can take a look at what happens when there is no trust anywhere. I think that you will destroy yourself as a development team, because you are constantly checking and seeing what the other person has done and if he or she is doing it right. And that's also not feasible in terms of time.*
> *What happens between developers and customers, product owners, users or similar relationships: without trust, I don't think that you can discuss problems authentically and honestly. Because if you have to tackle a problem, you always have to admit that you might not be doing something right somewhere – you have to reveal gaps in your knowledge or something like that, so that you get the right solution.*
> *You have to trust the other side. And if you want to be in a more agile environment, you also have to accept the fact that you might not know exactly what will happen later on. In other words, if you don't trust the development team to come up with the right thing, you can't take the agile path here. You'd have to define exactly what's going to come out of it, no matter what happens in between, and that doesn't fit the agile approach." (E3)*

E1 further refined that, from his perspective, without trust, work is much more complicated, and targets may not be reached as efficiently as they could within a trustful team. He stated from management perspective:

> *"I don't need to tell you how many times we have somehow reached informal agreements orally, on the phone and they have been kept. We can do that because this trust is there. It also makes many things easier; trust reduces complexity and also accelerates processes. Trust is a completely underestimated component for the success of a project, because it makes things uncomplicated, simplifies and accelerates them. Of course, there is trust necessary in all three dimensions: trust from the team to the management, from the management to the customer and to the team. And from the customer to the team, to give them the confidence that they can do it." (E1)*

A manager from customer side further explained, based on experiences from the past, that trust is important, but that it needs time for a team to establish trust:

> *"When I think back to the first project we did with this supplier, we had several issues in the performance and getting the results we expected. The atmosphere was stressful as everybody was under pressure to deliver. Here nobody trusted each other, and the results reflected it. After this project, which we finally brought to a good end with compromises on both sides, trust began to grow. And with further projects, personal relationships established and with each project, trust and quality raised as issues could be discussed very early without finger-pointing to find someone to blame for." (I2)*

As a last point related to trust, missing trust from the management in the project team may also lead a project to failure. In the described case, the project was steered into a completely wrong direction:

> *"At some point in the project, everybody was just doing what he was told by the management instead of looking for the best solution. There was no trust from the*

> *hierarchy levels above. […] If we had had more freedom, we would have chosen our process partners from a pool of experts instead of managers who finally defined requirements. At the end, neither the core team nor the stakeholders knew or could implement the requirements of the end-users, what finally lead to the development of a software which completely differed from the necessary solution. The software was useless in several aspects. With trust from the management, the project would have worked far better." (I5)*

Based on the question, if the importance of trust differs depending on the chosen project management approach, the answers were all pointing to the same direction.

From a developer's perspective, E4 stated:

> *"When we used the waterfall approach, trust was an enabler to be more efficient when we developed software. Trust between the developers, and also between the customer and us, gave us more freedom to react on changing requirements. Now, with the agile approach, trust became even more important. Release cycles are getting shorter and therefore, requirements are implemented step-by-step and with that, often features are developed in parallel. If one feature doesn't work, we can't take the whole release into production. Therefore, trust is getting more and more important." (E4)*

From the view of a product owner, trust was also evaluated as becoming more and more important:

> *"With the agile approach, the trust between all involved parties is essential for project success. I have to rely on the developers, that the effort estimations are realistic and feasible to be implemented within the cycles, the business partners need to rely on myself, trusting me that I prioritise in the interest of them and from the IT perspective, the developers have to rely on the business units so that they have the capacities to test, and last but not least also my management has to trust myself that I prioritise the budget in the sense of the company, as the management boards are slowly disappearing." (I4)*

→ Trust is a very important fact to ensure efficiently working teams.

→ With trust, even complex projects can be handled smoothly and done successfully.

→ Trust is even more important in projects that follow the iterative project management approach than it was already with the sequential management approach.

4.3.5 Location of teams

The location of the teams was mentioned by all interviewees, at least indirectly.

A project manager from the developer side, for example, explained that the transformation from sequential project management approach to the iterative one brought unfamiliar situations, which no-one had foreseen when the transformation was performed, as working just remotely on topics was really uncommon:

> *"The first project that we did with the agile approach, was very strange. I was used to have onsite workshops in the beginning to become familiar with all the processes, get to know all involved project members, and also to define a common target for the project, or at least to understand it. In the first agile project, the project manager just sent us a list of requirements that he put into Jira, added a short description of the project, and asked for effort estimations and a timeline. We tired to do that, but at the first personal discussion by phone it became very clear that we did not understand the same as the requester meant. This was really frustrating as we really had invested much time in the estimation." (E3)*

An internal project manager talked about the same situation and added:

> *"When we realised that we have completely talked past each other, we decided to do an onsite workshop as soon as possible to get a common understanding of the topic and also that the background and our needs would be understood by the developers. This really helped. And more video calls followed, as we remarked that seeing each other is different than just talking." (I2)*

In general, distances between customers and suppliers are seen as challenges, but feasible ones:

> *"For me, it is very important to know the person behind a name. I therefore always try to have an in-person workshop at the beginning of each project to strengthen the team. From my experience, the team works better together when the project team has met in person and know each other. Afterwards, communication via mail, phone or video calls are as good as physical meetings. But if the distance is not too far, I still prefer presence meetings for detailed, complex process discussions or discussions where physical work on a flipchart is helpful." (E1)*

Two interviewees also stated that in the past, projects failed due to locally separated teams in different time zones. Coordination of meetings was very difficult as time frames were very small and detailed discussions of open issues were only possible in these time slots or in elaborate email sequences:

> *"The project didn't work because the developers didn't know what the concrete requirements really were. For a long time, it was certainly the distance, the time shift to the USA, especially the restriction of common working hours. […] In the past, just a few years before, at least one developer came to Germany once a year for a week or two and met with us in the lab, we went through the most important topics and fixed bugs. By being on site, things went faster than when talking via email or teleconferencing." (E2)*

→ Getting to know each other personally and getting a common understanding of all processes and targets is key to success.

→ Location of teams in different time zones is difficult for efficient project work.

4.3.6 Evaluation project manager and team member specific criteria

The analysis of the data from the interviews came to the result, that many of the criteria from literature were also covered by the opinions of the interviewees.

It is not surprising, that team experience and team competences play a big role. But in terms of team setup and skills, it is remarkable that project leader competences were named as a prerequisite for projects to become successful by all interviewees. This is especially remarkable when an iterative approach was chosen, as a dedicated project manager role does not exist as the team is commonly responsible for the results. In the interviewee's projects, the agile approach was never followed 100% as there was always a 'main responsible person' named. The interviewees did not name specific functions that a project manager should have, and the planning and controlling of progress was not seen as critical for success.

The commitment to the project in general was an often-named aspect, whereas the commitment to change, mindset and alignment, and team autonomy were not explicitly named. But in the context of the team, three additional aspects were named in addition to the success factors from the literature, and are therefore reflected in the new list of success factors: a 'harmonious team', 'trust' as core value of the team, and the 'team size'. These aspects play a big role in the successful work on projects in the perspective of the interviewees. Assumably, with trust in a harmonious team, the mindset and alignment to the common values was covered without explicitly naming it. The right team size contributes to efficient communications, coordination, and to achieve successful projects.

The (co) location of teams was also named as a factor to be considered, but more in regards to time zone issues, rather than to have separated or centralised teams in general.

The summary of the development of factors for project manager and team members during research process are show in Figure 12:

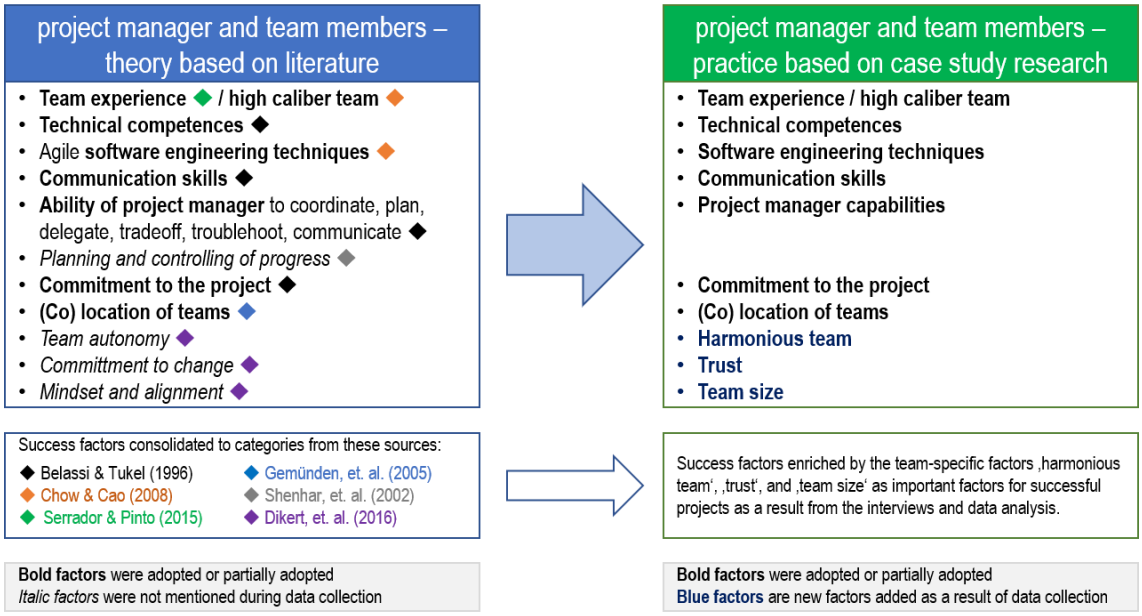

Figure 12: Results of data analysis of success factors related to project manager and team members: Individual project manager and team member competences and skills, as well as the setup of a harmonious, well-sized team with trust as a core value contribute to successful projects.

4.4 Organisational structure and processes

Besides the project specific and team factors, also organisational factors play a role. This means, factors inside the organisational boundary and factors regarding project governance, e.g., management structures, methodologies and processes that need to be used, responsibilities and authorities for decision-making, etc.

The third group of factors is therefore related to the organisational structure and processes of the enterprise. The structures are important as they are giving the environmental parameters, in which the project team has to work, and in which project management methods have to be integrated properly.

The factors named by the interviewees were clustered and described in this section.

4.4.1 Operational and organisational structure

For an enterprise to perform an agile transformation from a sequential to an iterative approach, not only the project management approach itself needs to be changed, all processes and structures of the organisation have to be analysed and adjusted. As already described above, the change of processes is necessary.

Organisations that use a sequential approach for software development projects are usually hierarchically organised, also the organisation investigated in this dissertation. To

enable working in agile teams, this structure needs to be broken up and responsibility for project success must be taken by the individuals:

> *"In the agile approach, people need to become self-responsible for projects within their team, instead of having one single project leader, who is responsible for everything. For that, agile roles need to be defined and more than that, their responsibilities must be clear to everyone." (I1)*

Following the most common iterative approach 'Scrum', there is just one product owner who defines the requirements and prioritises them, one agile master to enable efficient working conditions and to remove impediments, and a development team consisting of three to nine members to specify and develop the product. In large organisations, adaptions of this role model may be necessary and/or other forms of iterative models, e.g., Scrum of Scrums, may be used. (cf. section 2.2.2)

One of the characteristics of hierarchically organised enterprises is its structure with the setup of decision boards and other committees. They need to be informed about the progress of projects, take decisions about allocation of budgets, resources, etc.:

> *"With our grown structure, in which hierarchies are reflected in form of leadership-circles on all levels and steering boards for projects, products, initiatives, etc., we still need to work on breaking up these structures to enable agile working within the products or projects. I think we are on a good way, but we still have some way to go." (I1)*

A product owner remarked that in the context of budgets, the organisation must change to enable flexible budget allocation:

> *"When we want to become fully agile, also budgets need to be available throughout the year and I, as a product owner, need to be able to assign them to the topics that are currently required, and I must also be able to reassign budgets, if necessary. Currently, I do not have this full flexibility due to 'old' hierarchical structures." (I2)*

Further, it is important that the organisation and the project team work close together and enable each other:

> *"I think, if everyone in the organisation, independent on his or her role inside or outside of the project team, aims at becoming agile and getting the best for the company, then the agile transformation can work. Everybody needs to change behaviours to enable an agile working model." (I4)*

As already described in section 4.2.5, the target group for the system plays a big role in terms of acceptance of iterative delivery of software. This is also reflected in the chosen project management approach. From the management perspective, it was therefore

mentioned in the context of software delivery strategy, that there has to be an adapted approach in place which fits especially to the company. I1 stated:

> *"In our company, we had to set up an adopted, customised agile approach. With the hierarchical organisation and committees that are still in place, this is necessary. The approach is not final yet, and I am not sure if it will be really final at some time. I think it will be on a constant review after its finalised." (I1)*

→ Breaking up existing structures within an organisation.

→ Actively enable change in all functions, inside and outside of project teams.

→ Customising of the project management approach is necessary.

4.4.2 Organisational governance and compliance

In large enterprises, almost all IT projects have to be discussed with, and approved by, committees like works council, data protection officers, HR management board, etc. The necessity to present new projects early to these committees to prevent delays later in the project, and to be able to adjust requirements to their requests, was named by many interviewees as an essential requirement:

> *"The topic of data protection in general is also very important. Works council and data protection officers should be involved very early. It is very important to clarify all this in advance. Otherwise, the project faces the danger to be stopped any time late in the project." (I2)*

I4 had the same point of view, but she said that it is getting more and more difficult to ensure early involvement of all parties when the iterative approach is used:

> *"With the agile approach, requirements change more often and if you need to inform all involved parties for every change you make, which may take months, agility is not given anymore. We need to find ways to enable involvement and agility at the same time." (E4)*

E3 for example stated that he had once a project which was completely done, but which has never been used by the customer until now, as the approval of the works council is still missing:

> *"Without this approval, we were not allowed to take this project into productive use, which is really frustrating, as we put much effort, energy and time in the realisation of this project." (E3)*

In addition to the involvement of all committees, it is further important to comply with all internal governance regulations which are given by central purchasing departments, general criteria for business of the company, etc.:

> *"When I did my first tender within a project, I was really surprised about the many criteria that need to be fulfilled. It started from having at least three comparable*

offers, which seemed easy for me, but then I remarked that there are several criteria that need to be fulfilled by the suppliers, like conformity to data protection requirements, sustainability of the company, ISO 9001 certifications, just to name a few." (I4)

I3 further added, from the view of a project manager, that with the structured approval after each phase, being conform with all these regulations, was easier following the sequential approach:

"With the agile approach, we had to learn how to become conform with all internal and external regulations, as the gateways as we had them in the waterfall approach, were not necessary any more. And, to be honest, at the first moment, we were really happy because the it was really much effort to prepare all these gateways for every project, but in the end, we now have the same efforts but we need to discipline ourselves to follow all regulations." (I3)

→ Early involvement of committees ensures smooth project progress.

→ With the iterative approach, constant involvement of the committees is even more important than in the sequential approach, as requirements change more quickly.

→ Compliance with all regulations must be ensured in both approaches.

4.4.3 Procurement and contracting

Together with the breaking up of hierarchical structures, purchasing processes need to be revised as well to enable iterative working models.

E1 described the challenge of estimating efforts from a supplier side:

"During tender phase, the requirements are evaluated, estimated and an offer is generated by the potential suppliers. The offer creation is easy for us, following the waterfall approach, as the requirements are all clear for the whole project in the beginning. Following the agile approach, you do not know what will be required in the end. Therefore, usually smaller offers, but more of them, are necessary. Especially for larger projects, this is a problem, as you can't estimate in the beginning what will be required next or in the end." (E1)

But there is also a disadvantage in the offers for sequentially managed projects, where every requirement is defined upfront. In here, sequential projects face the challenge, that they have less flexibility in adapting to changing requirements than with an iterative approach:

"We often had the problem, that the requirements were specified to a very detailed extent, and also that our costs were calculated based on the required skills and availability of our staff. Reacting to changing requirements was always difficult, as the contract was based on exactly these requirements." (E5)

I1 looked at the topic of biding phases from the internal view of the large enterprise and stated:

> *"We were used to specify tender processes for large projects. Now we face the challenge, that not all requirements are clear. So, we needed to find a way to contract larger packages without knowing what we exactly need. But we still needed to follow corporate tender rules." (I1)*

This point, to have the necessity to define new ways of contracting, was named by all interviewees which are usually involved in the contracting process, either from the contracting company or on the supplier side.

I1 stated, that this problem was known very early in the transformation process. Therefore, a core team to address this topic was created consisting of members of the management, project managers, and specialists from purchasing department with the target to create a new purchasing model. To do so, new process for biding phases were designed to perform biding based on reference user stories which can be easily estimated and efforts can be compared. It works in a way that prices for packages are negotiated and fixed in form of T-Shirt sizes:

> *"With that procedure, we can ensure, on the one hand, that competition takes place and, on the other hand, that business, IT and the suppliers itself have planning security, that this chosen supplier is contracted for the whole project by negotiation of a frame contract." (I1)*

I2 described the process for calling packages as follows:

> *"In detail, reference requests are estimated by the supplier and categorised using T-Shirt sizes from S to XXL. The prices are already negotiated between purchasing department and the supplier and we can very easily call them, whenever needed in the project. The request process is very quick and with that, we can very easily act agile. At the same time, we are able to follow corporate rules for competition and can avoid single sourcing of topics, and with that avoid monopolism." (I2)*

As a project manager, I3 confirmed that this process is working very well now:

> *"It took a while to establish the process, and also to enable the tools to handle such requests. But now it works very well and we are able to flexibly order implementations of user stories." (I3)*

The established process is also well accepted from supplier side:

> *"We now have much more flexibility in providing exactly what the customer needs, and with the new model we can very easily offer the required solutions. But I also have to admit, that the efforts on our side to make the necessary staff available for each sprint is more complex than in the waterfall model, where resources were usually planned for several months up to a year upfront." (E5)*

→ Competition and biding phases are easier in sequential models, as all requirements are known in the beginning.

→ Iterative approaches give more chances for flexibility in reacting to changing requirements on both sides.

→ Tools and processes for biding, offering, calling must be adapted to support iterative approaches.

4.4.4 Culture of the organisation

The corporate culture, and the behaviour of all individuals within a project, is another factor for success, independent on the chosen project management approach.

Usually, people don't talk about cultural aspects from their point of view, by directly naming them 'cultural' topics. They are more subliminally named. E1 for example stated on cultural aspects in the context of chances and risks of the iterative approach:

> *"If you want to do it differently than you were doing it in the past, you always face the challenge that you have to convince everybody that this is a chance and not harassment. They need to see and 'feel' the chances of the new approach, you need to show them the advantages that the change brings." (E1)*

The answer of E2 went in the same direction, but he added that, from his experience, not everybody could be convinced:

> *"I had one associate who really refused doing things differently in the beginning. Here, I unfortunately had to order the change. When I look back at this, it was really hard. But now, some years later, he really enjoys the new approach and we can laugh about our talk those days." (E2)*

A project manager (I4) stated that it was a learning process to change to the iterative project management approach:

> *"We had to learn how to work differently. In the beginning, no-one really knew what needed to be done and how – following the agile approach. We were also very insecure in what our competences and responsibilities were – or specifically mine. From my perspective, with the introduction of the agile approach we had to learn to trust each other." (I4)*

When the interviewees felt that not only the associates had to change their working behaviour, but also the company itself started to change, they started to accept the new approach. This aspect was named by almost all interviewees as a common point. As an example, I2 stated:

> *"When we started, we were given the new agile working model and we had to deal with it. There were no purchasing processes, management structures, etc. aligned with the new approach. And, to be honest, communication was horrible. Many of*

> *my colleagues did not even know that something changed, and we already did it. But at the point where also all the boards, prioritisation processes, etc. were changed, I could accept the new approach. And now I like it and can't imagine how we could work such a long time with the waterfall approach." (I2)*

From the supplier side, the successful completion of a project with a small team using the iterative approach, also convinced the others to be open to the new approach:

> *"After we finished the first project using the agile approach, the involved colleagues told them about their experiences and about the advantages they saw. Surely, there were also still issues in communication, our tools were not set up optimally, but at a glance it can be said that everybody was happy about the new way of working. With this positive experience, also our colleagues who were still working with the 'old' approach became curious and we involved them step-by-step into agile projects. Today, we are all working agile." (E1)*

As can be seen from the interviewee's answers, the culture and values of a company and its associates are not namely mentioned, but as the basis needs to fit with the new approach, also these values need to match with the ones of the organisational culture.

→ Everybody needs to be involved in the agile change and must be part of it.

→ Change always brings new ways of working and thinking, which must be supported by the entire organisation.

4.4.5 Team motivation, training, education and coaching

One question during the interviews aimed at finding out, how people or teams could be motivated, either from inside the team, or from the organisational perspective. Therefore, the interviewees were asked if, and how people, could be trained, educated, coached, or motivated to fully support a team. According to the answers of the interviewees, it is almost impossible to motivate people if they are not interested at all in the project. Motivation must come from inside the team. This means, that if the topic of a project is interesting as such, people like to work for it. Additionally, if the team is harmonious and working within the team is joyful, self-motivation is enhanced by reciprocal motivation to commonly reach the target and conclude the project successfully. E1 told from his role as a manager, that positive feedback is essential:

> *"Because my colleagues could do their job well, they got positive feedback. This feedback from the customer is also terribly important for my colleagues." (E1)*

E3, a software developer confirmed that feedback is well team motivation:

> *"I think what really motivates a team is when you get feedback on what you do. You often hear that an office job is nine-to-five boring. That's not true if you always work together with other business partners, with people who tell you afterwards*

> *what you did well and also tell you what you didn't do so well. […] Direct and honest feedback is very valuable for motivation." (E3)*

Extrinsic motivation is very difficult, team events like common dinner or other events may support it, but only if the willingness to work within the team is already there. E1 explains team motivation as follows:

> *"Well, it is important that the team feels involved and emotionally attached to the project. There must be emotions involved. For this you have to inform the team actively, they have to feel informed about what is going on. Secondly, I am a friend of bringing people together, and therefore, workshops are very important so that people get to know each other personally, exchange information. and, often smiled at, but also an evening event, where you go out for dinner and talk about non-technical and non-business things, that is all very important to connect the people involved emotionally with a project." (E1)*

But when it comes to the skills and understanding of agile measures, methods and tools, the view is different. As with every change, the involved or affected people need to be trained. Very often, only directly involved people are trained, e.g., project managers are trained in agile methods. Though, also business units, process experts, infrastructure architects, purchasing departments, boards and committees need to be trained for the new processes to understand the interrelations between all involved processes that change with the new methods:

> *"From my perspective, it was really helpful to get a basis training on agile methods and tool usage. With that, I was able to work with my colleagues using these tools and methods, and now, I would say that I am really good in working agile, because I learned so much in my daily work with the more experienced colleagues." (I4)*

Even if not every individual associate can be trained, at least a broad and transparent communication about the new measures, tools, etc. has to be ensured to include all associates and partners into the transformation process. Early involvement of key users into the transformation also helps to ensure understanding and support for the change:

> *"In my new role as 'product owner' I encouraged everyone involved in our topics to participate in basis trainings to get an understanding of the processes and tools. I even encouraged our purchasing department to get a training on agile methods to be able to support us in our changing requirements." (I2)*

Joint learning from agile coaches is also an approach that was described by a project manager as a method which really helped his project to be successful:

> *"At the beginning of the project, we really had no idea how the project could be done using the agile approach. I even bought myself a book about user story writing, with minor success. But then we engaged a professional agile coach who supported us with our first staps in the agile world. And this was really worth it, the whole team profited of his experience and 'learning by doing'. I would really*

recommend to everybody who starts using an agile project management approach to engage a coach." (I3)

From the learning needs perspective, another associate said that from his experience, also mangers should be educated properly in agile methods to support projects and the associates who work in them. I5 described the need as follows:

"In our project, almost the whole team was hired directly from university, so we had a good basic knowledge on agile models in theory. We then had our training sessions and afterwards agile working was no problem. Unfortunately, almost the whole management team did not have a training so far, and therefore there came up many discussions based on the missing training. After their training, they could much better understand our problems and many impediments could be removed instantly." (I5)

→ Team motivation must come from inside the team.

→ Changes in values and culture need to be driven by the organisation.

→ Basis trainings on iterative project management approaches and tools are necessary and helpful for associates and managers.

→ Professional agile coaching with 'leaning by doing' is a very good approach to learn how to use agile tools in the iterative approach.

4.4.6 Evaluation organisational structure and process specific criteria

This section showed, that factors related to the organisational structure and processes can't be seen individually from the team related factors and project related factors.

As in the previous categories, the criteria from literature do not match entirely with the results from data analysis, and therefore success factors were rearranged based on the findings from the case study.

Top management support was not named, but in general inclusion of management into project plays an important role, especially when a product owner in agile structures represents management, and is part of the requirements management process. In sequential project management, the management support is also relevant as steering committees are reflected by managers from the hierarchies of involved people and processes. In iterative projects, the product owner has the task, together with an agile master, to assign resources properly. In the sequential approach, assignment of resources is done by the project manager in coordination with the line management. Therefore, the success factors 'resources availability' and 'resource sharing' were combined with 'management support' and clustered to the category 'resource management'.

Project organisation structures were not explicitly named, nor was project management autonomy. The interviewees did not see it as necessary to supply the team with a specific model or frame in which they can act. These points were therefore not transferred.

A new category ‘agile project management methods’ was created and subsumes ‘agile project management processes’ as well as the strategy of how results can be delivered to the customer.

The development of the organisation and of the people, the team, agile trainings and coaching are necessary to enable an agile culture. Agile culture is new to the factors, this was not named in the literature as a success factor, but the aspects that are related to it were already covered by the results from the literature.

An aspect that was upgraded in its importance by putting it as a single factor, is ‘choosing and customising the agile approach’. Its relevance is one of the most important results of the interviews, as the need to provide a framework for organisations to develop the most suitable agile approach based on their specific needs is reflected in this aspect.

As the fifth main category, the enablement of the organisation to become agile was added. This aspect reflects necessary adaptions of the organisation in their supporting business units like HR management, purchasing department and processes, etc.

In summary, success factors in the organisational structure and processes were rearranged to five new categories, which reflect the main aspects for successful projects based on the results of data analysis

The summary of the development of factors for organisational structure and processes during research process are show in Figure 13:

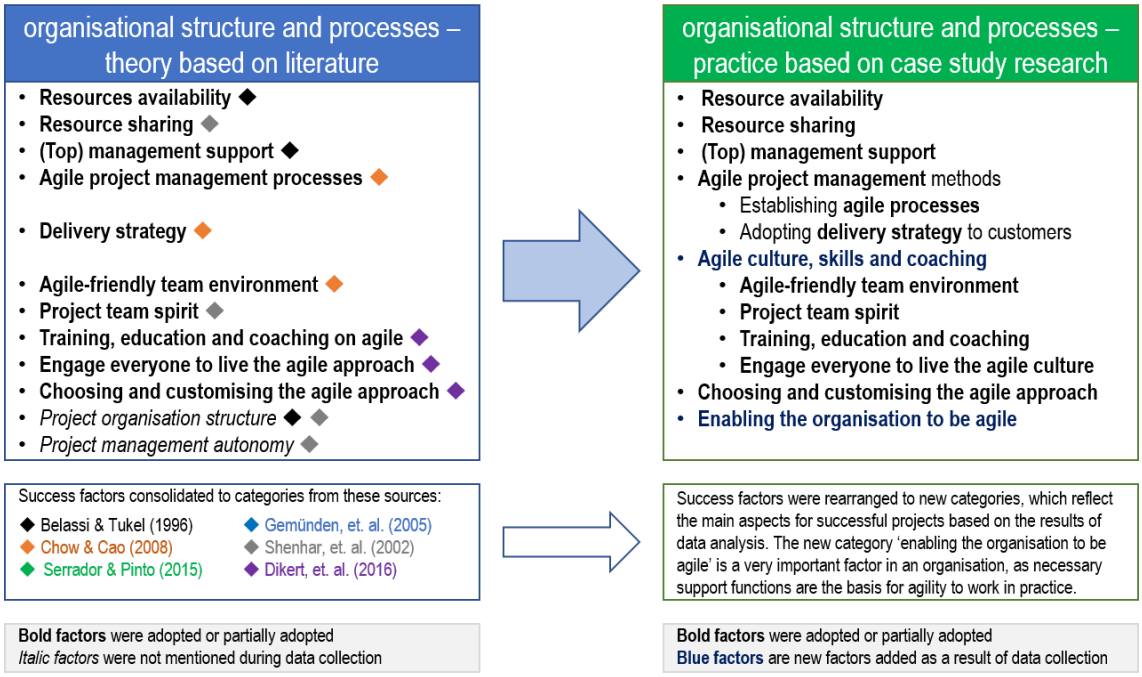

Figure 13: Results of data analysis of success factors related to organisational structure and processes: Resource management, enablement of an organisation to be agile by setting the right frame parameters, and the customisation of the agile approach to the individual needs of an organisation are contributing to project success.

4.5 External factors

The fourth group of factors is related to the external environment, which has an influence on all projects that need to be done using any project management method.

External factors are in general independent of the chosen approach, but nevertheless their influence on the project management approach and possibilities to fulfil external requirements needs to be investigated.

4.5.1 Technological environment

The technological environment influences IT projects in the way that technological change is getting faster and faster. Due to emerging cyber-attacks, the necessity to improve security and constantly update all components, is a big challenge to all system responsible persons:

> *"With the agile approach and shorter sprints and releases, we now have the possibility to update our systems in smaller cycles and provide them with the most recent security patches." (E2)*

In addition to security patching, also the general use of new technologies is influencing software development. Cloud technologies and agile project management approaches in

all parts of the industry lead to necessary adaptions when interfaces are established to other systems:

> *"In the past, most of the systems were hosted in our own data centres, now we use many systems that are provided as SAAS [software as a service] solutions or developed directly for cloud hosting. We need to adapt our 'old' applications to be able to make them interact with the new systems. So here the agile approach really helps us to have shorter cycles to do so." (I3)*

→ Technological change forces companies to faster react on technological progress.

→ Shorter release cycles bring possibilities for quicker changes.

4.5.2 Legal requirements

For IT systems, which are only used within a company, and which do not have a face to the customer, the influence of legal factors is mainly referred to audit-related topics, e.g., ISO 9001 certifications. Further, for applications that are also used from users of a bank, also binding rules from the national bank authority (BAFIN) have to be considered:

> *"When we look at the legal requirements, all applications must be audit-proof. We have several audits every year, from penetration testing of the applications to ISO 9001 certifications and audits for systems that are under surveillance of bank authorities. We really need to set up the system in a way that all these rules are followed and a certain standard is maintained." (I1)*

In addition to this, also compliance with the European 'General Data Protection Regulation' (GDPR), like securing the retention period of personal data, must be given. Therefore, it must be considered for each new system, but also for all existing systems, that only necessary data is processed:

> *"When we start a new project, we always have to keep all the regulations in mind that need to be followed. It starts with our internal rules for tender, the supplier needs to have specific certifications, and we need to comply with all current laws, most recently the new EU GDPR regulation which really had many changes as consequences for our systems.*
> *We have to take care, that all rules are followed. With the GDPR, we are even more required to define clear rules about which data we really need, how we store it, and which procedures are necessary to delete the data after the purpose of data collection is obsolete." (I2)*

Depending on the user group, for which the software is designed, also other regulations have to be considered:

> *"When I think about our other customer, a super market chain for which we program the electronic cash registers, we have to follow the rules of the government for payment transactions and money laundering laws. This is very specific and for every new project you have to check the legal requirements." (E2)*

→ Compliance with existing rules must be ensured at all times.

→ Legal requirements have to be considered newly for every new project based on the field of software usage.

→ Audits and certifications constantly review compliance with rules.

4.5.3 Further external factors

Customer satisfaction is sometimes considered to be an internal factor, when the internal IT department delivers software to a business unit. In many cases, and also in this dissertation, most of the software is implemented externally by suppliers, therefore the customer satisfaction is a factor that is externally influenced. So, from supplier side, customer satisfaction was named as one of the key criteria to determine if a project was completed successfully (see also section 4.2.1).

The investigated departments and products have no direct contact or interface to end customers, therefore the influence of customer satisfaction to the chosen project management model can't be evaluated.

The political, social and economic environment also can't be evaluated in detail. I2, a product owner and project manager, said that he must be able to autonomously react on budget cuts based on the economic situation of the enterprise, but based on this, no preferences for project management models can be derived:

> *"Especially for large projects, which have a duration of a year or longer, adoptions to new requirements from the organisation like budget cuts, new legal requirements, etc. need to be possible." (I2)*

In the interviews, also factors from political or social environment did not play a role, neither did competitors.

The given answers of interviewees from supplier side showed that for suppliers it is crucial to adapt on changing project management approaches to be able to compete with others. Nevertheless, competitors and their performance do not have an influence on choosing the right approach, as adjustments need to be done based on the requirements from tender.

4.5.4 Evaluation external factors

In the category of external factors, there can be stated that the deviation between literature and data from the interviews is the largest of all four categories. This can be explained by the fact that the focus of the investigated project and the environment of the department

and supplier is internally. This means, that the generated IT systems are all designed and developed for internal use. Therefore, external factors are only relevant to a certain extend. Related to customer satisfaction, there was already stated that the customer or supplier, depending on the point of view, are external in this context, as the supplier is externally contracted by the large enterprise (cf. section 4.2.1). The same is valid for the strong customer involvement, which is more an internal factor in the analysed case than an externally influenced factor. Therefore, these factors were kept as an external factor, recognising that the customer is internally from the view of the large enterprise, for which the agile model should be developed in this dissertation.

The political, social, and economic factors were taken out, as they play a minor or no role in the definition of an agile approach in general. But the strong expression of legal requirements in terms of laws, e.g., regarding data protection, and audits lead to the result that 'legal requirements' were added as a new main factor for success from the external environment. Technological factors also always play a role in the IT sector due to the constant technological progress and changing requirements in used technologies like cloudification, etc.

The inclusion of people with agile experience was also taken out from the external environment, as this factor was already considered in the organisational edge, where external coaching was named as a factor for enabling an organisation.

The summary of the development of external factors during research process are show in Figure 14:

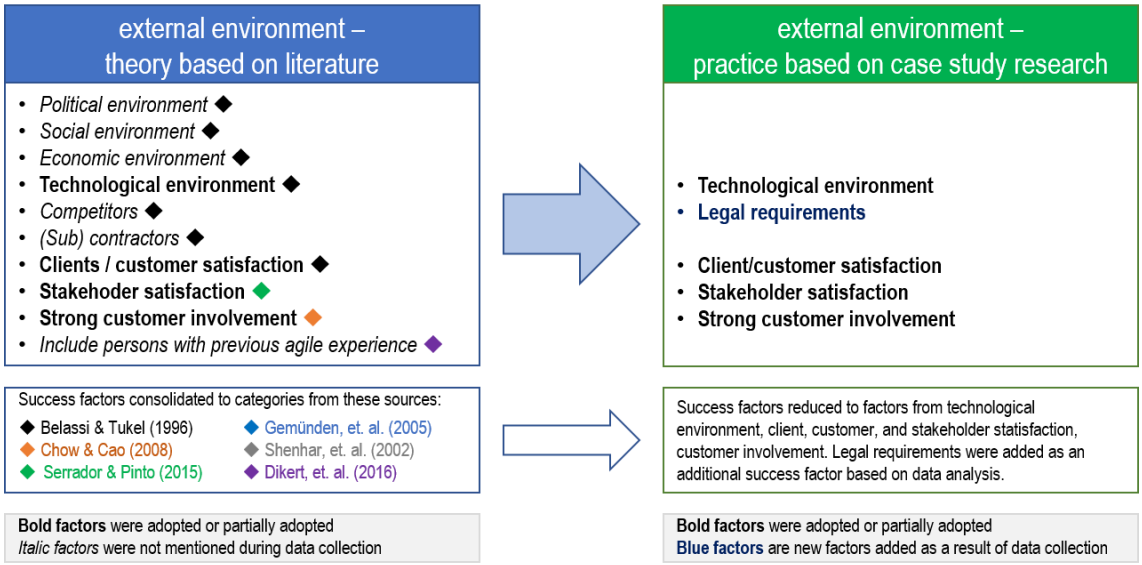

Figure 14: Results of data analysis of success factors related to external environment: technological and legal factors are to be considered, as well as satisfaction of customers and stakeholders should be achieved by strong customer involvement.

4.6 Chosen project management methods

As defined in ISO 21500, there is the need to have defined processes for each project phase including specification of deliverables and a review process with inspection and approval. The interviewees were therefore asked to describe the procedure how they would work on the case and how they would design the process. The questions also aimed at finding out if the chosen project lifecycle and deliverables per phase are more oriented on the sequential model or on the iterative approach. The interviewees were asked to describe how they would set up the project as project manager starting from requirements definition until delivery of final product. In this context, it was especially interesting to see if steps were left out or added, and if the process management model or specific processes were tailored based on specific requirements.

The chosen approach was mostly not a clean approach of one direction, there can be recognised that they intuitively used a hybrid approach. E5, for example, stated that he would always start with a workshop and afterwards work in a hybrid mode:

> *"I would try to create a small exploration concept on a technical level and create user stories for technical topics as well as user stories for business requirements. I would then actually want to have the commitment of all involved project team members from business units as well as from IT side, to ensure that everyone involved in the project has the same view." (E5)*

The hybrid approach can be seen as exploration concepts and user stories are common in the iterative way of working. The fact that all of these stories should be written and approved before the implementation starts, is more a habit from the sequential approach, where all requirements are defined before the implementation starts. It became clear, that E5 is already working in a hybrid model.

When it comes to the question of customer satisfaction about deliverables, E5 stated that the releases are planned on a quarterly basis, but requirements are prioritised in shorter cycles:

> *"I always try to get all wishes of the customers into one of the four releases that we have per year. And I think I really manage to get the topics placed within our team on short notice, so that we can satisfy the customer throughout the year." (E5)*

E4 stated, that with switching to the iterative approach, the requirements definition in the requests became much better due to the smaller packages. He reflected on the quality of delivered software:

> *"Actually, I think our release management […] is very successful. We deliver the software, business and/or IT is testing, and after approval we take these*

> *components into production. After testing, we sometimes have to do second round to fix errors found in the deliverables, but with the detailed specification of user stories, the detail level of specifications became much better." (E4)*

As an answer on the question what could be approved, the release manager said that the risk on prioritising topics on short notice is to produce errors in the productive systems when testing is not done properly, or if too much complexity comes into the system:

> *"In our case, in the last two weeks before going live are very stressful. That means that sometimes it's a bit hectic, because we don't release every two weeks, but our developers have development cycles of two weeks. It happens very often that business has urgent requirements that they want to have implemented and put into the production release. And there's the danger that some errors come into the software due to this speed or due to insufficient testing." (E5)*

The challenge on setting up a hybrid model gets obvious. If you would follow either the sequential approach or the iterative approach, the processes would be clearer as you have long-term planned releases or (smaller) regular sprints.

All interviewees independently agreed that a kind of exploration concept is essential to get a common understanding of the system, and that user stories or any other documentation is necessary to provide the requirements to the customer. The deliverables then have to be provided in form of releases to the end users.

The preferences of the approach became clear when interviewees were asked about their preferred approach to provide a new system to the customer. E1, for example, stated that for him, the sequential, waterfall approach is a successful approach to delivering the required software:

> *"We like to do this: In the basic stage we first create something that does 90% to 95%. Then you have the chance to make small corrections or polish the user interface, with the knowledge you have gained from the introduction of the system in the first enhancement stage, which ideally comes about 6 months later. In this enhancement stage you can then also take change requests or other adaptions into account." (E1)*

As can be seen from this statement, a sequential approach is not really flexible, as the upfront defined requirements should be implemented before changes can be prioritised.

Another interviewee stated that in his eyes, a sequential approach offers the possibility to add functionalities or fix issues from conception phase in the enhancement phase:

> *"In the waterfall model, enhancement stages are common to implement functionalities, that were not planned in the beginning or to fix errors made in the concept phase." (E3)*

Asking E3 about flexibility in changing requirements, he stated that the iterative approach offers here many new possibilities to quickly react on changing requirements:

> *"During the time of implementation, requirements may have changed. In the agile model, adjustments of requirements are easier possible as requirements can be adjusted per sprint by reprioritising requirements in the backlog. In the waterfall model, we were very inflexible as the implementation was planned from the beginning to the end including all requirements and the customer expected to get what was defined several months ago." (E3)*

→ Extensions in sequential models are more complex than in iterative models as a new concept phase needs to be done.

→ Extensions in iterative models are easier as the approach is designed in a way to enable constant adjustments based on changing requirements.

4.7 Further observations

Besides the results that were expected, there emerged also results that were not expected as such. These remarkable results are described in this section:

4.7.1 Importance of the team for project success

It was expected that a harmonious team, in which communication and atmosphere is good, is an enabler for success in projects. With a good team, many challenges can be taken together, and with good teamwork, also challenging topics can be handled and projects can be brought to a successful end. On the other side, it was expected that inharmonious teams may be a factor for projects to fail.

But none of the interviewees named an inharmonious team as a main factor for failure in unsuccessful projects. The main cause for failure of projects from the past was named by all interviewees to be unclear processes and unclear targets.

Besides the team, a common understanding of the goal and timeline for all involved parties, including stakeholders, sponsors, etc. is necessary to bring a project to success. In this context, a common understanding of the roles and their responsibilities support the success of a project as all involved people pull together.

→ That means, that a well-functioning project team is an enabler for successful project, but other factors like having a common target and clear processes are as important as a good team to enable successful projects.

→ In contrast, projects can also be successful with an inharmonious team, when the other factors enable it.

4.7.2 Clear understanding of roles and responsibilities

The roles and responsibilities in all kind of organisations must be defined properly. In this section, the answers of interviewees regarding roles and responsibilities are reflected.
Based on the theory, in iterative approaches like Scrum, teams should be allowed to self-organise and to be autonomic. Besides the autonomous dev-team, also the role of the product owner as the one person to prioritise requirements is essential for teams to be efficient. The Scrum master, as the other additional role, is responsible to remove impediments to enable the team to work efficiently.
But during the interviews, it became clear, that not all interviewees had the same understanding of the roles. Even if all participants stated that they already worked in agile projects, there were still questions regarding roles. Interestingly, these questions occurred when asking them to assign themselves to a role. E3 for example asked:

> *"What exactly are the tasks of an agile master?" (E3)*

I4 and I5, project managers from business side, both asked:

> *"Am I part of the development team or what is my role?" (I4)*

After explaining, that the development team consists of all team members which are not product owner, scrum master or stakeholder, they reflected:

> *"Ok, that means that the dev-team it is the same as a project team? Then I am part of the dev-team." (I5)*

Here it became clear, that the roles in agile and waterfall model are not properly differentiated and that people still think in the waterfall model when it comes to roles definitions and understanding of tasks.

4.8 Summary of data analysis and discussion

After evaluation of all available data from the interviews, it can be summarised that not all factors from literature seem to play a role in practical use of tools in real projects within large organisations. Further, also factors that were not named directly in literature as success factors were named to be important from the point of view of the interviewees.
Based on these results, the critical success factors were analysed and reworked based on the collected data, to find critical success factors for projects in large organisations.
The factors were grouped in four categories: factors related to the project, factors related to the project manager and team members, factors related to organisational structure and processes, and factors related to the external environment.

Figure 15 shows the newly derived success factors based on the collected data in this dissertation. The four success factor categories cluster all aspects that are relevant for successful projects in large organisation. These categories and success factors are used as basis for the definition of the decision support framework in the next chapter.

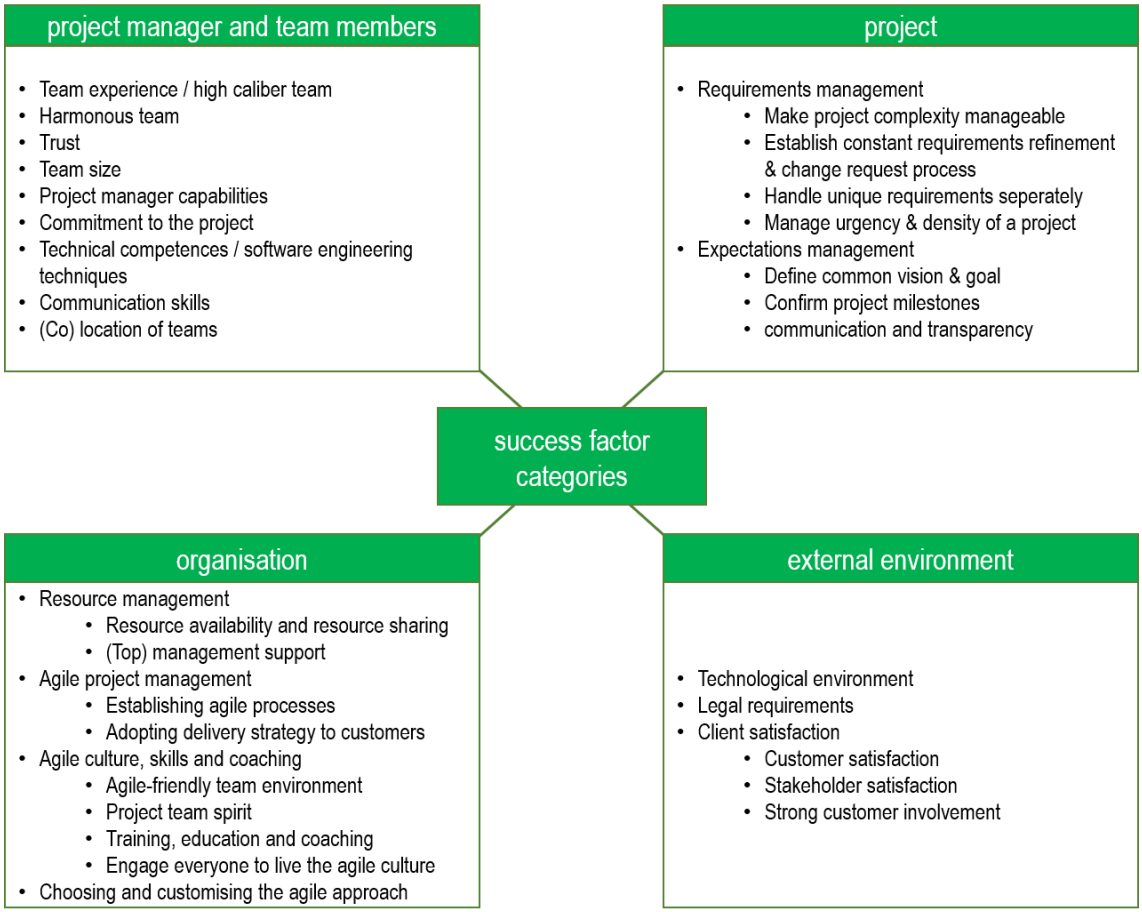

Figure 15: Key success factors identified during data analysis based on case study research

5 Development of decision support matrices, the PSIL framework, and its validation

5.1 Introduction

As can be seen from the previous chapters, it is very unlikely that one standard approach from the literature fits exactly to the needs of a company, especially not to large enterprises with global processes that need to continue working after the agile transformation. There are many aspects that need to be considered, when the decision-makers in large organisations think about changing from a sequential project management model, e.g., the waterfall approach, to an iterative, agile project management model, like Scrum. In most of the cases, there is no right or wrong, for or against using a sequential or an iterative approach. Mostly, the truth will be lying in-between in form of a hybrid approach.
This dissertation provides a framework for enterprises to choose the most suitable parts from both worlds, to enable them creating a hybrid approach to best support agile transformation in their organisation.

Section 5.2 describes the generated support framework and explains the horizontal and vertical axes of the model. Based on the answers in the interviews, especially on the chosen methods, task descriptions, and team setup for the scenario, four different project management models could be derived. The chosen steps and the implicitly chosen project management model led to the advantages and disadvantages of their use in practice and are described in this section.

In **section 5.3**, the key success factors for projects, which were described in the previous chapters, are applied to large enterprises on the focus of agile transformation. The success factors serve as a basis for decision making, clustered into the four main categories: project specific factors, factors related to the project manager and team members, factors related to organisational structure and processes, and external factors. For each aspect, the decision matrix from section 5.2 is filled, to serve as a decision basis for managers. With this framework, decision-makers can derive their own specific agile working model. Based on this detailed framework, an agile working model using the hybrid approach is described as an example for a large enterprise in **section 5.4**. With a framework like this, an agile working model can be introduced to large enterprises, considering the main aspects for project success.

In **section 5.5**, the application and validation of the designed model is described. As a first application, an example model of a hybrid approach for a large organisation was

defined. Additionally, the results of this dissertation were presented to the interviewees, and their evaluations of the model was questioned and summarised as a first validation of the model in the investigated context.

Section 5.6 summarises the results of this chapter.

5.2 Decision support matrix derivation

Based on the knowledge from literature, and the results from the interviews, it became clear, that there are different ways of doing projects and that very often, projects are done using a customised approach. Literature also stated that one of the factors to support successful projects is to have a customised approach, based on the needs of the company. Tasks within a project are handled differently in the different approaches. Usually, none of the approaches is capable to be used one to one in a large enterprise. Therefore, companies need to define their own model considering different factors. They are described in the following chapters.

When a company has to take the decision as whether or not to become agile, the decision will probably be that they want to become agile to a certain extent. This dissertation provides the reader with a decision support framework for defining a customised model based on different approaches.

To do so, the framework was derived in form of a matrix, consisting of categories and success factors (horizontally), and different approaches (vertically).

5.2.1 Project management approaches (vertical axis)

In this dissertation, the sequential approach and the iterative approach were compared. Literature in this context was analysed to find out, how agile transformation in large organisations was done in the past. Further, the two models also served as a basis to compare and classify the answers from the interviews regarding usage of common methods in the operational business.

As a result, there is almost in all cases the need to be flexible when it comes to the application of a theory in practice. In a first approach, the results were clustered in three categories: iterative approach, sequential approach, and hybrid approach. Further, during the research it was recognised, that a further differentiation of the hybrid approach became necessary. In the literature, several articles showed that there are derivations in the approach depending on the approach you come from. Also, during the interviews, it became clear, that interviewees that worked already using an iterative approach adapted their

behaviour from this side, whereas interviewees that used to work in a sequential approach, described their working model from this side. Therefore, the hybrid approach was split into two approaches: an adapted sequential approach (called “sequential light”) and an adapted iterative approach (called “iterative light”). With that, the basic approach is clear, and also requirements for and prerequisites of the usage of this approach can be applied. Further, the “light” approaches also allow specific adaptions of an approach to individual needs of a company. It is recommended for enterprises to customise their individual approach within the general alignment to one of these approaches, meaning to remain in the columns “pure sequential” and “sequential light” or “iterative light” and “pure iterative” to keep the focus, values and theories behind an approach. In some cases, it may be necessary to use aspects from the other approach as well. This is possible, but it should be used rarely to avoid mixing the mindset that serves as a basis behind each approach.

5.2.2 Categories and success factors (horizontal axis)

In addition to the vertical axis, which reflects the different approaches and their emphasis into full and light, the horizontal axis describes the criteria which support decision-makers in their decision for the most suitable approach.

The criteria for choosing the right model were clustered into the already described four categories ‘project characteristics’ (cf. sections 4.2 / 5.3.1), ‘project manager and team members’ (cf. sections 4.3 / 5.3.2), ‘organisational structure and processes’ (cf. sections 4.4 / 5.3.3) and ‘environmental factors’ (cf. sections 4.5 / 5.3.4). Each category contains several success factors which need to be considered to come to a decision about the best suitable approach. All criteria within a category are related and depending on each other. Therefore, for each category, all factors need to be considered, and a model must be created. Ideally, for all categories the same approach is chosen. In some cases, this may not be possible or may not the best suitable solution for the enterprise. Therefore, decision-makers can choose from all approaches to define the best suitable setup of a specific agile working model for their individual needs.

5.3 Decision support matrices

This dissertation aims at providing a framework to decision-makers of large organisations, to help them taking the right decision regarding the best suitable project management approach for the agile transformation of their organisation.

Therefore, the critical success factors, which resulted from the interviews and literature review, were arranged in form of decision matrices to support decision making based on given individual frame parameters within each enterprise.

The factors were clustered into four categories:

- project specific factors,
- factors related to the project manager and team members,
- factors regarding organisational structure and processes and
- external factors.

The following chapter gives an overview about topics that are handled differently in the iterative approach and the sequential approach. It also shows possible solution of a hybrid approach, to take the best from both worlds, the sequential and the iterative one. To support this, the project management approaches were defined as parameters in the horizontal axis: pure sequential, sequential light, iterative light, pure iterative. For each success factor, details are provided in these parameters as guidance for decision support.

Table 4 shows an example of the decision matrix table as criteria are described in the following chapter.

	pure sequential	**sequential light**	**iterative light**	**pure iterative**
success factor (reference to section)	Overall statement for success factor in sequential approach. Advantage sequential approach for topic. Disadvantage sequential approach for topic.		Overall statement for success factor in iterative approach. Advantage iterative approach for topic. Disadvantage iterative approach for topic.	
	Specification of topic in pure sequential approach.	Specification of topic in sequential light approach.	Specification of topic in iterative light approach.	Specification of topic in pure iterative approach.

Table 4: General structure of a decision matrix with the success factor and the relevant reference to data section in the first column, and specifications of the success factor in the different approaches.

The decision matrices (like in Table 4) present the gained information from the interviews in a structured way and are all formatted identically.

The first column (grey) contains the reference to the corresponding results section in chapter 4, from where the content comes from.

The sequential characteristics are kept in orange, with pure sequential in orange, and sequential light in light orange. The iterative characteristics are formatted in blue, with iterative light in light blue, and pure iterative in blue.

For each success factor, an overall description and a specification of the topic in the according approach is given (black), and the advantages (green) and disadvantages (red) of each approach is described.
Following the approach-specific characteristics, the last line further differentiates between the pure and light specification within each approach. These differentiations contain detailed characteristics of the specific success factors, and design examples from practice were included to help decision-makers to understand the different specifications. All decision matrices are consisting of condensed information from the interviews, and have a very close relation to practice (cf. chapter 4).

Each sub-section of this chapter is therefore set up in way, that it starts with an overall statement and advantages and disadvantages of the usage of the iterative or sequential approach for this topic. Afterwards, for each topic, a decision matrix was derived.

5.3.1 Project characteristics

The first group of factors is related to the characteristics of the projects that need to be done using the project management method.

5.3.1.1 Project vision, scope and goal

A clear vision and scope of a project is essential for project success, independent on the chosen approach. For larger projects, constant revisions of the vison, scope and goal are necessary. The project vision, scope and goals are only secondarily relevant for choosing the approach, but still, they need to be clear. If a sequential approach, like the waterfall model, is chosen, the vision, scope and goal must be clear in the very beginning, as all activities are defined in the beginning, and there is only one single development path, in which all elements from vision and scope, as well as for goals fulfilment, must be met. When following an iterative approach, it is still essential to have a common understanding of the project vision, but with the iterative progress of the project, scope and goals may be adjusted constantly. With this, it became clear that revision process of vision, scope and goal have to be handled differently in the different approaches.
The project vision, mission, goals, and targets are necessary to get an overall feeling about direction, in which the project should go. Depending on the chosen approach, the necessity of the availability of the vision, mission, goals, and targets in the very beginning varies. Whereas in the pure sequential approach everything needs to be there in the

beginning of a project, the more an iterative approach is chosen, the more flexibility is given to further adjust them.

The main advantage of the sequential approach is, that all requirements of the project, the vision, and mission are to be fully fulfilled with the delivery of the system. This is, at the same time, also the main disadvantage of the iterative approach, as the initial vision, mission, goals, and requirements may not be fulfilled at the end of the project due to the flexibility to adjust the requirements during project duration. Vision and mission may be come out of scope without being remarked. This flexibility to change the fundamentals vision, mission, goals, and targets constantly, in fact, can also be an advantage of the iterative approach, and, at the same time, is a disadvantage of the sequential approach as changes here are only possible to a certain extent (cf. section 4.2.1)

The characteristics for project vision, mission, goals, and targets are described in the following decision matrix Table 5:

	pure sequential	sequential light	iterative light	pure iterative
project vision, scope, goals, and targets (section 4.2.1)	The vision, mission, goals, and targets must be very clear in the beginning. The fulfilment of requirements from vision, scope and overall goals will be provided with the provisioning of the system. Adjustments of vision, scope and goals are only possible to a very limited extend.		The vision, mission goals, and targets should be clear in the beginning. Adjustments of vision, scope and goals are possible during the development of the system based on changing requirements. The fulfilment of initial requirements from vision, scope and overall goals may vary in the end from the initial expectations.	
	The fulfilment of the requirements from vision, mission, and goals must be done in one single step, as the entire system is provided to the users at once. Therefore, its definitions must be clear in the beginning.	The fulfilment of the requirements from vision, mission, and goals can be done in several steps, as the system is provided to the users in releases. Therefore, its definitions can be refined per release.	The fulfilment of the requirements from vision, mission, and goals can be done in several steps, as the system is provided to the users in longer sprints. Therefore, its definitions can be refined per sprint or release.	The fulfilment of the requirements from vision, mission, and goals can be done step-by-step, as the system is provided to the users constantly in sprints. Therefore, its definitions can be refined per sprint or release.

Table 5: Decision matrix for project vision, mission, goals, and targets:
They play an important role for success of projects, refinement process is different based on chosen approach.

5.3.1.2 Project complexity, size, value, urgency, uniqueness

In general, project complexity, size, value, urgency and uniqueness do not have an influence on the chosen project management method. Both methods are scalable and can be used for all kind of projects. The project management itself and the team must be set up differently, but it can be said that no method is in general faster, cheaper, or better than

the other. But regarding complexity management, which is one of the main success factors of a project, the two approaches give different tools at hand. The sequential approach requires all requirements to be defined upfront, whereas the iterative approach demands smaller stories which enforces the requesters to drill down the requirements to a more focused document.

The management and reduction of project complexity and process complexity was named as one of the main criteria for project success. This factor is independent on the chosen approach. With the sequential approach, the complexity can easier be reduced due to the fact that the requirements are not defined in large concepts, but in smaller user stories.

Table 6 shows the characteristics of complexity management based on the results of the data analysis (cf. section 4.2.2):

	pure sequential	sequential light	iterative light	pure iterative
project complexity, size, value, urgency, uniqueness (section 4.2.2)	All kind of projects can be handled. Provisioning of the entire functionality to the users at once. Complex systems are delivered at once, usually after longer period of implementation. Possibilities to do adjustments are limited, and complexity may not be manageable.		All kind of projects can be handled. Complex systems are delivered iteratively, good possibilities to request adjustments and make complexity manageable. Iterative provisioning of features to the users may lead to dissatisfaction, as only small parts of the system are usable from the beginning.	
	The entire system is provided to the users at once. All complexity in processes and requirements has to be described in the beginning of the project.	The system is provided to the users in releases, e.g., focused on specific user groups, functionalities, etc. Complexity in processes and requirements can be split up to several levels of delivery.	Provisioning of features to the users in defined, bigger releases. Complexity in processes and requirements can be split up to several user stories, and delivery can be done in several releases.	Provisioning of features to the users in defined, small releases. Complexity in processes and requirements must be split up to several user stories, and delivery can be done in several releases.

Table 6: Decision matrix for project complexity, size, value, urgency, uniqueness:
Main differences between the different approaches are the provisioning and handling of complex systems.

5.3.1.3 Requirements management and target management

In addition to the long-term project vision, scope and goals, the requirements definition and short-term targets have different relevance in the two approaches.

When all requirements are clear from the beginning, and if it is not expected that any changes in requirements occur during the project, then a sequential approach is the right one. If there are only some requirements clear from the beginning, then the iterative approach is more suitable. But in practice, none of these two extremes is realistic.

Even if all requirements are known in detail for the whole project from the beginning, which is typical for the sequential approach, there may always occur necessary adjustments when the project is ready to go live. This may be changing interfaces, changing legal requirements, new business requirements, etc., which then have to be adjusted in a second phase of implementation to fulfil customer's needs.

When the iterative approach is followed, requirements and targets that were agreed in the very beginning and implemented in one of the first releases of a project, may also have to be changed later on again. This may also lead to high efforts, e.g., when the function is already in productive use and is a core component of the system. The advantage of the iterative approach is that the flexibility to react on changing requirements during the project duration is higher, but a professional requirements management is necessary, as only then, all targets can be met. Further, the danger of losing focus is higher than in a sequential project. To avoid this, constant re-assessment of project scope is necessary.

Table 7 summarises the criteria and characteristics for requirements management and target management (cf. section 4.2.3) in a decision matrix based on the different approaches.

	pure sequential	sequential light	iterative light	pure iterative
requirements management / target management (section 4.2.3)	Everything is clear in the beginning. No surprises about efforts, costs, time, etc. Limited possibilities to react on changing requirements during project.		Specification is done just in time. Option to quickly react on changing requirements during project. Project duration, final results, efforts cannot be estimated due to missing requirements definitions.	
	The entire project is done in just one big release. Every requirement needs to be defined in the beginning. All project phases are executed just once.	The entire project is done in several, smaller releases. Every requirement needs to be defined in the beginning of each release. All project phases are executed once per release.	The project is done in multiple, longer sprints. Every requirement needs to be defined during backlog refinement in the current sprint for the next sprint. Each sprint contains all activities.	The project is done in multiple, short sprints (max. 4 weeks each). Every requirement needs to be defined during backlog refinement in the current sprint for the next sprint. Each sprint contains all activities.

Table 7: Decision matrix for requirements management and target management: Requirements definition and refinement process differ most between different approaches.

5.3.1.4 Characteristics and provisioning of deliverables, change requests and user acceptance

The results that are delivered to the customer depend on the chosen approach. Therefore, provisioning of deliverables is depending on the way of prioritisation and management of requirements. When a sequential approach is chosen, the customer sees the results at

the end, when all requirements are implemented as defined in the beginning of the project. When the iterative approach is used, the results can be seen after each sprint, when they are delivered to the customer. Here, there are as well advantages and disadvantages on both sides. When the customer gets all the results as an entire package at the end of the project, it may happen that he gets what was defined some time ago, but requirements may have changed in the meantime. On the other hand, the customer will get the entire system with all functionalities at once. In the iterative approach, each release provides only parts of the software. Here, also the expectations of the customers and failure tolerance play a role. If a fully working system with all features implemented at once is expected, then a sequential approach fits better than an iterative approach, where fragments are delivered step-by-step until the entire system, will be available.

In both approaches, a detailed management of change requests is necessary, but the possibilities for change request implementation are different. In an iterative approach, change requests are reflected in changed requirements for the next sprint, in a sequential approach, a next (or additional) functional release which contains the new requirements must be planned.

Table 8 summarises the aspects of provisioning of software to the customers based on the data from section 4.2.4.

provisioning of deliverables / change requests / release management (section 4.2.4)	**pure sequential**	**sequential light**	**iterative light**	**pure iterative**
	The entire system will be delivered as specified after implementation period. All functionalities are available at once. Change requests during the development phase are not reflected in the results.		The system will be delivered step-by-step, and functionalities will incrementally be added. Change requests during the development phase are constantly reflected in the results. Not all functionalities are available at once.	
	The entire system will be delivered as specified in the beginning after implementation period. All functionalities can be used from the beginning for all users. Change requests from users during the development phase are not reflected in the result.	The system will be delivered in previously defined, smaller releases. Functionalities can be used step-by-step. Change requests from users can be taken into consideration when detailing the next release. Users must accept incrementally added features.	Functionalities are delivered on a regular basis in defined releases, which contain the results of several sprints (e.g., one release per quarter). Users must accept incrementally added features.	Functionalities are delivered on a regular basis after each sprint. Users must accept incrementally added features.

Table 8: Decision matrix for provisioning of deliverables, change requests and release management: Availability of entire system and system components differs based on the chosen approach.

5.3.1.5 Communication and target group acceptance

For the acceptance of new IT-systems it is essential that changes for the users are properly communicated. Here, the communication strategy and communication efforts are also dependent on the chosen approach and the involved users.

When it comes to delivery of a new system, training and communication, all possibilities must be considered. If the end user group is small and flexible in using new functionalities on a frequent basis, then the iterative approach would maybe be the better choice. If the system is designed to be used by an entire enterprise, the provision of the system 'as a whole' may be more suitable, as training and communication efforts can be reduced, and acceptance of the system may be raised. On the other hand, it may also be a chance to provide functionalities step-by-step, so that users get used to the system by starting with simple features, which are then extended by more complex functions, which may even not be needed by everyone.

If a system is designed to be used by only a few power users, the communication and development strategy may be different from the one to communicate a system to all employees of an enterprise. Especially in global, multi-national enterprises, efforts may not be underestimated. The target group also influences the chosen method, as acceptance of 100,000 users to get new functionalities every two weeks may be not that high as compared to a group of 10 power users who may even be involved in the design of the new system. Also, communication channels may differ depending on the frequency of the provisioning of new features.

Table 9 shows the characteristics of user communication based on the results from chapter 4.2.5 in form of a decision matrix.

	pure sequential	sequential light	iterative light	pure iterative
Communication and target group acceptance (section 4.2.5)	Target group orientation is necessary in all kind of projects. Provisioning of the entire functionality to the end users, which reduces, e.g., communication and training efforts, when many users are affected. A single training / communication may be sufficient. Complex systems are delivered very late as a whole, possibilities to test acceptance and to roll out minor releases to smaller groups of people are hardly possible.		Target group orientation is necessary in all kind of projects. Complex systems are delivered iteratively, good possibilities to communicate smaller releases with defined features to a specific, smaller user group and to train them. Constant provisioning of features to the users may lead to high communication and training efforts, when many users are affected.	
	Complex systems may require one-time training and communication efforts	Complex systems may require several training and communication efforts.	Features are provided in defined packages, for which communication and training may be steered based on the provided functionality.	Features are provided in defined packages, sprints for which communication and training may be steered based on the provided functionality.

Table 9: Decision matrix for communication and target group acceptance: End user target group and its characteristics is a relevant factor for choosing the best suitable approach.

5.3.2 Project manager and team members

The second group of factors is related to the project manager and team members that need to work with the given project management method.

5.3.2.1 Team roles

The roles, and more important their staffing, is one of the key success factors for a project. In a sequential project, project roles are hierarchically organised and clear per phase. Further, team roles are filled with people for the entire project duration. In an iterative approach, like Scrum, staffing is done autonomously by the team per sprint, so there is no hierarchy existing, and coordination of task completion is more complex.

The team should further be set up with experts in their field, as well as with business process experts, project management experts, and technical experts. The better the knowledge of the team, the better are the chances for a project to be successful.

Depending on the chosen approach, the availability of the responsible people is different. When a sequential approach is chosen, all relevant people for describing the business processes and designing the solution must be available almost full time during the first phases and during the test phase. In an iterative approach, large topics are split to smaller ones. Therefore, the availability of experts is only demanded in sprints where his or her

expert knowledge is necessary. Capacity needs are not concentrated on the beginning of the project, capacity needs vary based on prioritised topics per sprint.

The results are summarised in Table 10, based on the findings in section 4.3.1.

	pure sequential	sequential light	iterative light	pure iterative
Team roles (section 4.3.1)	Clear hierarchical roles. Demand of high team availability depending on project phase. Clear structures and responsibilities. High demand in resources availability depending on current phase.		No hierarchical roles, autonomous team and independent working. Demand of team availability during the entire project, varying extent based on prioritised topics per sprint. Equal responsibilities. Long-term, partially demand of resources availability, which cannot be planned upfront.	
	Defined structures and responsibilities. Demand of high team availability depending on project phase.	Defined structures and responsibilities, but sub-roles to support shared responsibility. Demand of high team availability depending on project phase can be reduced by defining smaller releases.	Definition of team leads with responsibilities for specific topics, autonomous team and independent working remains. Demand of team availability can be structured by pre-prioritisation of topics.	No hierarchical roles, autonomous team and independent working. Demand of team availability during the entire project duration at varying extent, based on prioritised topics per sprint.

Table 10: Decision matrix for team roles:
Demand of availability of different team roles differs in different approaches.

As the table above shows, the team itself plays a big role in project success. Good people are essential, independent on the chosen approach. The degree of independence of individuals within the team, or the team as a whole, as well as the requirement and willingness of the management for the team to be independent, may be the determining factor of choosing an iterative or sequential approach.

5.3.2.2 Team characteristics and team leaders

For a team to be successful, it is also important that the composition of the team is harmonious. The team should ideally consist of different types of people, whereby experienced people can be important pillars within the team. Young professionals may need some experienced people to get support from, and experienced team members may profit from new ideas of young professionals. In the sequential approach, the role of the project leader has an exposed position, as he or she is responsible for the whole project. In the iterative methods, there exists no team lead, therefore, it is even more important to have experienced ‘leader type people’ within the project team.

Table 11 summarises the results from the interviews from section 4.3.2:

	pure sequential	sequential light	iterative light	pure iterative
Team characteristics, experience and team leaders (section 4.3.2)	The project manager is the overall responsible person for project success. In hierarchical organisations, a project manager is necessary. A harmonious team of experienced experts is key to success. Responsibilities are clear. Individuals have to rely on the project manager and have less freedom in decision-taking.		There exists no responsible person which is accountable for project success, all team members are jointly responsible for project success. A harmonious team of experienced experts is key to success. Individuals have more freedom to take decisions. It exists not one responsible person.	
	The team consists of a project manager (team lead) who is fully responsible for the project success and several project team members.	The team consists of a project manager (team lead) and sub project managers who are together responsible for the project success.	The team consists of several team members, who have all equal rights and are jointly responsible for project success, but the team defines a 'speaker' who serves as a direct contact to the management.	The team consists of several team members, who have all equal rights and are jointly responsible for project success.

Table 11: Decision matrix for team characteristics, experience and team leaders: Responsibility for team results differs most between the different approaches.

5.3.2.3 Team size

The team plays a central role, if not the central role, for success of projects. Therefore, in addition to the harmoniously working team, also capabilities and knowledge of the team play a role. The team should be formed out of specialists in their specific field. The entire team should cover all required competences, so that the team capability fits best to successfully complete a project. Individual knowledge is as important as interaction between the team members. A harmonious team is much more efficient than a team that is just a composition of experts. In the sequential project management approach, teams are set up for a specific project from all disciplines, whereby the team size is not defined. In the iterative approach, the team size is limited. Following the Scrum approach, e.g., it should not exceed nine team members. For larger teams, scaling frameworks can be used (e.g., LESS, SAFE, etc.). The challenge in projects which use an iterative approach, is, that enough resources with the necessary skills are available at the right time, to ensure satisfaction of all individuals.

The results from section 4.3.3 are summarised in the following decision matrix for team size (Table 12):

	pure sequential	sequential light	iterative light	pure iterative
Team size (section 4.3.3)	For each project, experts from different fields are needed to successfully complete a project. Team size is not limited by the methods. Finding the best size for the project is difficult due to often long-term projects with many involved parties.		For each project, experts from different fields are needed to successfully complete a project. Team size is given by the used methods. Large projects may need to be split into smaller projects, or the right people may be missing.	
	The project team is set up in the beginning and stays the same from the beginning of the project until the final closure. Team size may be very big, depending on the covered business processes and technologies.	The project team is set up in the beginning, but availability of experts is based on the prioritised topics per release. Team size may be very big, depending on the covered business processes and technologies, but at the same time, team size will be reduced to an optimum.	The core project team is set up in the beginning, further stakeholders or team members are named and known from the beginning but take action when they are needed. Team size is small, additional specialists may be added on demand, depending on the covered business processes and technologies, based on previous planning.	The core project team is set up in the beginning, further stakeholders or team members are added during progress of a project. Team size is small, additional specialists may be added on demand, depending on the covered business processes and technologies.

Table 12: Decision matrix for team size:
Sequential projects have no limitation in team size, iterative projects aim at smaller team size.

5.3.2.4 Trust

For projects to run smoothly, trust plays an important role within the project team. Within a trustful team, processes can be handled much quicker and more informal than in teams without trust. Therefore, when projects a done using an iterative approach, where the collective is responsible for project success, and where formalism, e.g., in terms of steering committees or project gateways, is reduced to a minimum, trust becomes even more important than in sequential projects, where every project phase will be approved by a committee.

Table 13 summarises the results from the interviews as described in section 4.3.4:

	pure sequential	sequential light	iterative light	pure iterative
Trust (section 4.3.4)	Trust is important for smooth project process and enabler for successful projects. Defined gateways and steering committees constantly approve project progress and project quality. Potential flexibility that trust would give in efficient teams enabled by trust maybe slowed down by gateways.		Trust is important for smooth project process and enabler for successful projects. Trust enables projects move fast forward by relying on each other and by optimising process steps. Missing gateways and steering committees may lead to lower quality, as self-approvals are required.	
	Every project phase is approved by a gateway. Steering committees constantly assess project progress and approve budgets, plannings, etc.	Every project phase is approved by a gateway, but gateway meetings may be skipped. Stakeholders are part of the project team and constantly assess project progress without official meetings.	For each sprint, the team members take responsibility for the reaching of the overall project targets, but a defined group of stakeholders is additionally informed on a regular basis. Trust between all project team member enables efficient working and successful releases.	For each sprint, the team members take responsibility for the reaching of the overall project targets. Every project team member trusts and relies on the other.

Table 13: Decision matrix for trust:
Trust is the most important social factor within a team, even more important in iterative approach as gateways and committees are missing.

5.3.2.5 Location of teams

The location of teams is a controversially discussed topic. All interviewees stated that it is much easier and more efficient when teams are located at the same place. As this is often not possible, specific meetings should be done in person. The initial project kick-off, for example, is one of the best examples for on-site workshops. In here, personal relationships are established and the basis for trustful collaboration is laid. The necessary availability of team members is different, depending on the chosen approach. When a sequential approach is chosen, all involved people are necessary in the requirements definition phase in the beginning, whereas in an iterative approach, experts are needed in the requirements specification phase of the sprint, in which their specific input is needed. Nevertheless, it is usually helpful when the entire team comes together at least once in person, to build up personal relationships and trust.

Additionally, if teams are located in different time zones, collaboration is further demanding and difficult due to longer answering times to questions and limited time-windows in which all associates are available.

The following Table 14 summarises the results of the interviews from section 4.3.5:

	pure sequential	sequential light	iterative light	pure iterative
Location of teams (section 4.3.5)	For teams that know and trust each other, local separation is easier to handle. Onsite location of all involved people makes collaboration more efficient, especially as onsite presence is mainly needed in the early phase of a project. Distributed teams require discipline and structure. Availability of teams remote for various, long sessions in the beginning of the project is necessary.		For teams that know and trust each other, local separation is easier to handle. Short, but regular sessions make collaboration in distributed teams possible, e.g., in dailies or weeklies. Availability of distributed teams and employment in several projects may lead to complex timeslot coordination, especially in short development cycles and in complex projects with many different experts.	
	Demand of high team availability in the early project phase. Requirements definition phase should be done in person with all involved project members to gain common understanding of the requirements.	Demand of high team availability in the early project phase. A split into smaller projects reduces timeframes per sub-project. Initial onsite workshops with all involved project team members to get common understanding, afterwards online sessions.	Demand of team availability can be structured by pre-prioritisation of topics to make joining of additional experts plannable. Initial onsite workshop with all involved project team members to get common understanding, afterwards online sessions with the core team and needed experts.	Demand of team availability during the entire project duration, but with less extent at one time. Experts need to join depending on the topic. Only core team is part of initial phase or exploration phase.

Table 14: Decision matrix for location of teams:
Location of teams has different implications, as demand for availability of individuals in the team differs based on the different approaches.

5.3.3 Organisational structure and processes

The third group of factors is related to the organisational structure and processes of the enterprise, in which the project team has to work on the projects with the given project management method.

5.3.3.1 Operational and organisational structure

The operational and organisational structure play a big role in the transformation of an enterprise, as the organisation must support agile working. Many large enterprises are hierarchically structured, which means that usually reporting of results is done bottom-up and requirements are defined top-down. Often, there are also cross-functional requirements reflected in operational structures, e.g., business departments require new software systems to be implemented by IT departments, or functional requirements from one department lead to process adjustments in another department. When a sequential approach is used, all involved people and processes are defined upfront, responsibilities are confirmed, and projects can be executed. A project manager is responsible for the progress

and success of a project, and steering committees with managers from all involved departments control the progress and take decisions when necessary. Usually, in large enterprises, planning and prioritisation of projects takes place once a year and, re-prioritisation is a complex process.

This structure is contrary to the iterative approach, where there exist no hierarchies, the team is entirely responsible for the results, meaning every individual has responsibilities, but not the individual manager. In practice, this is one of the biggest challenges in large enterprises, as budgets, resources, etc., are all steered top down. Here, hybrid approaches can be established to give responsibility for budget, etc. into the product development teams. This can be reached, for example, when product owners are introduced and provided with responsibility for budget, people, flexibility, and other necessary resources. Prioritisation of topics also has to be aligned with the product team.

The organisational structures and processes form the third category. They were shown in section 4.4.1 and are summarised in the following decision matrix Table 15:

	pure sequential	**sequential light**	**iterative light**	**pure iterative**
Operational and organisational structure (section 4.4.1)	Hierarchical organisational structures and hierarchical project setup. Clear roles, budgets, escalation levels, deliverables, etc. Less flexibility to react on changing or upcoming requirements due to hierarchical decision processes.		Flat organisation hierarchies and flat structures in project setup. High flexibility to do whatever is necessary, based on current requirements. No clear roles, not one single responsible person, escalation levels not defined.	
	All projects are prioritised in boards, resources for the project are allocated, and project roles are confirmed. Usually, planning in large enterprises takes place on a long term, e.g., on a yearly basis.	A basic set of projects is prioritised in boards on a long-term basis, but departments have possibilities to use resources and budget flexible for projects or requirements that occur during project progress.	Resources and budgets are distributed commonly based on importance of known requirements in advance for a specific period. The team is responsible for the satisfaction of the customer. Where appropriate, a team lead may be defined.	Product requirements are prioritised for each sprint, cross-functional between all available resources, budgets, requirements, systems, etc.

Table 15: Decision matrix for operational and organisational structure:
Prioritisation processes for budgets, people, etc. differ in the different approaches.

5.3.3.2 Organisational governance and compliance

In addition to organisational processes and structures, also governance requirements need to be fulfilled. This can be external, legal requirements, like the EU General Data Protection Regulation (GDPR) or specific regulations from financial authorities, like legal

retention periods (cf. also section 5.3.4.2), documentation requirements, requirements for quality audits, like ISO 9001 or 27001 certifications, etc. In this context, conventional project management methods give more guidance with artefacts that are clearly defined, e.g., in ISO norms for project management. For iterative project management, the challenge is to remain lean and agile by supplying all legally relevant documentation and by fulfilling all security relevant requirements at the same time.

In addition to these criteria, also all internal committees, like the works council, data protection officers, etc. need to confirm and approve projects. With a sequential approach, the approval of these committees was usually a necessity to be able to proceed to the next phase. With an iterative approach, these gateways are not necessary anymore, and every project needs to ensure compliance with all the committees and rules on its own responsibility.

The results from section 4.4.2 are summarised in the decision matrix in the following Table 16:

<table>
<tr><th></th><th>pure sequential</th><th>sequential light</th><th>iterative light</th><th>pure iterative</th></tr>
<tr><td rowspan="2">Organisational governance and compliance (section 4.4.2)</td><td colspan="2">Structured documentation of phase results, especially necessary when legal requirements must be met.
Official reviews of all artefacts at the end of each phase, in which requirements can be checked.
High documentation efforts.</td><td colspan="2">Documentation of results in user stories or Wikis. Ways to ensure legal requirements have to be defined.
Less structured processes lead to less efforts in formal documentations.
Compliance risks due to missing gateway reviews.</td></tr>
<tr><td>Structured documentation of all results at the end of each phase.
Document types are clearly defined, each requirement leads to a specific document.
Formal gateways approve results of each phase.</td><td>Structured documentation of all results at the end of each phase.
Documentation requirements can be tailored, documentation can be done by its needs, combination of documentation in online tools possible.
More informal gateways approve results of each phase and give more flexibility to the project team.</td><td>Documentation of all results in the corresponding epics or user stories.
Guidance of required documentation, approvals, etc. through informal gateways, coaches, mentors, etc. possible.</td><td>Documentation of all results in the corresponding epics or user stories, but no guidance of required documentation, approvals, etc. through self-responsibility of the team and missing gateways.</td></tr>
</table>

Table 16: Decision matrix for organisational governance and compliance:
Compliance with rules and regulations can be handled easier in a sequential approach as gateways are more formal than in the iterative approach.

5.3.3.3 Procurement and contracting

In large organisations, usually the purchasing department is steering tender phases for new IT systems. In sequential approaches, the concept phase is done as a first step, afterwards the implementation of the concept is part of a second tender phase, where several suppliers are asked for offers. The offers can be compared easily, as the requirements are specified to a certain degree in the concept. The project can then be contracted entirely to a software development partner. As already described, effort estimation is complex when an iterative approach is used, as requirements are not clear from the beginning. Therefore, the implementation cannot be contracted entirely, and competition is more difficult. Companies therefore have to look at constructs where competition is possible. As a possible tool for estimation and classification in sizes, efforts are often classified in T-Shirt sizes to make contracting possible in an iterative approach. Fort that, reference stories which are to be defined as known requirements for the first sprints, serve as reference stories to further contract next sprints. As can be seen, the approaches in sequential and iterative project management models vary strongly, therefore purchasing department needs to define new processes for the new approach. With the T-Shirt approach, as an example, companies are able to negotiate frame contracts with suppliers for fixed price T-Shirt sizes that can be ordered individually by the project team, instead of contracting the entire project in one order.

Table 17 summarises the data from the interviews (cf. section 4.4.3) consolidated in a decision matrix:

	pure sequential	sequential light	iterative light	pure iterative
Procurement / contracting (section 4.4.3)	Projects are negotiated entirely. Transparent competition, fix price for the entire project. Change requests need to be negotiated separately.		Packages are negotiated in form of frame contracts. Transparent competition based on reference stories. Change requests are handled as regular stories. No fix price for the entire project known from the beginning.	
	The requirements of the entire project are known and contracted with a delivery timeline. Change requests need to be negotiated separately.	The requirements of the entire project are known and contracted with a delivery timeline. Packages for change requests can be negotiated separately upfront and are ordered on a demand by the project team.	Requirements are estimated, and T-Shirt sized packages are ordered from a frame contract on an individual basis. Work packages can be negotiated with a fix price for clearly defined tasks or recurring requirements.	Requirements are estimated and T-Shirt sized packages are ordered from a frame contract on an individual basis.

Table 17: Decision matrix for procurement and contracting
purchasing processes vary significantly as the subject of contracting has different clarity at the time of contracting.

5.3.3.4 Culture of the organisation

As can be seen from the interviewee's answers, the culture and values of the company and its associates are not namely mentioned, but as the basis needs to fit with the new approach, also these values were named implicitly as the behaviour of the people needs to match with the values and culture of the organisation.

Agile values should be communicated and lived within the company to ensure efficient working processes. As an enabler, agile communities or social events may help people to identify with the new values. In the end, the new values should become part of the DNA of the company, to be fully aligned with all other functions within the organisation.

As stated by an interviewee, starting with a successful pilot project may help to convince others to follow the approach; learnings from the pilot can be applied to the general agile working model. It may also help to start with people who are experienced in working agile in iterative projects, or who are willing to work agile, as less resistance has to be expected. Afterwards, all people in the organisation should be involved step-by-step to prepare a smooth introduction into the new tools. In this context, also highlighting positive experiences supports the acceptance of a new model.

An essential aspect in culture change is that everybody needs to be involved in the change process and must become part of it. Further, as change always brings new ways of working and thinking, the agile working model must be supported by the entire organisation.

The results from section 4.4.4 can be found in Table 18:

	pure sequential	sequential light	iterative light	pure iterative
Culture of the organisation (section 4.4.4)	Corporate culture and values are mainly based on structured components. Values and culture characterised by clear given structures from organisation. Few possibilities to define own processes, procedures, working habits.		Corporate culture and values are mainly based on individual components. Values and culture characterised by equal responsibilities, trust, and only few guidelines from the organisation. Clear structures and responsibilities may be missed by associates.	
	Defined structures and responsibilities coin the values and culture of the organisation.	Defined structures and responsibilities coin the values and culture of the organisation, but flexibility in defining own structures in projects, etc.	Openness, self-responsibility and trust coin the values and culture of the organisation, but guidelines given regarding specific aspects.	Openness, self-responsibility and trust coin the values and culture of the organisation.

Table 18: Decision matrix for culture of the organisation
culture of an organisation differs in the approaches based on underlying organisational structures.

5.3.3.5 Team motivation, training, education and coaching

As described in section 5.3.2, different team competences and roles are required depending on the used project management method. From the organisational perspective, two aspects need to be considered. The first is that corporate culture needs to support and encourage change of employees. Every change of job requirements also means the willingness of associates to support this change by changing themselves. If this is given, the organisation should provide offers for trainings, for example in iterative working methods, role models, tools, etc. But not only employees should be trained in new organisational requirements, also managers have a role model function and should therefore also be trained in all new functions. In addition to personal training, coaching by experienced people or good practices from other departments, divisions or companies may help to support the change process. When a company continues using a sequential approach, training is helpful as well to strengthen associates is the tool use, methods, roles, etc. Also, in apparent well-known technologies, there are often unexploited potentials to be lifted.

The results from section 4.4.5 are summarised in the decision matrix in Table 19:

	pure sequential	sequential light	iterative light	pure iterative
Team motivation, training, education and coaching (section 4.4.5)	Training on sequential methods, best practices, tools and coaching on the job supports successful projects. Promote unexploited potentials. Training only supports willing people; motivation needs to come from each individual.		Training on iterative methods, best practices, tools and coaching on the job supports successful projects. Promote new ways of thinking and acting. Training only supports willing people; motivation needs to come from each individual.	
	Training and coaching on sequential methods, best practices, tools.	Training and coaching on sequential methods, best practices, tools. Enhancement of sequential approach by training on techniques, tools, practices, etc. from other disciplines.	Training and coaching on iterative methods, best practices, tools. Enhancement of iterative approach by training on techniques, tools, practices, etc. from other disciplines.	Training and coaching on iterative methods, best practices, tools.

Table 19: Decision matrix for team motivation, training, education and coaching: Almost no difference, except from the different methods.

5.3.4 External factors

The fourth group of factors is related to the external environment, which has an influence on all projects that need to be done using any project management method.

External factors are, in general, independent of the chosen approach, but nevertheless, their influence on the project management approach and possibilities to fulfil external requirements, needs to be investigated.

5.3.4.1 Technological environment

The first aspect in the category of external factors, is the technological environment. The ever-accelerating technological progress in the information technology and software development industry influences the need to react on changing requirements, to always be up to date in terms of state-of-the-art technology use, and to secure the applications.

The process of updating systems always requires technical releases. In the sequential approach they need to be planned manually as additional releases, whereas they can be included in existing sprints in iterative approaches.

The interview results from section 4.5.1 are reflected in Table 20:

	pure sequential	sequential light	iterative light	pure iterative
Technological environment (section 4.5.1)	Technological changes have to be considered in the long-term planning. Necessary security or technology specialists may be allocated in the beginning of a project, and security levels are defined upfront. Reaction on changing requirements on security, switching to new technologies, etc. is only possible on a long term.		Technological changes can be considered in the regular sprint planning. Reaction on changing requirements on security, switching to new technologies, etc. is constantly possible. Necessary security or technology specialists have to be allocated whenever changes are necessary.	
	Adaptions to changing security requirements are only possible after completion of a project phase.	Adaptions to changing security requirements are only possible after completion of a project phase, but shorter phases enable quicker reaction times.	Adaptions to changing security requirements are possible in each release, based on reprioritisation of requirements in the current sprint or release.	Adaptions to changing security requirements are possible in each sprint.

Table 20: Decision matrix for technological environment:
Planning of technological releases is different based on the chosen approach.

5.3.4.2 Legal requirements

From the legal perspective, all topics related to audits and laws need to be considered. The extent to which this is relevant, depends strongly on the field, in which the software is used. As an example, the EU General Data Protection Regulation can be named, as well as specific regulations from bank authorities.

The interview results from section 4.5.2 are reflected in Table 21:

	pure sequential	sequential light	iterative light	pure iterative
Legal requirements (section 4.5.2)	Necessity to comply with regulations from authorities and related to audits. Compliance can be ensured by planning the implementation of requirements on a constant basis with regular review cycles. Ad-hoc adjustments to quickly changing or new requirements are difficult.		Necessity to comply with regulations from authorities and related to audits. Compliance can be ensured by planning the implementation of requirements on a constant basis or ad-hoc to react on quickly changing or new requirements. Resources to ensure proper reviews need to be allocated on a dynamic basis.	
	Adaptions to changing regulations are only possible after completion of a project phase.	Adaptions to changing regulations are only possible after completion of a project phase, but shorter phases enable quicker reaction times.	Adaptions to changing regulations are possible in each release, based on reprioritising of requirements in the current sprint or release.	Adaptions to changing regulations are possible in each sprint.

Table 21: Decision matrix for legal requirements:
Legal requirements have to be fulfilled in both approaches, but flexibility is higher in iterative approaches.

5.3.4.3 Further external factors

As a result, from the interviews, the customer satisfaction, stakeholder satisfaction and strong customer involvement are necessary.

The interview results from section 4.5.3 are reflected in Table 22:

	pure sequential	sequential light	iterative light	pure iterative
Further external factors (section 4.5.3)	Customer satisfaction and stakeholder satisfaction need to be ensured. Integration of customers and stakeholders can be done at specific times in the project. Due to long cycles, stakeholders may change over time.		Customer satisfaction and stakeholder satisfaction need to be ensured. Thanks to short release cycles, customers and stakeholders can be involved easily on a constant basis and results can be seen. Integration of customers and stakeholders has to be done on a constant basis which leads to higher constant efforts.	
	Integration of, and communication to customers and stakeholders has to take place at defined synchro points in the project.	Integration of, and communication to customers and stakeholders has to take place at defined synchro points in the project. The frequency is based on the chosen release frequency.	Integration of, and communication to customers and stakeholders happens in defined agile meetings or based on release cycles of new system components to the users.	Integration of, and communication to customers and stakeholders happens in defined agile meetings.

Table 22: Decision matrix for further external factors:
Customer, client, and stakeholder satisfaction is target in both approaches; involvement of target groups differs in both approaches.

5.4 The PSIL framework

The decision support matrices in section 5.3 showed that there is a broad range of characteristics to specific success factors. Every approach has its own advantages and disadvantages, all based on the specific requirements of an enterprise. The four categories of success factors, which play a role in choosing the most suitable approach, were considered. For every factor of the categories, a decision matrix containing characteristics of a pure and light sequential approach, as well as of a pure and light iterative approach, was described.

As the decision support matrices show, the ‘sequential light’ and ‘iterative light’ approaches are often similar. Their difference is based on the approach it comes from, and usually aspects from the other approach enrich the model. To find the best suitable approach, decision-makers need to have a deeper look into the details of the topics, and then a decision can be made based on the overall assessment, to create the approach that fits best for the organisation.

As a result, success factors and their interdependencies could be identified, and served as basis to develop a new decision support framework, the '**PSIL framework'**. This framework describes factors for successful project management in the different approaches 'pure sequential', 'sequential light', 'pure iterative', and 'iterative light', and aims at supporting large enterprises to perform a successful agile transformation. The letters reflect to the different approaches that are used in the decision matrices:

- P – pure characteristics
- S – sequential project management approach (left two columns)
- I – iterative project management approach (right two columns)
- L – light characteristics

The PSIL framework contains all decision matrices and combines them. With the PSIL framework, decision-makers can individually analyse each success factor regarding its relevance for his or her specific needs based on the frame parameters within the enterprise that should be transformed.

The different factors, and with that also the data matrices, are correlated to a certain extent. These dependencies are related to the individual parameters of the enterprise and have to be evaluated individually by the decision-makers.

The PSIL framework is shown in Figure 16 and Figure 17.

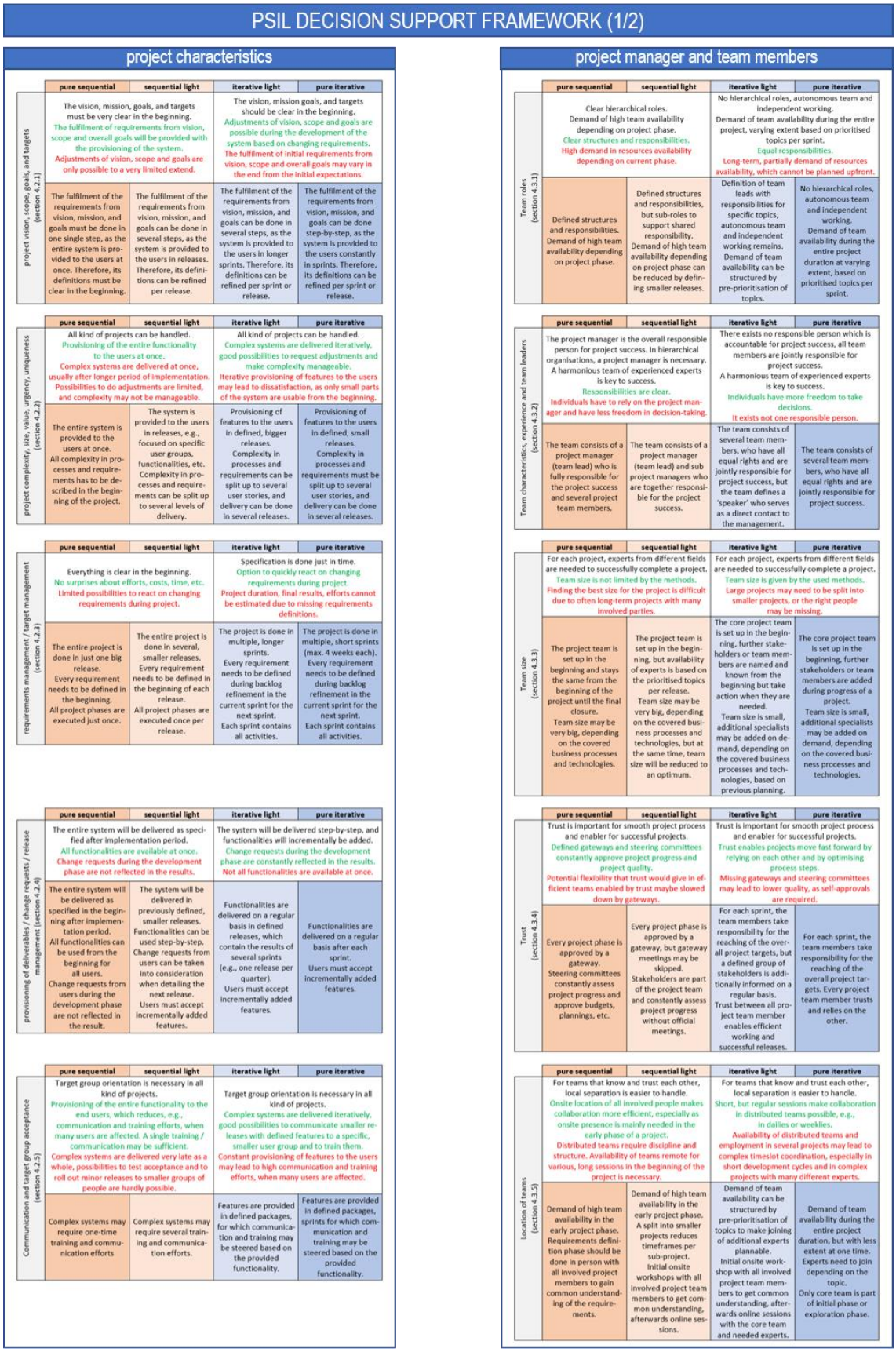

Figure 16: PSIL decision support framework as a tool for decision-makers to individually develop their specific agile working model based on given frame parameters and prerequisites (part 1/2: 'project characteristics' (section 5.3.1) and 'project manager and team members (section 5.3.2))

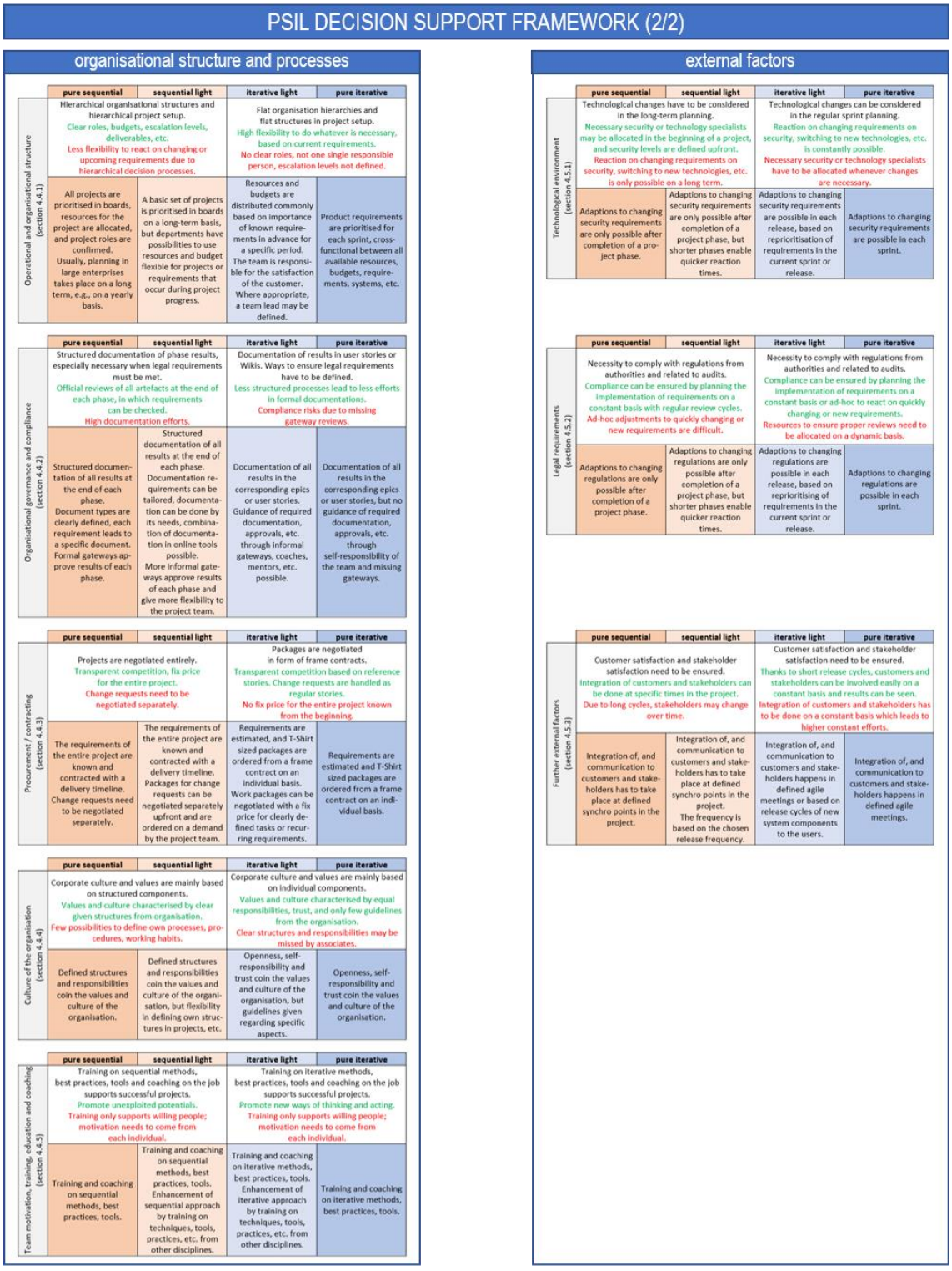

Figure 17: PSIL decision support framework as a tool for decision-makers to individually develop their specific agile working model based on given frame parameters and prerequisites (part 2/2: 'organisational structure and processes' (section 5.3.3) and 'external factors' (section 5.3.4))

5.5 Validation of the PSIL framework

As a first 'proof of concept', the PSIL decision support framework was applied and tested on the example of a large organisation. The defined example model of a hybrid approach, demonstrates, how the criteria could be applied, and which aspects could play a role to decide for a specific approach (section 5.5.1).
Further, the developed PSIL framework was discussed with interviewees, with were also interviewed for data collection (cf. section 3.6). With this approach, a first validation of the model regarding its applicability to operative business requirements and to practice (5.5.2).

5.5.1 Example model of a hybrid approach for a large enterprise

In this section, an example hybrid approach is defined for large enterprises. With this example, a possible setup for large organisations that transform from sequential approach into an iterative approach is shown.
This example describes an approach taken from practice. It describes the agile transformation and setup of a large enterprise from the automotive industry. The organisation has its headquarters in Germany, and IT projects are steered and executed in general from Germany. In the international context, local IT departments support with the local requirements definition, rollout and training within their region.
The example is based on the criteria from the decision matrices (cf. section 5.3). Basically, the iterative light approach was chosen throughout the example. For the organisational factors, elements from sequential light and iterative light were combined to be able to reflect organisational requirements. Enhancements and adaptions to the decision matrices were done based on the experiences of the author of this dissertation within the investigated large enterprise.

5.5.1.1 Project characteristics – iterative light

The enterprise decided to have one approach for all kind of projects. The decision was taken in regard to the many projects that are cross-divisional, cross-functional, concern overlapping processes, and usually involve multiple suppliers. The project complexity reaches from simple to very complex. As many involved people, internal and external stuff, work in several projects in parallel, the decision to have one agile working model was taken. As there exist many different requirements, also from legal perspective, the first premise was that the model has to be scalable. Further, the end-user and customer-

groups of a new system vary from a handful of specialists, up to all system users within the company.

Before a project starts, there exists the possibility to start with an exploration phase, in which the basic requirements, targets, involved processes, process partners etc. are analysed to get a good 'initial backlog' and also to gain estimates about efforts, cost, time, etc.

At the end of the project duration, the entire system will be delivered as specified, independent of the complexity of a project.

To be flexible regarding the different sizes of projects, provisioning circles of functionality can vary, and releases can be customised as needed for the specific case. In the example, simple systems have a sprint cycle of two weeks, and deliver releases to the end-users every two to six weeks. Complex systems have sprint cycles of four to six weeks and deliver releases every quarter or twice a year. Nevertheless, as sprints are planned regularly, the possibility to request adjustments to the system was always given.

Mostly, not all functionalities are available at once. But if a project decides that productive use of the system makes only sense when all functionalities are in place, then they can simply customize the release in a manner, that it contains all functionalities.

Also, communication and training take place depending on the target user groups, complexity, involvement of users in the development or test process, etc.

5.5.1.2 Project manager and team members – iterative light

Setting up the project team is always a critical factor within a project, as the team plays a big role for project success. The iterative light approach was chosen here as it describes a good combination of iterative working methods and well-known structured working aspects from sequential approaches. One of the biggest problems in projects within large organisations is the availability of all necessary project team members during the duration of a project. Therefore, the possibility to combine sprints to logical releases gives a project team the chance to proactively plan releases based on availabilities of capacities needed for specific functionalities. Experts are needed for smaller time periods and resources can be planned based on topics and availabilities of experts. With this, it can be ensured that the business processes are well represented by the relevant people, and the know-how transfer from business to IT is ensured.

With the introduction of a product owner tandem, meaning to have one product owner on business side and one on IT side, it was further ensured that demands and requirements

from both sides are well represented in the team. The responsibility for project success remains in the team, but the product owners have influence on prioritisation during backlog refinement and sprint planning.

To ensure that all involved people have a dedicated knowledge about business processes, the team, which worked on this specific project, was kept as constant as possible, and information about the project was shared constantly. The product owners, who are also responsible for capacity and budget planning, ensured that projects could run smoothly. With this measure, individuals had more freedom to take decisions within the project, and responsibilities were clear in the given frame parameters.

The introduced sprints demanded availability of all involved parties with limited resources over time, but for topics which required the know-how of everyone, it was still possible to have larger meetings or workshops, where all people were present.

In regular sprints, the project team defined short sessions to ensure collaboration and knowledge exchange. In some projects the exchange sessions were weekly meetings, in other projects, exchange was organised on a daily basis. The frequency was depending on the need of exchange, and on the frame parameters, if the teams were onsite or distributed over several locations.

5.5.1.3 Organisational structures and processes – combination of iterative light and sequential light

The integration of a new agile working model into the organisational structures of an organisation represented a significant challenge in the change process.

Hierarchical structures worked in opposite direction to the iterative approach. Therefore, clear roles, budgets, escalation levels, deliverables, etc. needed to be reflected in the new organisation structure. Without any change, the introduction of the agile working model within a hierarchic organisation would have failed. In the example, general hierarchies within the organisation were hardly adjusted, but on the operational level, projects became flat hierarchies, and flat structures with responsibilities given to the whole team. This led to higher flexibility in reacting to changing requirements and targets. Further assignments of tasks to individuals from different projects within a product became easier. This was possible through the combination of hierarchical planning and by providing more flexibility within products. A basic set of projects is prioritised in boards, but the product owners and the product team have additional resources and budgets which can be used flexible for unplanned projects or requirements that come up in the daily business.

Another aspect that is, beneath governance related topics, well defined in sequential models, is the entire purchasing topic. In the sequential world, the requirements of the entire project are known from the beginning (after concept phase), and can be negotiated and contracted with a specific delivery timeline. With that, transparent competition and a fix price for the entire project is ensured, just change requests need to be negotiated separately. For the new iterative model, where each and every user story has to be estimated separately on demand during backlog estimation, there was the need to have some flexibility in on demand ordering of these stories without having a tender phase for each topic. In the example, structures from sequential models were used and combined with iterative models. For each project or product, the business and IT department described reference stories in several sizes (T-shirt sizes). These stories were then estimated (effort in time, costs) by the competing suppliers and became comparable by that. In addition, licenses and work packages with a fix price for clearly defined tasks or recurring requirements or scope were defined. Purchasing then negotiated a frame contract on this basis, including fix prices per license, work packages, T-Shirts and a total volume of items which was expected/planned for the project. Then, the project team could easily order T-Shirt sized packages, licenses, or work packages from a frame contract on an individual basis.
The change from a sequential model to an iterative approach always also needs training and coaching for all involved people. In this example, basic trainings on tools, methods and requirements management, as well as on new working procedures and values, were centrally offered. Additionally, a community of practice was established, where questions can be asked, examples are published, and any kind of material is provided. Project teams can also book expert sessions, have a coach to support on using tools, or even accompany them in their first agile project, etc. With these broad possibilities for information and training, every involved associate could contribute to the change process, and could also benefit from existing knowledge. In addition to the training of the project team, also management trainings were offered, to also enable them to adjust steering mechanisms to the new agile working model.

5.5.1.4 External factors – iterative light

Information technology underlays a very fast change. New technologies, or requirements to the technologies that serve as a basis for systems, need to be adjusted constantly. For this, the iterative approach brought many advantages, as new requirements can be planned per release by re-prioritising backlog items. To ensure a certain software quality, and also

to ensure revisions to be feasible, technological adaptions, or adaptions due to security reasons, were always planned with buffer capacities in each release. With that, quick reactions to changing or new requirements could be ensured keeping the agile working approach.

For some projects, additional specific regulations had to be met, e.g., specific regulations from bank authorities. For these projects, specific requirements for structured documentation of data privacy topics, regulations, roles and rights management, etc. needed be met. The team was offered possibilities to organise documentation in agile tools, and experts shared their knowledge on legal topics case related. With this, requirements from compliance, corporate governance, and audit requirements could be met without losing agility.

To ensure customer and stakeholder satisfaction, there was a two-stage process established. Direct customers and stakeholders are integrated into the project team in the regular meetings like reviews. Indirect stakeholders were informed in monthly or quarterly product boards, where all current projects are discussed regarding their progress, budgets, rollout progress, etc. With that, an efficient communication and involvement of all stakeholders and customers could be ensured according to demand.

As can be seen from this example, the framework is very flexible and can be used as the basis for other models in large organisations. Changing parameters are also considered, and with that, individual agile working models for large organisations can be created.

5.5.2 Validation of the PSIL framework applicability to practice

In the previous section, a first application of the PSIL framework to an example enterprise was described. A further practical validation of the framework was performed by consulting the interviewees. The procedure and the results are described in this section.

5.5.2.1 Review workshop setup and discussion

To perform a first practical validation of the PSIL framework, a virtual workshop was prepared. The aim of this workshop was to present the results of this dissertation to the interviewees to receive their evaluations and opinions on the framework. As a basis, the data matrices and the resulting PSIL framework were presented and explained in detail to all interviewees in a 45-minute presentation. Most people from the initial interviews were present in this virtual session. The presentation was followed by a 90-minute discussion to explore if the derivations made by the researcher as a result of the outcome of the

interviews are well-reflected in the data matrices. Further, it was discussed if there was any content or context in the framework missing from their point of view. As a result, all interviewees stated that all aspects from the interviews are reflected in the framework and that from their point of view, no information given in the interviews is missing.

After the workshop, the researcher summarised all results, and finally presented them to all participants in another 30-minute session, to finally discuss all the results (final 30 minutes).

5.5.2.2 Results of the review workshop and discussion

In the workshop, every interviewee was asked about his/her opinion about the PSIL framework and if its existence would have helped him/her in defining an agile working model.

Figure 18 shows the main topics as they were discussed in the workshop and subsequent interviews. The feedback was summarised in the following section.

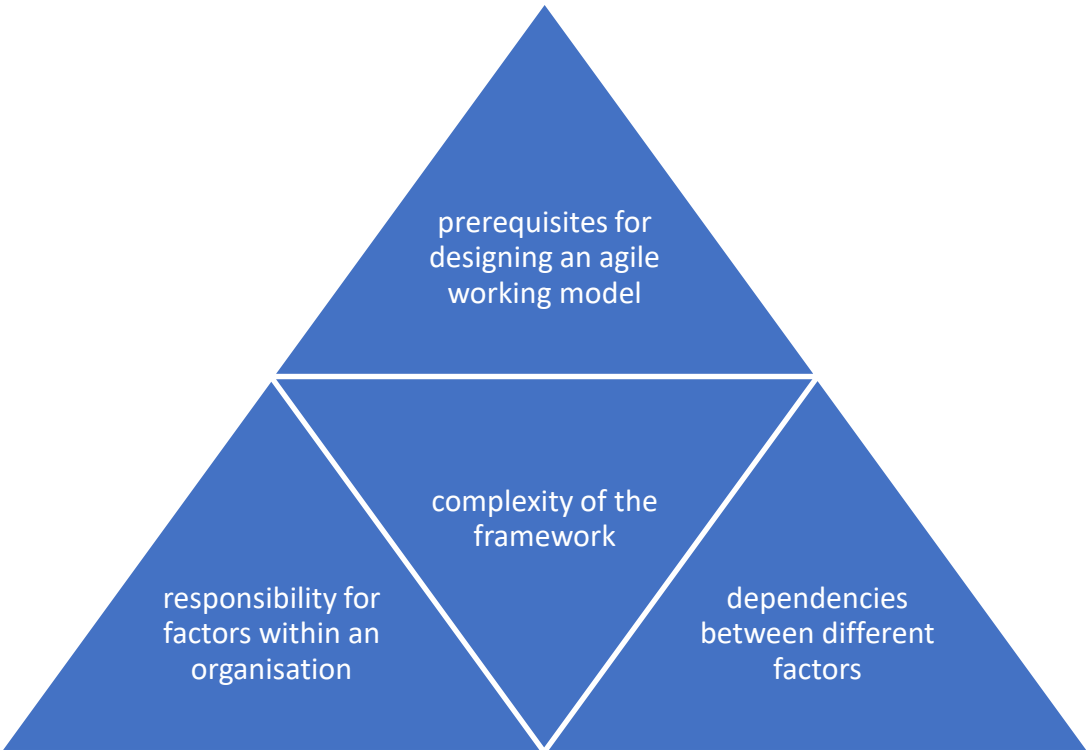

Figure 18: Topics discussed in the PSIL framework workshop.

Complexity of the framework

The framework was considered by all interviewees as a helpful tool to assess all relevant aspects regarding the definition of an agile working model. One interviewee stated that

he would not have thought about all of these dimensions when developing a new model, and finds the details in which every aspect is described very helpful to understand the meanings behind each aspect.

It was further seen by interviewees as a very complex system, which enables the readers to classify given aspects from their specific work environment into the specific approaches. The complexity of the framework was also named as a challenge, as the many different factors need to be assessed individually based on the given frame parameters within an organisation to derive an agile working model based on a specific approach.

Gradation of approaches

The gradation of each approach in a pure and light version were seen as helpful by many interviewees, as the projects mostly cannot be done using one approach straight, but the right mixture of methods can make an approach successful and lead to an acceptance of the methods used in this approach. One interviewee stated that the further detailing of the approaches makes them more practical and enables project teams to individually adopt approaches to the specific needs.

Responsibility for different categories of factors

Some interviewees further differentiated the model into two categories: the first category, consisting of the criteria for ‘project characteristics’, and criteria for ‘project manager and team members’, and the second category consisting of the criteria for ‘organisational structure and processes’, and ‘external factors’. They had the opinion that the factors of the second category have to be defined from a global perspective, e.g., for an entire company. A manager for example stated that these factors can hardly be influenced or individually adjusted depending on the project, and that a guideline and setup from a corporate perspective makes sense and would be necessary. A project manager even went further stating that these factors need to be framed by the management or any corporate governance department as they need to be valid for the entire enterprise and need to be followed by all employees and become part of the culture. Therefore, for the factors of this category, the company should give a range per factor, in which the projects could individually define their specific approach.

The factors from the first category, on the other hand, are project specific and the flexibility based on the given project setup should be possible. Here, all interviewed project managers stated that they would expect to get freedom in the individual use of methods

within a given frame in their specific projects. In detail, on the project characteristics side, several interviewees stated that they find it difficult to define a 'one size fits all' approach. Therefore, they would rather individually assess the factors from the framework, in which they could act, instead of being given just one factor. As an example, an interviewee said that a project that can only be provided as a whole system, like a completely new HR system for an enterprise, should be done using the sequential approach and for a project that provides value with each increment, the iterative approach could be more suitable. This example showed that in this category, flexibility based on the project is helpful to find the best suitable approach, e.g., regarding the project size, the project team, and its setup.

Dependency between different factors

In addition to the split into two categories, some interviewees addressed that they see it as a big challenge to clearly define an agile working model which follows just one specific approach, or even a specification of an approach. In this context, the possibility to individually choose aspects from different approaches was seen as a challenge, and some aspects seemed to be too related to each other to be handled in completely different approaches. A manager, in addition, addressed the idea to further analyse the framework regarding dependent and mutually exclusive factors. With this, decision makers could be further supported in defining an approach that is most suitable for an organisation.

Prerequisites for designing an agile working model

A manager from the organisation stated that, from his point of view, the decision maker who has the task to define a new agile working model, must be skilled in different fields of an organisation. From his point of view, there would be necessary an expert team consisting of experienced project managers, specialists in the field of organisation development, and process specialists to ensure that the new model supports all needs of all involved parties. He further stated that there would be needed some experience in the definition of agile working models to be able to make the right decisions for the best suitable approach for each aspect. He therefore would also work with a consultant to support with experience and with an objective view. Another interviewee added that, in addition to the example model in this dissertation, a set of good practice or best practice models, which apply the PSIL framework to specific cases in practice, would be helpful for decision makers in defining their specific agile working model.

In summary, all interviewees stated that the PSIL framework is a good tool to start with the model definition, as it forces decision makers to analyse aspects from many different points of view, which they wouldn't have considered without a guideline.

5.6 Summary development of decision support matrices, the PSIL framework, and its validation

In this chapter, the development of decision matrices was described and for each success factor, which was assessed as relevant for this dissertation, the data matrix was elaborated and filled with the relevant data.

As a result from the decision support matrices, the PSIL framework, which contains all matrices from this chapter, was derived. It contains all relevant data which may serve decision makers as a basis to define an agile working model which best supports the needs of their own organisation, considering all frame parameters and prerequisites from their individual needs.

The chapter concludes with the validation of the PSIL framework, which was done in two ways. As a first application, an example model of a hybrid approach for a large organisation was defined. Additionally, the results of this dissertation were presented to the interviewees, and their evaluations of the model was questioned and summarised as a first validation of the model in the investigated context.

6 Conclusion

6.1 Key results

In this chapter, the results of this dissertation are summarised, contributions are made and an outlook is given for future research.

6.2 Achievement of research aim

This dissertation was written in the context of agile transformation of large organisations and to find out how successful transformation can be supported. In detail, the aim of this dissertation was to provide a framework, which supports decision-makers in large organisations to find the best project management setup for their specific context and needs. To do so, the key success factors for project management were analysed regarding their relevance and influence on choosing the best fitting project management approach. Choosing the right management approach is essential for enterprises that want to perform a transformation process from a classical, sequential project management approach towards an iterative, agile approach.
In order to reach the aim of this dissertation, the following research steps were defined and followed:

Research Step 1:

> *Conduct a critical literature review on project management approaches, agile transformation and success factors for projects as the basic main factors in order to derive a model for an agile project management approach for primary research.*

The literature review was performed and several aspects for successful transformation were found that served as a basis for primary research. Especially the many critical success factors of projects, which could basically be assigned to the four main sectors project characteristics, project manager and team members, organisational structure and processes, and external factors, were used to derive a scenario and to build the interview on them. As a result, the factors could be narrowed to a condensed view on the most relevant success factors based on the interviews.

Research Step 2:

> *Find the best suitable research design to gain as much data as necessary to find criteria for a successful agile project management approach.*

Based on the success criteria for (agile) project management, a specific scenario was developed to be able to cover all aspects that may be relevant for successful agile transformation of large organisations. This scenario was then used as a basis for semi-structured in-depth expert interviews. With that approach, it was ensured that the main aspects of project management disciplines and factors that may make the difference if a project is successful or fails, were covered. Further, interviews became comparable, and with that, the basis to reach the aim of deriving a decision framework was laid.

Research Step 3:

> *Analyse the acquired research data concerning its contribution to derive a model for decision-makers to choose the right approach.*

The data acquired from the interviews reached saturation, which could be seen as no more new information was attained during the last interviews. With the data, the researcher was able to define decision matrices for all relevant success factors in the four focus areas. These data matrices were defined as a basis for decision-makers to be able to walk through all aspects step-by-step and to decide for each success factor, if it be covered following the pure sequential, sequential light, iterative light, or pure iterative approach.

Research Step 4:

> *Derive a framework from acquired data to support large enterprises in their process of the definition of an agile project management approach.*

Based on the decision matrices in the four focus areas, the PSIL decision support framework could be derived. Decision-makers are now able to follow the decision matrices and derive a model which perfectly fits into their specific environment and organisational structure. The PSIL framework gives a full set of factors that need to be considered when defining a company-specific agile working model.

In summary, all the steps were followed, and the research aim was achieved. With that, the achievement of the overall target of this dissertation was supported.

6.3 Answering the research questions

Based on the research gaps, the research questions were formulated, and their answering is summarised as follows.

Research question 1:

> *What are the key success factors for the execution of IT projects in large organisations focusing on factors related to the project, to the project manager and the team members, to the organisation, and to the external environment, and how did they contribute to successfully completion of projects?*

This research question aimed at finding factors that are important for IT projects to work, independent on the chosen project management approach, knowing that all interviewees already have their experience in sequential project management (mostly waterfall approach) and in iterative project management (agile approaches like Scrum). The interview and the scenario were also structured in a way that all aspects were covered.

This question was fully answered. The interviews led to the result, which factors contribute to successful completion of projects or failure, and which factor do play a minor or no role for project success (cf. section 4.8). With the decision matrices for each of these factors, which were determined as critical success factors, a broad range from a pure sequential approach to a pure iterative approach was derived and answered the question (cf. chapter 5).

Research question 2:

> *What were the biggest challenges that had to be taken in the context of agile transformation in large organisations in terms of roles and responsibilities and how did the set-up work or fail?*

This research question aimed at finding out which challenges had to be managed by the involved project team members in the process of the transition from conventional organisation setup to the agile project setup. It focused especially on roles and responsibilities of the project team members, on the role of decision-making authorities, on self-responsibility of each individual person, and on their flexibility in reacting to changing requirements in the agile context.

This question was fully answered. The roles and responsibilities were reflected in all focus areas, and their impact is reflected in the decision matrices. The project specific roles are reflected, e.g., in the project manager and project team area, and in the culture of an organisation, team motivation and education, which are part of the organisational processes. As a result, it can be stated, that the biggest challenge of agile transformation is to consider people, their roles, responsibilities and also people’s needs in all areas of an organisation.

Research question 3:

> *What are the special challenges in large hierarchical enterprises that need to be changed to enable efficient project management following the iterative / agile approach and how could they be resolved?*

The third research question aimed at functions within hierarchically organised enterprises that need to be considered to enable agile working models within the company, e.g., purchasing process, HR processes, trainings, etc. These functions are essential for large enterprises to run, but adaptions are necessary compared to the existing, sequential approaches.

This question was fully answered. From the results of the interviews, it became clear, that basic processes of an organisation need to be adapted to changing requirements. The purchasing processes, as an example, are reflected as an individual success factor, and with that, all aspects of the procurement and contracting area are reflected in a separate decision matrix in the organisational area. From the area of HR management, training on new methods or other educational methods are to be considered. Education and training also obtained an individual decision matrix to reflect its importance.

In summary can be stated, that all research questions were fully answered and that all answers contributed to achieve the research goal.

6.4 Contribution to knowledge

With the results of this dissertation, three research gaps could be filled, and with that, a contribution to knowledge in these fields was reached.

The first research gap was the missing evaluation of critical success factors for IT project management in large enterprises, and to find out, how they are related to the project, to the project manager and team members, to the organisation, and to the external environment, as well as how their fulfilment will contribute to a successful completion of projects. This gap was filled by the development of decision matrices for decision-makers, which support them finding the right approach for their specific case.

The second research gap that was the missing knowledge about transformation of roles from hierarchical organisations to agile organisations. To fill the gap, constant training of people from all hierarchical levels, as well as the integration of experts and exchange with experienced people can help to address this change. In this case, the corporate culture plays an additional role. All factors related to the transformation of roles, were also all

reflected in specific decision matrices, to support decision-makers to find the best suitable approach, depending on their individual organisational structures and environmental factors. This gap was addressed and filled with the results of this dissertation.

The third gap, which was covered by this dissertation, was the missing concept of an integration and transformation of business functions from hierarchical organisations into agile organisations. To close this gap, the roles and functions, that are necessary to successfully perform an agile transformation, were determined, and their characteristics were reflected in decision matrices in the organisational area.

In addition to the filling of the three research gaps, the development of the decision matrices as such, is a further contribution to knowledge. In the literature, there exist no such decision framework or decision matrices. There was also no gap from the literature, stating that a decision support framework for decision-makers is necessary and that there a need to develop it. With the solution of the researcher to define decision matrices for all success factors for projects, the additional gap of a missing framework was discovered during research and was filled at the same time with the results of the interviews.
The process of creating a decision support framework was based on three steps: First, the necessity of decision matrices for decision-making was analysed. Second, the criteria for a matrix were derived, and the topics for which decision matrices are necessary were determined. Third, based on these requirements, the data matrices were filled, and mainly contribute to the result of this dissertation.
The decision matrices focus on giving decision-makers a very easy to use tool at hand, to determine the degree to which a sequential or iterative approach fits best for the large organisation that should pass through agile transformation. Each matrix contains of four categories, from pure sequential, via sequential light and iterative light, to the pure iterative approach. For each type, the characteristics of the specific success factors were described in detail, including examples, which help decision-makers to understand the different specifications. Further, for each success factor, the advantages and disadvantages of each approach were described, and an overall description of the topic in the according approach was given.

Table 23 shows again the structure of the decision matrices which served as the basis of the framework generation (cf. Table 4):

	pure sequential	sequential light	iterative light	pure iterative
success factor (reference to section)	Overall statement for success factor in sequential approach. Advantage sequential approach for topic. Disadvantage sequential approach for topic.		Overall statement for success factor in iterative approach. Advantage iterative approach for topic. Disadvantage iterative approach for topic.	
	Specification of topic in pure sequential approach.	Specification of topic in sequential light approach.	Specification of topic in iterative light approach.	Specification of topic in pure iterative approach.

Table 23: Structure of a decision matrix, reflecting the 'sequential approach' on the left, and the 'iterative approach' on the right, and enabling a further differentiation into 'pure' and 'light' of each approach.

With the generic structure of the decision matrix, and the straight forward filling of the fields, the decision matrices are a flexible instrument to also enable decision-makers to add data matrices for their specific needs. As an example, industry-specific criteria can be added as a topic, and the decision criteria for each approach can be defined.
With this flexibility, new categories or success factors that may come up in the future, can be evaluated and the model can serve as a standard decision support tool.

In addition to the filling of research gaps and the development of decision matrices for choosing the best suitable approach, the use of a new kind of research methodology is another contribution to knowledge.
With this dissertation, the commonly used research approach to use expert interviews to get insights into thoughts, opinions and knowledge from experienced people in their field, was combined with a case scenario. The scenario served as a basis for the semi-structured, in-depth expert interviews to generate a realistic fictional case, on which the interviewees could show how they would work on it in the real world. With this procedure, a specific, realistic requirement was described, which, at the same time, provided the interviewees with many detailed information, but let them much space to define the procedure how to solve the problem. With the results of this dissertation, the usage of scenarios as a method to enrich expert interviews can be seen as a valid approach for further studies.

6.5 Contribution to practice

In addition to the contribution to knowledge, this dissertation also provides a contribution to practice. The PSIL decision support framework for decision-makers in large

organisations is provided to support them in defining the agile approach of their organisation. To do so, the success factors of projects were analysed regarding their applicability to requirements in large organisations by questioning them indirectly or directly to the interviewees, or by deriving their relevance based on the results from the interviews.

With the description of the main use cases of the iterative project management approach, the sequential approach, and their finer gradation into iterative light and sequential light, enterprises can easily compare their frame parameters, requirements and potential change factors with the model, to decide for the best suitable approach. With the model, decision-makers are also led through the main success factors of a project, and based on these factors, an individual agile working model can be derived.

In all four categories for project success, this dissertation contributes to practice:

In the first category, project characteristics, the common understanding and support of the project vision and goals, requirements management, and proper provisioning and communication to the team and stakeholders are important. The dissertation supports the reader with examples from practice and with that, project setup can be optimised by project managers.

The second category, project manager and team members, also provided insights into the importance of the team for project success. The detailed information about the project size, project team setup, team characteristics, and the importance of a harmonious team and how this can be reached, contribute practical value to the reader.

The third category, organisational structure and processes mainly provided solutions on how to enable an organisation to successfully support iterative processes from an organisational perspective, e.g., by enablement of the purchasing department or by providing a corporate culture that supports change.

The fourth category, external factors, reveals factors that cannot be influenced by the individual project managers, like laws and regulations, but for which organisations can supply support to facilitate their implementation by the project teams.

As can be seen, the contribution to practice creates value to two different target groups: the first and second category mainly support project managers in their daily business, but also responsible persons for organisational topics may profit from understanding the criteria that are necessary for teams and projects to be successful. The third and fourth category mainly supplies decision-makers from the process and organisation development divisions, as these categories supply the reader with characteristics and insights into the

success factors from the internal and external working environment, which enable successful projects.

When all decision matrices are answered by the decision-makers, an individual working model, that fits best to their individual needs, can easily be derived from the chosen approach per decision matrix tables.
This dissertation also showed an example derivation of an agile working model of a large organisation, which is based on the provided framework. With this proof of concept, the application of the PSIL decision support framework was successfully applied to practice.

Enterprises that will use the PSIL decision framework to derive their own, individualised, agile working model, may benefit from the results of this dissertation. With the focus on the main factors for project success, as they are reflected in the data matrices, the use of the framework could lead to a more efficient way to generate an agile working model, and efficiency of the daily business processes can be raised. Especially, large enterprises may benefit from considerations reflected in the model, as the model is based on experiences from the large organisation, in which context this dissertation was written.

6.6 Limitations of study and future research

This research followed a qualitative approach, with all interviews conducted within a large enterprise and a first-tier supplier in Germany. All involved interviewees are working in Germany, with the German culture being dominant in this research.
All aspects described in the PSIL framework can be taken as the basis for other multinational enterprises to define their individual agile transformation approach, and to develop their individual agile working model. Cultural aspects, different leadership models, corporate values, etc. may lead to different importance of individual success factors or data matrices. Therefore, adjustments may be needed, and different frame parameters need to be considered.
The PSIL decision support framework developed in this dissertation may then also serve as a basis for further research, and to answer the remaining three research gaps. Based on the model of this thesis, the definition of a general, detailed step-by-step model for agile transformation of large organisations can be derived and tested (Research Gap D), the dependencies of critical success factors and their characteristics in the different project

management approaches based on varying project specific parameters can be explored (Research Gap E), and the analysis of the fulfilment of ISO 21500 norm with hybrid approaches can be analysed and proved (Research Gap F) in future work.

Future research in this field could also test the model following the quantitative approach, e.g., by questioning an entire organisation or by having multiple organisations fill a questionnaire. With this data, the transferability of the developed model of this dissertation can be approved for use in other large organisations.

As a result from the first validation of the PSIL framework, further studies may analyse the framework regarding dependent and mutually exclusive factors based on a broad quantitative study in different large organisations, to further enrich the model by these dependencies between the success factors and the chosen approach.

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Appendix 1: Scenario description

The requirements to the new system are described in the project brief in the following Table 24:

PROJECT BRIEF – NEW REQUIREMENT FOR IT SYSTEM		
Contact person	Christian Schneider	IT
Requester	Parking permits business unit headquarter	Business
Project title	Digitalisation of the parking permits request workflow	
Content description (in form of a user story)	We request the creation of a new workflow system, with which every associate can request a parking permit. Parking permits can be requested for employees and managers. In the request, there must be differentiated between private cars of employees, where license plate information has to be entered manually per request; and company cars where license plate information comes from the “car pool management system”. The costs of a parking spot have to be withheld with monthly salary. Therefore, every associate pays a fix price per month, independent of the number of parking permits he has (background: he can only park in one spot at the same time). For all associates (employees and managers), the costs have to be settled with salary (interface to HR system). The costs may vary per parking object and user group. All parking permits can be booked on several media: Vehicle specific access card (for company cars), personal ID-card (for private card) and as QR-Code in iOS App. To reflect the mobile setup of QR-codes, an iOS App on company iPhones needs to be created. QR-codes then can be scanned to prove permissions at the gate. For the system, two bi-directional interfaces need to be set-up: All parking permits have to be sent to the global access system and limitations of parking permits from global access system have to be transmitted back. Secondly, an interface to the HR management system and payroll needs to be set up for cost withhold. Within the new system, a roles and rights management has to be set up. At least the following roles need to be considered: Employees without a company car, company car users, vehicle administration / parking administration, plant security & HR controlling.	
Description of Benefit What is the measurable benefit for the company?	Parking permits can be charged based on real permissions to enable fair trading of all associates. The request comes from board and works council.	

PROJECT BRIEF – NEW REQUIREMENT FOR IT SYSTEM						
Effective range	☐	Local	☒	Regional	☐	Global
Classification	☐	Legal requirement				
	☒	Board decision				
	☐	Audit requirement				
	☐	Risk reduction		Risk assessment		
	☐	Return greater than ____ %				
	☒	Process optimization				
	☐	Others				
	Board and works council decision.					
Requested start date	01/01/2020					
Requested date for Go-Live	31/12/2020					
	The implementation needs to be finished latest end of 2020 due to board and works council decision.					
Start criteria (Definition of Ready)	Project brief exists. Further details for implementation must be specified as part of the project.					
Acceptance criteria (Definition of Done)	System is set up with all interfaces and system is available at all locations in Germany.					
Additional information (on estimability)	Interface contracts need to be prepared for estimation of cost and resources at the beginning of the project.					
Financing of the project Please specify how this IT requirement is funded (e.g., 80% via IT prioritisation and 20% by requester, or 100% by requester, or …).			Department	Cost center	Share in %	
	☒	IT budget	---	---	100 %	
	☐	Requester	---	---	0 %	
	☐	Third-party financing	---	---	0 %	

Table 24: Example of project brief which served as scenario for case study research