JÖNKÖPING UNIVERSITY
School of Engineering

Support of SME´s in their Digital Transformation Journey

A study of the effectiveness of the SSM and EAM frameworks supporting family-owned manufacturing SME's taking on the digital transformation challenges.

PAPER WITHIN: Informatics
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JÖNKÖPING June 2020

This exam work has been carried out at the School of Engineering in Jönköping in the subject area Digital transformation and Enterprise Architecture Management of the Master of Science programme.
The authors take full responsibility for opinions, conclusions and findings presented.

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Scope: 30 credits

Date: 2020-06-29

Abstract

Digital Transformation (DT) opens up to new opportunities for companies by providing organizational flexibility and improving their business models. Due to lack of resources in form of financial power and qualified employees, family-owned manufacturing companies have a hard time reaching DT. However, these companies try their best to reach DT and along the road various challenges arise. The challenges that arise, result in a complex situation that is hard to understand. Organizations with complex situations have difficulties to perform successful IT initiatives that are required to reach DT.

The aim of this study was to identify challenges that family-owned manufacturing SMEs (FOMSMEs) encounter when striving for DT. Another aim of this research was to investigate how useful Soft Systems Methodology (SSM) is in helping family-owned manufacturing SMEs to understand their own complex situation. Also, the managerial practice called Enterprise Architecture Management (EAM) has been investigated regarding its usefulness in helping family-owned manufacturing SMEs to reach DT faster and easier. As a fourth and final aim in this study, an artefact has been created with suggested actions that address the identified challenges that FOMSMEs encounter when striving for DT.

By interviewing employees who have participated in IT initiatives at a family-owned manufacturing SME, this research has been able to answer the research questions. Several challenges were identified; communication errors, old systems and exceeding deadlines in projects. All of these challenges can, with the help of SSM, be associated with the identified root challenge: Lack of overview of IT-landscape and strategy. The informants' thoughts of usefulness of SSM in family-owned manufacturing SMEs were positive. In contrast, the informants' thoughts of usefulness of EAM in family-owned manufacturing SMEs were negative. The argument expressed by the informants was that as long as the owner family makes most of the decisions, a new managerial practice as EAM will not be useful in family-owned manufacturing SMEs.

Keywords:

Digital Transformation, Soft Systems Methodology, Enterprise Architecture Management, Family-owned manufacturing SMEs.

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Glossary

Small and medium-sized enterprises: Organizations with fewer than 250 employees and managerial decisions influenced by owners.

Digital Transformation: Flexible and effective organization with good alignment between their different layers such as business process, application, information & data and infrastructure

Manufacturing company: Company that put together a product in sequence from one station to another one. It uses components/parts/raw materials to make a completed product.

Owner-family prevailing norms and culture: Norms and culture that exists in a specific owner family.

Root challenges: The underlying challenge that leads to other challenges.

1 Introduction

The advanced information technology of today means new opportunities that open for new businesses, but it also brings challenges. Manufacturing companies find it difficult to accept these advantages and to use them to accomplish a more flexible and effective organization (Kaidalova et al., 2018). Most of the manufacturing companies have now reached the digitalization phase and have just begun to learn how to benefit from the digitized content to improve their processes and customer touchpoints.

Big companies that have financial resources usually develop their own digital platforms to manage and overcome their organizational inertia and to make the most of the opportunities that come with digitalization (Chen, Pan & Ouyang, 2014; Cui & Pan, 2015). However, most small and medium-sized enterprises (henceforth called SMEs) must depend on commercial platforms that come from third parties (Banerjee & Ma, 2012). The next phase for these manufacturing SMEs is Digital Transformation (henceforth called DT) (Alessandroni, 2019).

This study will investigate the existing challenges for family-owned manufacturing SMEs (henceforth called FOMSMEs) on their journey toward reaching DT. The criterion for an organization to be considered as a SME is that it needs to have less than 250 employees (OECD, 2005). Furthermore, an organization can be defined as family-owned if it fulfills the following criteria:

I. *"The majority of decision-making rights are in the possession of the natural person(s) who established the firm, or in the possession of the natural person(s) who has/have acquired the share capital of the firm, or in the possession of their spouses, parents, child, or children's direct heirs.*
II. *The majority of decision-making rights are indirect or direct.*
III. *At least one representative of the family or kin is formally involved in the governance of the firm.*
IV. *Listed companies meet the definition of family enterprise if the person(s) who established or acquired the firm (share capital) or their families or descendants possess 25% of the decision-making rights mandated by their share capital."*

Andersson et al., 2018. p 541

Once the challenges are identified, this study aims to use Soft Systems Methodology (henceforth called SSM) to find out if it is useful for FOMSMEs. SSM is known for its ability to explain and help stakeholders to understand the complex situation in their organization (Wang et al., 2015). After analyzing the usefulness of SSM, this study aims to continue with investigating the usefulness of Enterprise Architecture Management (henceforth called EAM) in FOMSMEs. EAM is known as a management practice for helping enterprises to reach DT (Ahlemann et al., 2012a). Furthermore, as an extension from identifying challenges and evaluating SSM and EAM, this study also aims to produce an action plan to support FOMSMEs to reach DT faster and easier.

A summary of the scientific contribution of this study:

- Identify challenges that FOMSMEs meet on their way toward DT.
- Evaluate the usefulness of SSM in FOMSMEs.
- Evaluate the usefulness of EAM in FOMSMEs.
- Provide an action plan for FOMSMEs to help them reach DT easier and more effective.

1.1. Background

In the beginning of the digital era, the idea of digitalization was to reduce physical data in form of papers and to reduce organizational costs (Lozic, 2019). With internet, digitalization of organizations became more essential. In this chapter, topics such as DT, SMEs, SSM and EAM will be presented.

1.1.1. Digital Transformation

Some might ask the question, why is DT so important and necessary for SMEs? Many studies have shown that the process of DT may improve organizational performance because of the changes that take place in key business processes, which result in better products and services. Furthermore, the process of DT also increases the use of information, which contributes to better business performance. For example, customization of services and products. Moreover, the DT journeys that SMEs make, lead to improved efficiency in form of costs and time, quality in form of less errors, better user experience for customers, better organizational flexibility and accessibility (Tarutė et al., 2018).

Earlier studies that have been conducted on DT and EAM with focus on manufacturing industries are about IoT products and their integration into EA layers (Kaidalova et al., 2018). Other studies on DT in manufacturing industries are about "Smart factory" focusing on laser cutting and 3D printing (Bertola & Teunissen, 2018) and about digital connectivity of industrial machines in manufacturing (Trapote et al., 2018). This study is unique because it focuses on researching the challenges that FOMSMEs encounter when trying to reach DT.

DT is driven by technologies and it is quickly adapted by organizations once they decide to go with it and reach it. Unfortunately, there are some barriers and challenges that slow down that adaption. Examples considered as barriers are diverse company structures, cultural challenges, lack of strategies, difficulty to prove ROI for stakeholders, qualified employees and poor funding, especially in SMEs (Ebert & Duarte, 2018). All of these challenges and obstacles may eventually lead to a complex situation where companies no longer know how to handle them.

An example on the effect of DT, the former CEO of Volkswagen's Latin America division David Powels says that under a period of three-years, his division gained a 30-percentage increased efficiency in some of the organizations' factories by focusing on digital processes and competences (Ebert & Duarte, 2018).

1.1.2. Digital Transformation in Small and Medium-sized Enterprises

DT has inspired companies to change and transform their business models. This transformation is more difficult to achieve for SMEs than larger organizations. This is due to limited resources for testing and implementing new business models and strategies. DT is not just about new business models, it is also about integrating new technologies and optimizing internal processes. SMEs are the driving force in most economies. They represent innovation, growth and employment in the society (Bouwman et al., 2019).

Larger companies usually create their own customized platforms to support their business processes. With rich resources and flexibility, these companies can use internal resources to implement and generate critical competence and capacity to overcome organizational challenges and prepare for future business processes (Cui & Pan, 2015). In contrast, due to lack of both internal and external resources, SMEs must rely on third-party commercial platforms (Banerjee & Ma, 2012). For SMEs to continue to be competitive, they need to invest in information communication technologies. Due to higher globalization and increased demand from consumers, SMEs need to invest in initiatives that help them reach DT (Tarutė et al., 2018).

SMEs have some characteristics that differentiate them from larger companies. For example, they have more limitations in form of resources. The management is influenced by the characteristics of the managers, who are influenced by prevailing norms that exist in their companies. Because of these characteristics, the implementation of DT in the SMEs is limited and severe (Tarutė et al., 2018).

1.1.3. Using Soft Systems Methodology to identify and understand challenges towards Digital Transformation

To understand the complex situations in FOMSMEs, SSM is chosen as a methodology that will be evaluated in this study. There are other methodologies and approaches for solving complex situations in organizations such as SAST methodology and the Organizational Cybernetics approach (Zlatanovic, 2016). For example, SAST is a good methodology to solve unstructured and undefined situations in organizations where the focus is on cultural and political aspects. However, the SAST methodology ignores other important aspects of an organization such as its structure and functioning (Zlatanovic, 2016). The Organizational Cybernetics approach, on the other hand, focuses on the structure and the communication aspects of an organization but it cannot handle the soft aspects in a complex situation (Zlatanovic, 2016).

The hypothesis of this research is that the best methodology to evaluate is SSM. The SSM focuses on both the soft aspects of a complex situation as well as on the operational and structural aspects of an organization (Antunes et al., 2016; Wang et al., 2015). SSM offers a structured approach to address complex situations by identifying and focusing on the main issues (Antunes et al., 2016). SSM was first presented by Checkland in 1972. It has its background in engineering and biology. The methodology is recognized for creating a good understanding for soft factors in

complex situations such as conflicts, human interests and emotions (Wang et al., 2015).

SSM is a framework for explaining complex situations where the nature of it is difficult to find and define (Nurani et al., 2018). In this case, the road towards DT where aspects such as characteristics of the managers, prevailing norms and lack of IT-knowledge are factors in a complex situation, which need to be identified, connected and explained (Li et al., 2018; Tarutė et al., 2018). The implementation of SSM is conducted by following 7 steps as shown in figure 1 below:

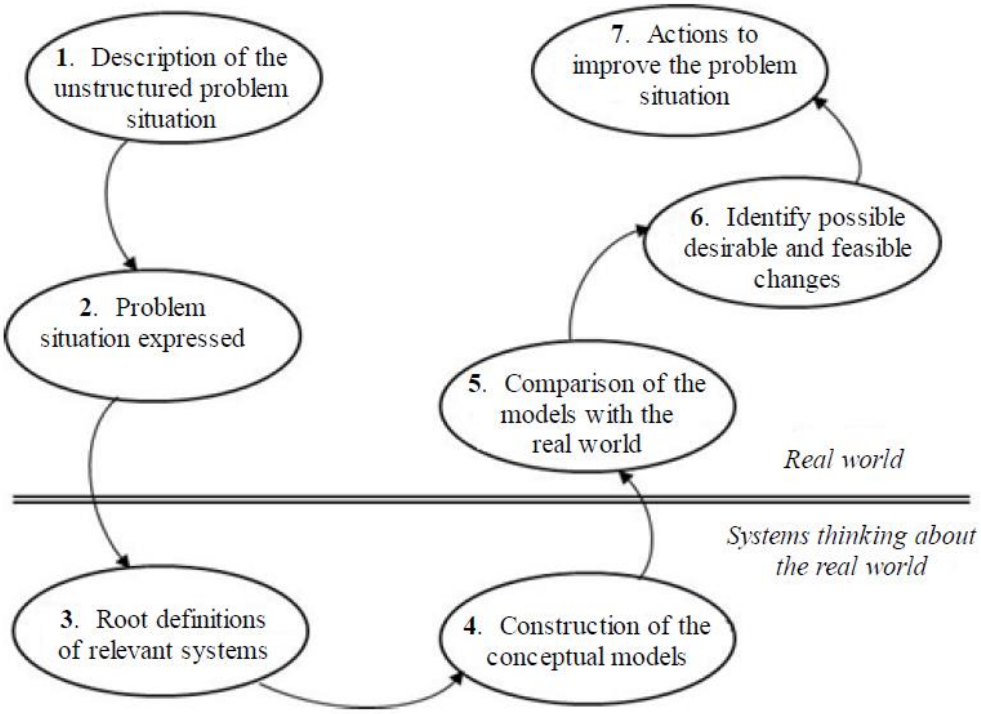


Figure 1. The 7 steps of SSM.

Source: Antues et al., 2016. p. 261

According to Cambridge university, SSM is based on following dictums:

1. *"Problems do not exist independent of human beings, they are constructs of the concerned mind, defined by individual world view; therefore, look not at the problem but at the situation.*
2. *Interrelationship of problems = 'mess' (multiple problem situation).*
3. *Worldview - different (and equally valid) interpretations of the world by each individual.*
4. *(Corollary of 1) Solutions are also intellectual constructs and no 'problem' exists in isolation.*
5. *Improvements in situations are most likely through sharing of perceptions, persuasion and debate. Analysts should be interactive/therapeutic rather than expert.*

6. *Analysts cannot be divorced from the problem."*

Source: University of Cambridge, Retrieved 2020-03-04
From: https://www.ifm.eng.cam.ac.uk/research/dstools/soft-systems-methodology/

Once the complex situation is understood by the stakeholders, the next step in this research process is to evaluate a good management aid that can help FOMSMEs reach DT.

1.1.4. Need of Enterprise Architecture Management in SMEs

According to Besson and Rowe (2012), reaching DT requires a good management rather than investing in just technological investment. Enterprise architecture and its different frameworks such as TOGAF or Zackman can help managements in organizations to improve their decision making, improve organizational alignment and provide directions for improvement (Niemi & Pekkola, 2019). However, this study believes that there is a need for a more comprehensive aid to be evaluated regarding its usefulness in helping FOMSMEs to reach DT. The hypothesis of this research is that the best aid to evaluate is EAM, since this is assessed to be a more comprehensive aid. Ahlemann & El Arbi (2012) identify seven different areas for a successful implementation of EAM in organizations, where Enterprise architecture is only one of seven. Ahlemann et al. (2012a) define EAM as follow:

"EAM is a management practice that establishes, maintains and uses a coherent set of guidelines, architecture principles and governance regimes that provide direction for and practical help with the design and the development of an enterprise's architecture in order to achieve its vision and strategy."

Ahlemann et al., 2012a. p. 20

Ahlemann et al. (2012a) argue that companies today face challenges in creating a flexible and effective organization while the complexity in the business world increases. Optimal use of the IT in the organizations contributes to new and better products and service-based information (Peppard & Ward, 2004). To enable optimal use of IT resources as well as information resources, there is a need for an IT management. Since long, it is recognized that "top management" has a large impact on organizational changes and their efforts to reach the DT is no exception (Jarvenpaa & Ives, 1991).

DT means optimal use of IT in the organizations that aim to create new and better products/services based on information (Peppard & Ward, 2004). When identifying the intersect, taking advantage of digitized content to improve processes and customer touchpoints (DT), there is a need of good EAM. This provides the companies with the prerequisites to implement a good alignment between layers such as business process, application, information & data and infrastructure when conducting complex transformation/projects in companies.

Enterprise Architecture Management was introduced in the early 1980s. It has evolved over the past decades and it still does. EAM has its roots in Zackman´s framework that

covers an overall design of organizations' information systems. Since then, the EAM has evolved as organizations experienced that just modeling is not enough (Ahlemann et al., 2012a).

Enterprise Architecture Management (EAM) can help organizations plan, coordinate and conduct complex transformation that is needed for reaching DT. EAM covers several layers such as business process, application, information and infrastructure. EAM gives organizations the prerequisites to implement a good alignment between these layers, for example through a common language that enables good decision making towards DT (Hauder, Roth, Schulz & Matthes, 2013; Ahlemann et al., 2012a).

Sonnenberger & Wißotzki (2013) argue that the implementation and use of EAM in industry enterprises are specifically difficult because of the complexity of production and relations between departments and IT systems. Although EAM contributes to establish structure, the extraction of full value is determined by the SME's ability of adapting and implementing its practice effectively (Timm et al., 2015).

1.2. Aim and research questions

It is important to note that FOMSMEs are the type of organization that this research is investigating and not just any SMEs. This means that the outcomes of this study, such as the action plan for FOMSMEs toward DT, cannot be applied to all types of SMEs. For example, a SME can be active and operate in any line of business such as reinsurance, consumer banking or retail. Depending on the line of business, different types of SMEs encounter different challenges. For example, for SMEs in chemical industry, regulatory compliance has been identified as a major challenge (Lampadarios, 2016). For SMEs in yacht tourism sector, resource saving systems such as water and energy saving systems have been identified as challenges (Battistella et al., 2018).

This study is conducted in collaboration with a family-owned manufacturing SME. This study is unique because no other studies have yet identified the challenges FOMSMEs face when reaching for DT. Neither have there been studies about usefulness of SSM and EAM in FOMSMEs and their journey towards DT. The company's objective is to become more flexible and effective in their organization and achieve a good alignment between their different layers such as business process, application, information & data and infrastructure.

The aim is to identify the challenges that FOMSMEs encounter when reaching for DT. Often, these challenges aggregate into a complex situation. As a result, this study has used SSM with the aim to analyze its usefulness and as a means to understand the complex situation. As a solution to the complex situation, EAM is used with the aim to analyze its usefulness in creating good alignment and structure between the company's different layers such as business process, application, information & data. The goal is, beside answering the research questions listed below, to create an action plan containing steps that can help FOMSMEs in their effort to reach DT in a documented and structured way.

The research questions that will be answered have been formulated as follow:

RQ1: What are the challenges FOMSMEs faces when attempting to reach DT?

RQ2: How useful is SSM in helping FOMSMEs to understand their DT situation?

RQ3: How useful is Enterprise Architecture Management in supporting FOMSMEs to reach DT?

RQ4: How can a family-owned manufacturing SME address the challenges of DT?

1.3. Delimitations

This research is conducted in a family-owned manufacturing SME and the results may not apply for all SMEs outside manufacturing. It may also not be applicable on manufacturing SMEs that are not family owned because of prevailing norms and culture that characterize family-owned companies.

The messy situation analyzed in this study is a result of efforts by the family-owned manufacturing SME trying to create better user experience for their customers, organizational flexibility and organizational effectivity by conducting projects leveraging technology to gain advantages over their competitors. SSM is a methodology that provides an understanding and feasible solutions for complex situations. SSM is used in effort to evaluate its usefulness in supporting stakeholders in FOMSMEs to understand complex situations that arise in connection with exertion to reach DT. To collect data for answering research question 2, only one model of each model type is created for evaluation of SSM. Furthermore, only the first 4 steps out of 7 in SSM that are presented in figure 1 have been conducted in this study. The remaining steps are irrelevant in regard to the purpose and formulation of research question 2 in this study.

Evaluation data from participants in this study, on usefulness of EAM in FOMSMEs will be based on explaining and showing models on EAM practice covering 7 areas that are important in a EAM initiative taken by organizations. Models used for evaluation of EAM will not be created by researchers in this study due to lack of resources. They will instead be selected from a book with the purpose of explaining best practice of EAM. The name of this book is "*Strategic Enterprise Architecture Management: Challenges, Best Practices, and Future Developments*" published under 2012 and is written by F. Ahlemann, E. Stettiner, M. Messerschmidt & C. Legner.

A final delimitation is the research strategy. Only the first 3 out of 5 activities in a complete design science process will be implemented. The activities left out are the testing and evaluating part of the artefact in design science process. This is due to lack of resources in form of time and staffing.

1.4. Outline

The structure of the report is as follows: the next chapter will address a theoretical background where detailed explanations are given about the subjects DT, EAM and SSM. The following chapter provides the research approach and implementation. For example, the research strategy and data collecting techniques used for the research. Chapter 4 includes the research's findings and the answers to the research questions. The concluding chapter of this report involves a discussion and conclusions based on the findings.

2. Theoretical background

In this chapter, a thorough presentation of the subjects DT, SSM and EAM is given.

2.1. The road towards Digital Transformation

Until today, the historical progress of DT has been divided in four phases as shown in figure 2. First, we have the digitization phase. According to Bloomberg (2018), this phase is mainly about transforming analog data or information so that it can be processed, transmitted and stored into zeroes and ones. By converting them into bytes and bits, the information can be processed by computing systems (Garge, 2018). Added values during this phase can be identified as:

- Reduction of paper processes
- Transformation from processing analog data to digital ones

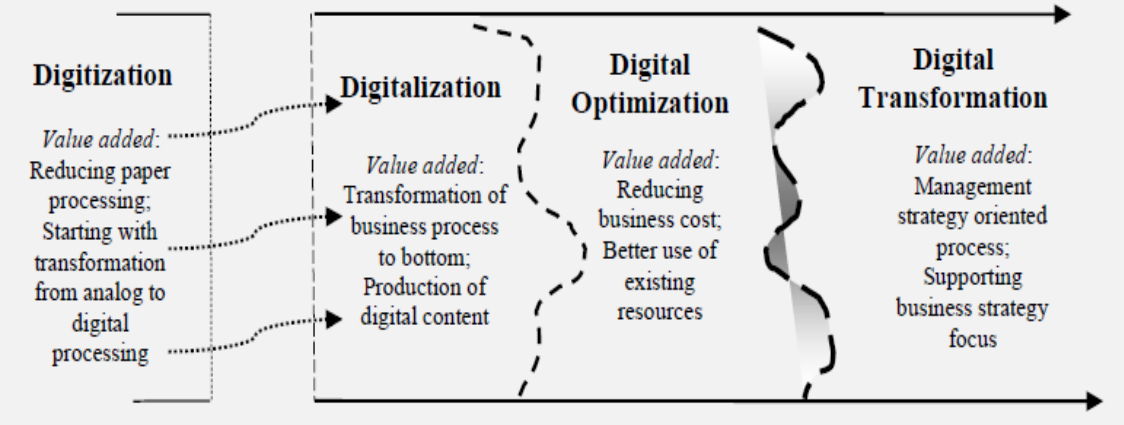


Figure 2. History of DT.

Source: Lozic, 2019. p. 161

The next phase towards DT is digitalization. Digitalization and Digitization are often associated and often used in literature without any distinction (Forbes, 2020). With digitalization, the idea is to transform business models so that new revenues and values add into the organizational portfolio, with the help and use of digital technologies (Schreckling & steiger, 2017). Digitalization changes the roles of employees and optimize process efficiency. An example of role change, which is seen as a central transformation during digitalization is when an employee puts down the hammer and instead learns how to use a digital controller to control an equipment (Bloomberg, 2018). Values added during this phase are identified as:

- New revenues and digital content
- Optimization of business processes

Digital optimization is the next phase towards DT. The focus during this phase is to lower the costs of processes and to increase the production efficiency. The ambitions of organizations during this phase is to produce competitive advantages under a short

period of time that give a greater chance of success than competitors (Lozic, 2019). Another focus that organizations usually have during this phase is to improve the use of internal resources in their effort for reaching the DT. Values added during this phase can be identified as:

- Reducing costs
- Better management of internal resources

DT is the main goal for many organizations. Reaching this phase means that organizations take advantage of technology in all aspects of its business. This results in technology change, cultural change, operational change and value delivery (Lozic, 2019). DT is often seen as a process of creating new business models by supporting and applying digital technologies. It is also known for helping organizations become customer-driven and improve organizational agility in a complex business environment by focusing on business strategy. Values added during this phase can be identified as:

- Align strategy process
- Strategic business approach

Next in the report, a thorough presentation of the SSM is given.

2.2. Soft Systems Methodology

SSM was introduced in 1972 by Checkland (Wang et al., 2015). The methodology has its roots in biology and engineering and gained more attention when traditional system analysis failed to include and consider soft problems (Wang et al., 2015). Hard systems are characterized by the possibility to define its purpose, goals and mission (SEBoK, n.d.A). In comparison, soft systems are complex have no pre-determined concrete goals (SEBoK, n.d.B).

SSM provides an approach that systematically analyzes and helps to understand complex situations. This study uses 4 type of models within SSM that fulfill different purposes to help answering research question 2 by explaining the complex situation.

Rich picture is created after step 1 (figure 3) when data about the complex situation is collected from participants. The rich picture created is based on the data that was collected for answering research question 1. The identified challenges will provide an overview of the complex situation that is prevailing in the participating. This is considered necessary for the first step of SSM. Models that will be used for evaluating the usefulness of SSM to help understand complex situations are as following:

1. Rich picture (Step 2, shown in figure 3)
2. Root definition (Step 3, shown in figure 3)
3. CATWOE (Step 3, shown in figure 3)
4. Activity models (Step 4, shown in figure 3)

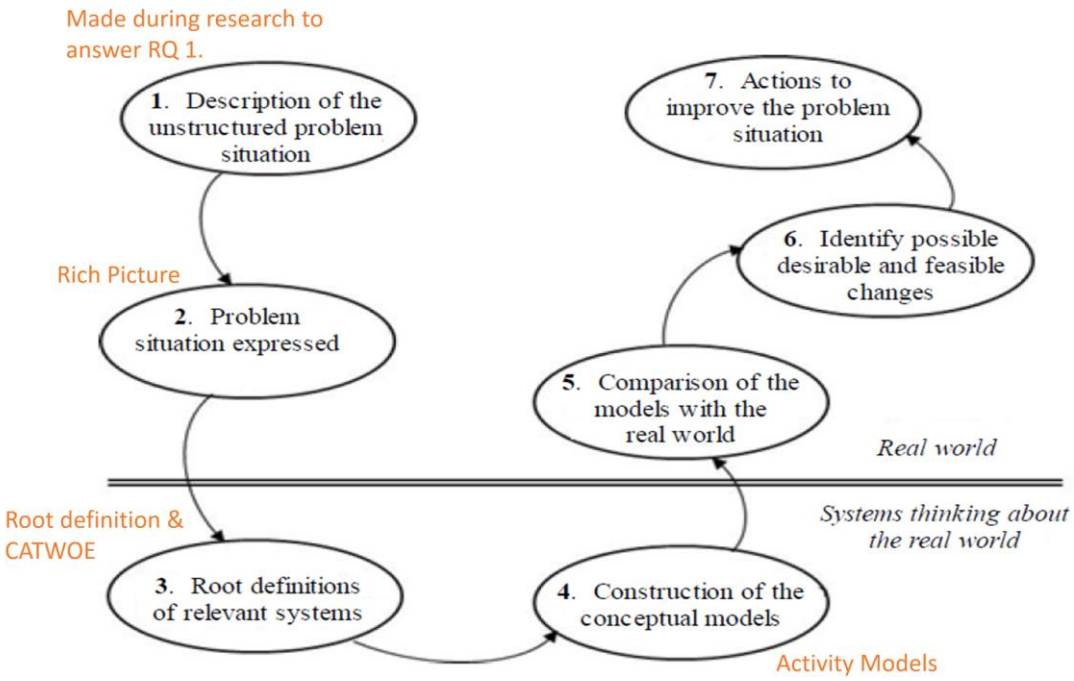


Figure 3. Steps in SSM that are covered in this research.
Source: Modified by this study; Original model by Antues et al., 2016. p. 261

The rich picture is usually a sketch that simplifies the complex situation from an As-Is perspective (figure 4). It contains all the stakeholders in the complex situation and their relationships to demonstrate a broader perspective on how the problems are related. The goal with this model is to reflect and express the real world situation as a coherent whole. This model does not have any specific notation that needs to be followed and it can be changed as the situation changes in the organization (Antunes et al., 2016; Checkland & Poulter, 2010).

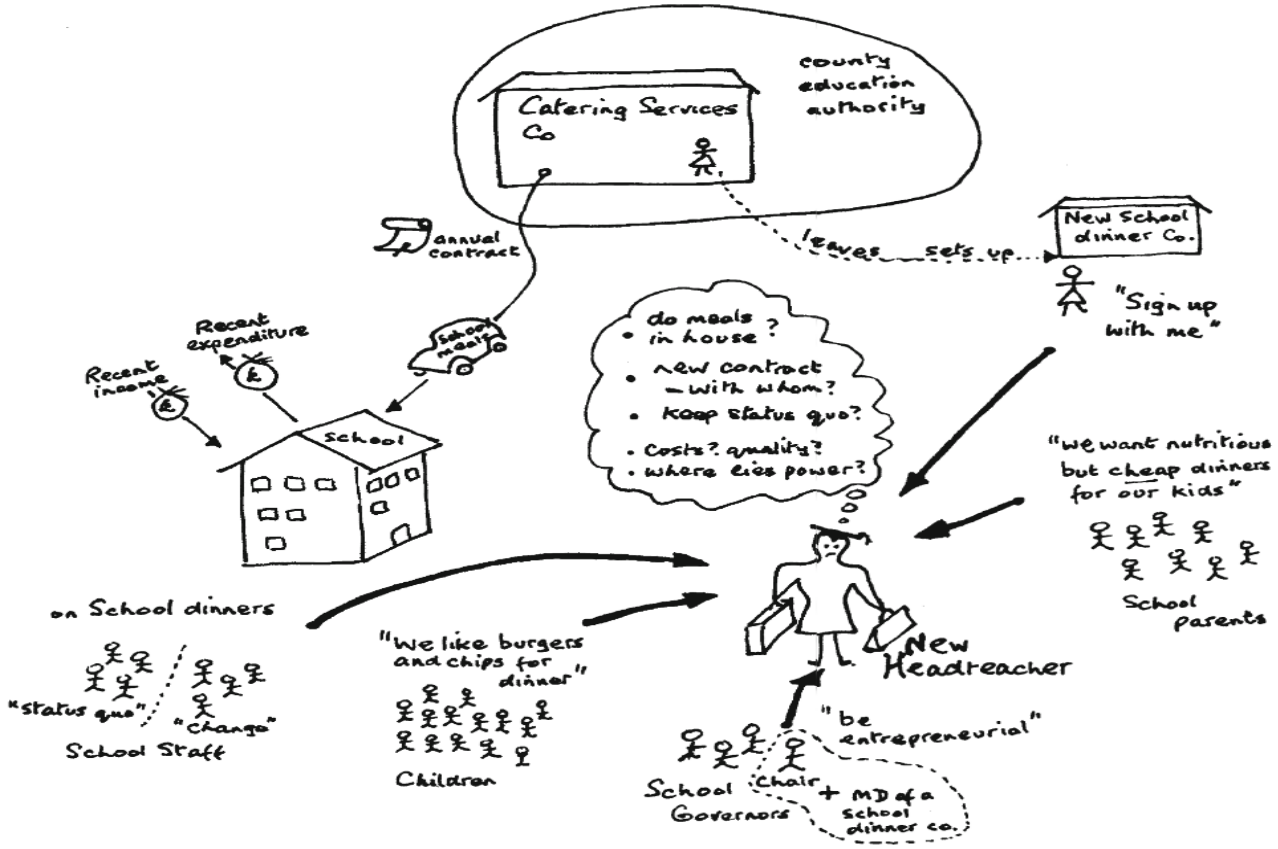


Figure 4. Example on a Rich Picture.

Source: Checkland & Poulter, 2010. p. 210

The work to be done during step 3 in SSM is to define the root definition (RD) of the system or systems that are in focus to be modelled in step 4 of SSM. A root definition is a description which briefly defines a system of interest in a To-Be state (Reynolds, n.d.). RD is closely connected to CATWOE modeling, which can also be done during step 3. Users of SSM can either use RD as a guide to do the CATWOE model or use CATWOE as a guide to create the RDs (Antunes et al., 2016; Checkland & Poulter, 2010). An example of root definition is as following:

"A householder-owned and staffed system to paint the garden fence, by hand-painting, in keeping with the overall decoration scheme of the property in order to enhance the appearance of the property"

Checkland & Poulter, 2010. p. 219

When creating RDs, the PQR formula can be helpful (Checkland & Poulter, 2010). For example, in a description of a system of interest, aspects such as these should be included: do P, by Q, in order to achieve R. The formula gives answers to the questions: What? How? Why? when creating RDs as a statement. Another appliance to use in order to secure that all fundamental elements are represented in the RDs is to use the CATWOE model (Checkland & Poulter, 2010).

CATWOE stands for Customer, Actor, Transformation, Worldview, Owner and Environment. It identifies different elements and their worldview on the system of interest and provides guidelines for both RDs and for the conceptual models. Practitioners of SSM often start with identifying the T and the W when using CATWOE. T in CATWOE is supposed to tell what elements will be changed by the system of interest and the W in CATWOE is supposed to tell what reasons or ideas there are that justify the transformation. The remaining letters help to identify elements as following (Checkland & Poulter, 2010):

A – The people who make the transformation happen.
C – The people affected by the transformation. Victims or beneficiaries.
E – External factors that are given when doing the transformation. Deadlines or budget.
O – Those who can stop the transformation process.

Below shows an example of a CATWOE model (figure 5) representing a furniture company.

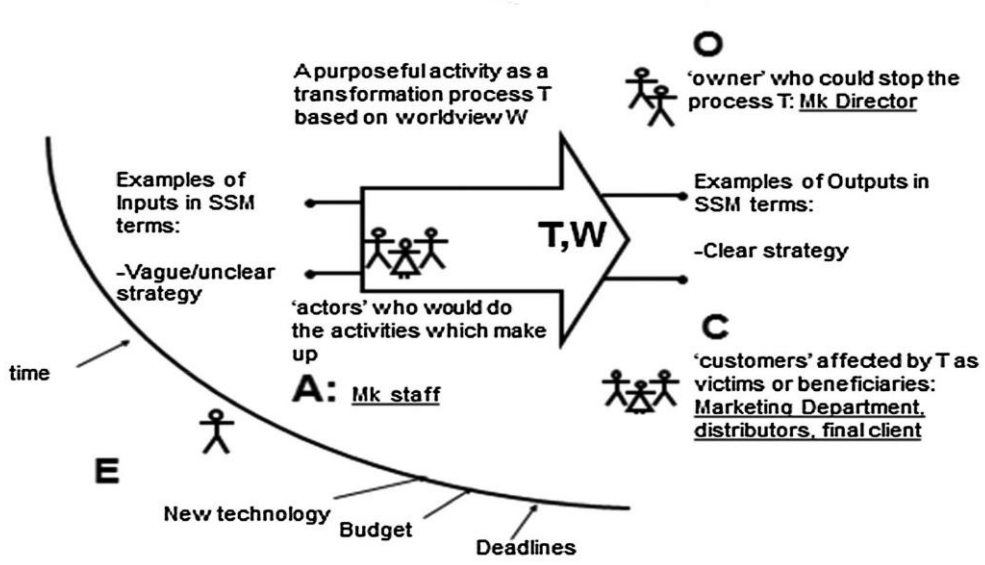


Figure 5. CATWOE model of a furniture company.

Source: Caceres, Hart, Vergés, & Lozano, 2015. p. 321

The last step used out of SSMs 7 steps is step 4, creation of Conceptual models. In this step, the decision to create activity models suitable for representing actions are based on different worldviews. Activity models are a set of activities and links that describe the transformation in the system of interest. Guidelines provided by CATWOE and RD are the foundation that the activity model can be based on. Activities aim to accomplish the purpose of given worldview and system of interest, but these activities are also controlled against given measures of performance, so that if necessary control actions can be made (Checkland & Poulter, 2010). Below (figure 6) is an example of an activity model.

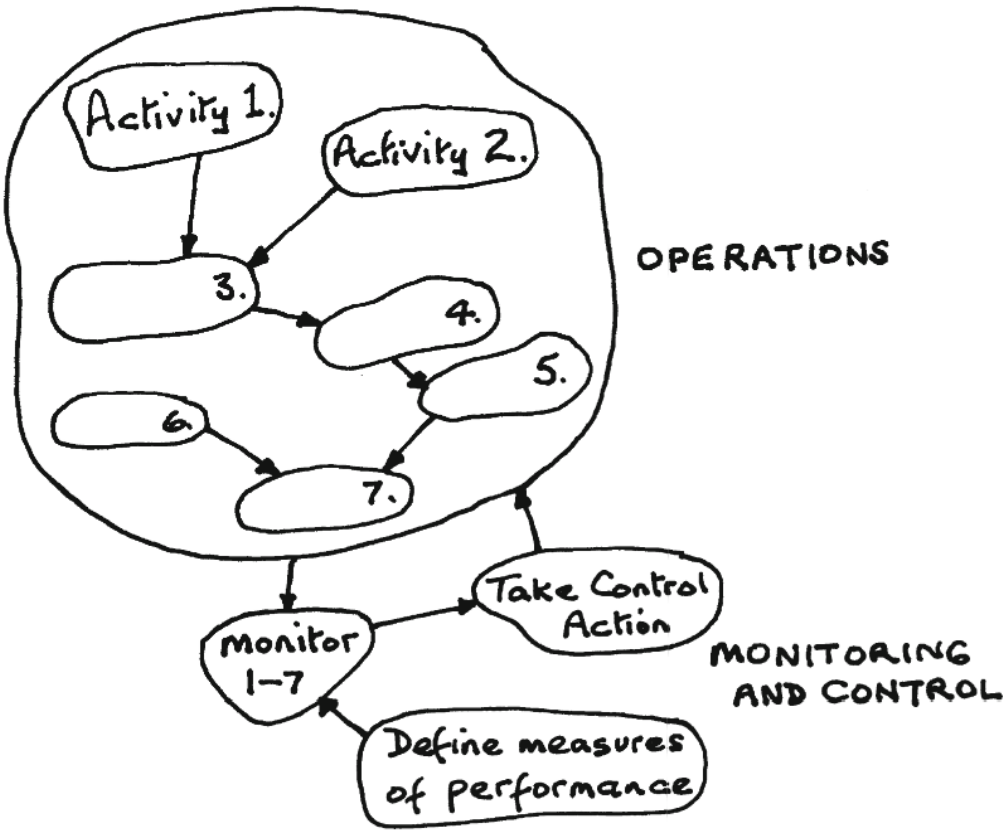


Figure 6. General design of an activity model.

Source: Checkland & Poulter, 2010. p. 204

One smart way to establish that the activity models created are of high quality and functional is to control if the activities reflect phrases that are in the RD. Another way of controlling is to ask yourself if there are any associations between activities listed in the model with something in the CATWOE or RD (Checkland & Poulter, 2010).

Usually after understanding a problem, the next natural step is to take actions to solve the understood problem. Once the usefulness of SSM in exploring and understanding complex situations in FOMSMEs is evaluated, the next proceeding step is to evaluate a practice to solve the complex situation. In this study, the usefulness of EAM as a practice for solving complex situation is evaluated.

2.3. Enterprise Architecture Management

EAM is a management approach that uses techniques from several practices such as business process management, change management and computer science. Ahlemann and El Arbi (2012) argue that seven different areas are important for successful implementation of EAM in organizations. These seven are as following:

1- Support and awareness from top management.

2- EAM governance.
3- Including EAM into strategic planning.
4- Including EAM into project life cycle.
5- Including EAM into operations and supervision.
6- Enterprise architecture framework and tools.
7- Adjustment, EAM introduction and people.

Support and awareness from top management in the organization are important. From an EAM perspective, the support from senior sponsorship is a vital factor for the success of an EAM initiative. Often, the senior executive that acts as a sponsor is the CIO in the company. This also needs to include executives such as the CEO, CFO and COO (Stettiner & Messerschmidt, 2012).

"We promote the idea that EAM should be seen as an endeavor that senior management sponsor and direct. Executives should provide the objectives, resources and leadership that guide the layout and the benefits of architecture management in their organisation."

Stettiner & Messerschmidt, 2012. p. 57

Stettiner and Messerschmidt (2012) present a list of suggested actions the senior executives should follow for a good EAM initiative. The top five recommended actions are:

- Create EAM sponsors out of senior executives
- Appoint a chief architect who is supported of the majority
- Clarify the goal of business and IT strategy
- Have deadlines and plan for a step by step implementation of EAM initiative
- Describe your role and grade of involvement in the EAM initiative

The second listed area important for successful implementation of EAM focuses on governance. Two types of EAM initiatives should be avoided in the implementation of EAM. The first initiative to avoid is implementing EAM without engagement. Then there is a risk that the initiative will not lead to any improvement in managing efforts when reaching for DT. The second initiative to avoid one is an initiative that is too narrow and over established with documentation in minute detail. Then there is a risk to aggravate an already complex situation and over-engineer the solution. This in turn causes time and cost overruns for the organization (Hobbs, 2012).

With the right governance and structure in organizations, an EAM initiative can be successful because right decisions are taken at the right place and at the right time with ensured delivery of EAM value. Another advantage is to have the right employee with the right competence who does the right thing. Governance and structure establish a framework that is used as a guide when designing solutions and taking decisions (Hobbs, 2012).

"When you apply EA governance, you have to find the right balance. You cannot have too little control, but you also cannot be dictatorial. Too much control would impose onerous and unnecessary constraints on the organisation. The challenge is therefore

to pragmatically structure the organisational components dedicated to EAM, balancing between the extremes."

Hobbs, 2012. p. 83

Including EAM in strategic planning improves the company's competence and capability in change management. Benefits from this area lead to better alignment between business processes and their strategic goals, better change cycles in areas such as business & IT and more organizational flexibility and agility. Two roles that EAM contribute with in the strategic planning are (Radeke & Legner, 2012):

- Acting as a support in coordination, formulation and planning of strategic initiatives.

- Improving the overall architectural quality to support future business requirements.

EAM cannot and should not be driven as neither a separate or as a parallel initiative for reaching DT in organizations. Trying to use EAM in parallel with another management practice can be problematic. EAM practice needs to be integrated in the strategy process in order to conduct common activities that lead to the higher strategical organizational goal (Radeke & Legner, 2012).

"During strategy formulation, EAM techniques assist managers with explicating and refining strategic directions in the form of target architectures. Finally, the documented as-is and target architectures help managers to identify migration plans and resolve interdependencies, which are often overseen without EAM. EAM practices thus ensure that, given the firm's capabilities and limitations, the chosen strategies are feasible."

Radeke & Legner, 2012. p. 113

Once an organization decides to conduct an EAM initiative, the holistic approach should also include guidelines of how to control, monitor and structure projects in the organization. Projects conducted within an EAM initiative, can be divided into four different steps (Lux & Ahlemann, 2012):

1- Establish project
2- Design of the project
3- Implementation of the project
4- Piloting and launching of the project

Step 1 takes place after the project has been described and approved. It focuses on allocating resources required by the project for a successful implementation. This phase also deals with scoping and delimiting of the project, making risk analysis and cost estimations on the project. After the project's approval in the strategic planning cycle, meaning that technical and business requirements are approved by senior executives, the second step is to design the project so that it is aligning with overall

architecture. Detailed models containing architectural components, choice of technology, touchpoints and changes in process and organizational structure are designed here. In step 3, all activities designed in step 2 are implemented. The 4th and final step is about piloting and launching the project. It can be challenging, especially for larger organizations to complete all the steps in this process. Pilot testing on one of few units can show managers if the concept works or not. Once the project is proven as functional and working, it is passed on to the next area of EAM, which are operating and supervising (Lux & Ahlemann, 2012).

Including EAM into operating and supervising is important because changes occur daily in operations. It is important not to mix strategic changes with operational changes. For example, strategic changes have the time horizon of long- and mid-term while operational changes have short-term horizon. Thousands of changes can occur in operational changes while in strategic changes there are tens to hundreds change projects per year (Legner & Löhe, 2012).

Three fields have been identified for successful inclusion of EAM into monitoring of operational changes. The first field is about implementing efficient procedures to manage operational changes. For example, implementing processes based on IT Infrastructure Library (ITIL, see figure 7). The second field is about implementing monitoring functions such as KPI for evaluation of current EA status to confirm whether operations are following the overall architectural strategy. The third field is about using the benefits of EA documentation to understand complex relationships between operations, especially beneficial for purposes of compliance in operations and risks management (Legner & Löhe, 2012).

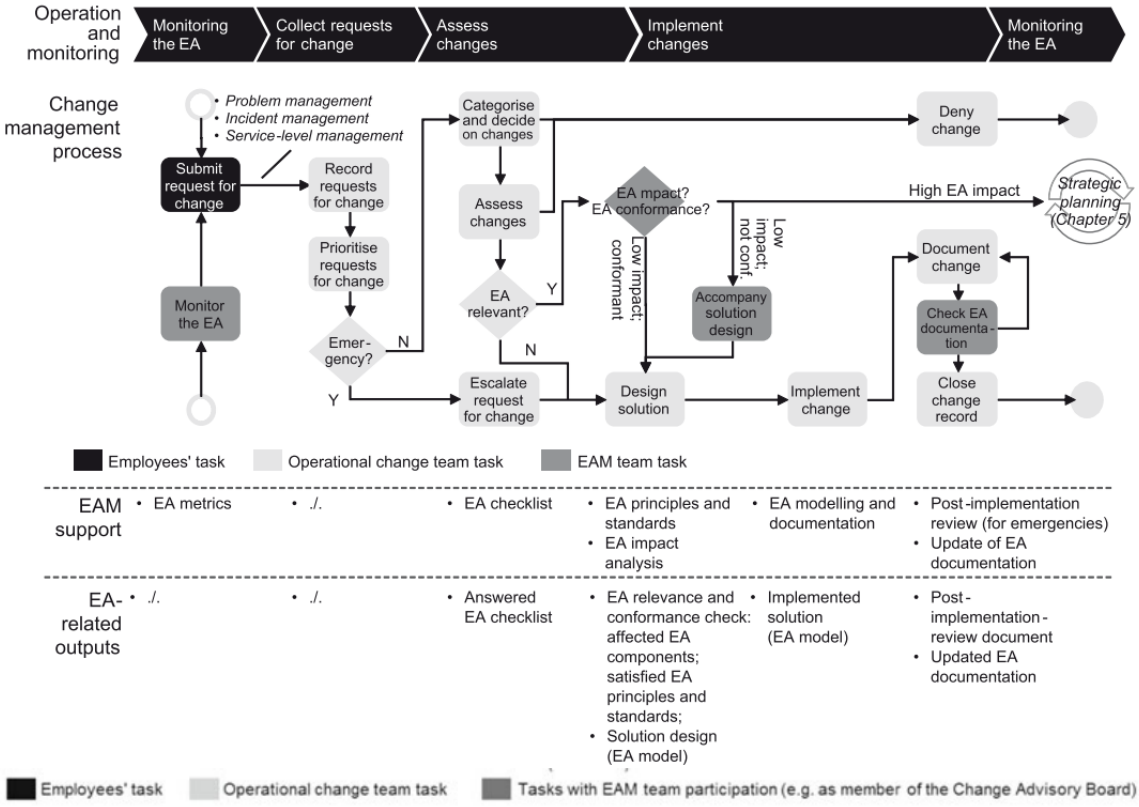


Figure 7. Procedures to manage operational changes with Integrated EAM.

Source: Legner & Löhe, 2012, p. 179.

The next area that is important for a successful EAM initiative is implementation and usage of EA frameworks. Many practitioners see EA frameworks as the starting point in an EAM initiative. It is difficult to select the right EA framework for their own companies. Therefore, a mix of several EA frameworks is recommended. Basten and Brons (2012) argue that the use of an EA framework is not the primary focus in this area. However, the documentation of EA is. EA models give a more holistic and broad view than business process models.

"Beside the key factors that position an enterprise (or domain) in the market and in terms of its value generation, they describe the organisation and processes, the information systems and technology used, the people and the corporate competencies on a conceptual or logical level, as they are today, or how they should be in the future."

Basten & Brons, 2012. p. 203

EA frameworks can provide suitable models based on purpose and the perspective of the stakeholder. Frameworks are guidelines to structure and form architectural artefacts. They also describe the relation between artefacts and provide a comprehensive approach. A typical EA framework consists of a reference EA, a methodology or approach to implementation and planning, guidelines for

documenting EA and equipment as well as common vocabulary/glossary (Basten & Brons, 2012).

EA is often represented via principles, policies and choice of technology in organizations. Usually, organizations are divided into four categories when modeled: Business architecture, Information architecture, Application architecture and Technology architecture. Depending on which category to model, different modelling notations are used. For example, for Information architecture, swim lane modeling is a suitable choice of notation for the purpose (Basten & Brons, 2012).

The last important area identified by Ahlemann and El Arbi (2012) for a successful EAM initiative is the adjustment of employees/people in organization toward following EAM practices. Soft factors such as employee acceptance are important for a successful EAM initiative. If this is not recognized, the initiative leads to rejection by both employees and senior executives in the end (Ahlemann, Mohan & Schäfczuk, 2012b)

"In short, because key users and important EAM stakeholders are the ones who eventually decide a new management approach's success or failure, aligning EAM practices with stakeholders' needs is a critical success factor."

Ahlemann et al., 2012b. p. 231

With organizational support in form of coaching and technical guidance, EAM practices can be expanded between stakeholders and employees. A change strategy for organizational adjustment to EAM practices can be established by making the use of EAM techniques fun. Advantages that come with EAM acceptance involve (Ahlemann et al., 2012b):

- Quicker practice of EAM
- Less conflicts and limited escalation risks
- Avoidance of negative impact on organizational culture
- Substantial employee satisfaction
- Likely decrease of operational costs

In the next chapter, the method of this research is presented.

3. Method and implementation

In scientific studies, it is of great importance to have a structured approach to conduct research in the best possible way with a high level of reliability and validity. The main reason why research methods exist and are used in various research is to achieve a reliable and valid knowledge of reality. Based on the aim and goal of this research, which is to answer the research questions and produce an artefact, the selected research methods and design mentioned below are most appropriate for this study. The structure of method in the study can be seen in figure 8 below.

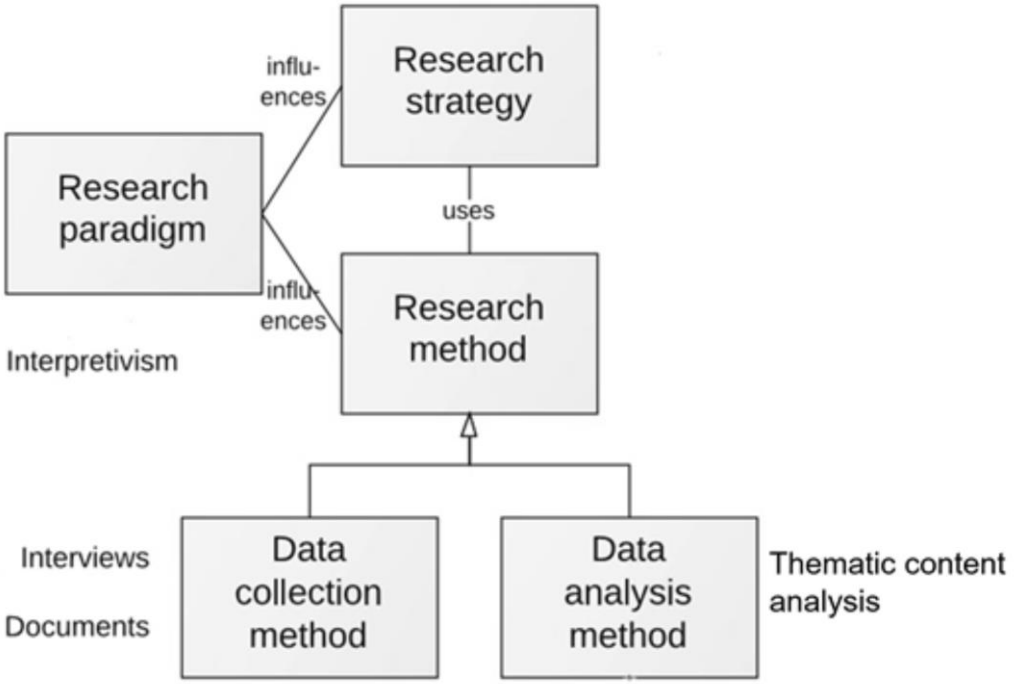


Figure 8. Structure of method in this study.

Source of figure: Modified figure, Original by Johannesson & Perjons, 2014, p.168.

3.1. Research paradigm

As research paradigm, this study has used interpretivism. This paradigm allows researchers to create an understanding for social phenomena. The interpretivism paradigm also allows researchers to get close to individuals involved in the studied phenomena as they create an understanding for their experiences and perspectives (Johannesson & Perjons, 2014). Unfortunately, the interpretivism paradigm has been criticized to result in biased studies. Based on the background of the researchers and their interest, there is a risk that an interpretivism research may lead to different results. Therefore, it is important that researchers acknowledge their bias (Johannesson & Perjons, 2014).

3.2. Qualitative research

This study has applied a qualitative research method. With the formulation of research questions, the aim of the study, the research area and the intended data collecting methods in mind, this approach seems to be most appropriate. Qualitative research means studying things in their daily and operating environments while trying to make sense of the phenomena that they are part of. When using a qualitative approach in studies, the practitioners gather empirical data through primary and secondary sources (Aspers & Corte, 2019). If a quantitative research approach had been chosen, the data collected would mainly contain numbers and not thoughts, words or descriptions of experiences which are needed to answer the research questions.

3.2.1. Design Science as strategy

When something is not right and there is a need for a change, a new artefact who solves problems affecting many, characterizes the outcome of a design science strategy. An artefact is a product of human intervention and the goal is to use it to solve practical complications (Johannesson & Perjons, 2014). With the aim to answer research question 4 and produce an artefact, design science is best suited compared to case studies, as an example. In case studies, an artefact is not the outcome but instead it is hypotheses, propositions, descriptions and explanations (Dresch et al., 2015). Another reason why design science is chosen as a strategy is because of the role of the researcher in a study. The role of a researcher in case studies is to observe while in design science it is to produce or evaluate artefacts (Dresch et al., 2015). The last reason to why design science is considered more suitable than case studies for this research is because of the study's objectives. In design science, the objectives are to develop artefacts that help solve practical problems. In contrast, the objectives in case studies are to test or create theories (Dresch et al., 2015). Based on these differences, design science is chosen as strategy to be applied in this study.

The idea is to answer the research question 1 and via the fishbone diagram identify the root challenges in FOMSMEs toward DT. Additionally, an artefact in form of an action plan that addresses the root challenges will be developed. The design science strategy can be divided into 5 activities: Explain Problem, Define Requirements, Design and Develop Artefact, Demonstrate Artefact and Evaluate Artefact (Johannesson & Perjons, 2014).

- **Explain Problem** activity involves identification and analysis of a practical problem. The identified problem should be general and practical so its artefact can be significant for global practice.

- **Define Requirements** activity means transforming the problem statement into a requirement list on the planned artefact. The identified requirements will not only consist of functionality of the artefact, it will also take the structure and the environment of the artefact into consideration.

- **Design and Develop Artefact** activity is the process where the artefact that addresses the explicated problem is created. In addition to fulfilling required functionality, the artefact should also address structural and environmental practice when it is implemented.

- **Demonstrate Artefact** activity means that the artefact is tested in either fictional or real cases. Also called for “proof of concept”.

- **Evaluate Artefact** activity is evaluating the artefact’s result. This activity shows if the artefact either solves the explicated problem or not.

To ensure that the answers to the research questions and the quality of the artefact indicate valid and reliable knowledge, the choice of right data collecting methods and techniques are vital for the study (Johannesson & Perjons, 2014). In the next sub-chapter, more about data collecting methods and techniques are be presented.

3.2.2. Data collecting methods and data analysis method

For this study, interview and document review have been chosen as data collecting methods. The main data collection method in qualitative research is interview. In comparison to quantitative research, where interviews are largely standardized and structured, interviews within qualitative research are more open and free (Hartman, 2004). The fact that interviews are largely standardized and structured mean that the order and formulation of the questions are pre-determined before the interview has started. Furthermore, it also means that all interviewees in the same survey will answer the same questions. In addition to the aforementioned explanations, the response options may also be limited, for example the interviewee can only answer "yes" or "no" on questions (Hartman, 2004).

There are several reasons to why interviews have been chosen as one data collecting method in this study and these are (Bryman, 2011):

- To take note of the informants’ feelings and expressions
- To get rich and detailed answers.
- The interview can take different directions, which gives more knowledge of what the informant experiences is relevant and important.
- The researchers can easily access more people in different situations and roles. For example, via distance interviews.

In this study, semi structured interviews will be applied with a high degree of standardization but a smaller degree of structure. This means that a few questions will be ready before the interview starts, but that the informant can still answer and express themselves freely (Hartman, 2004). Qualitative interviews can be perceived as a relatively free method, but it is important to prepare well for the interview. Since the informant can respond more free, there is a risk that they will shift focus from the intended research area. Before the interview, it is also necessary to prepare for how the interview will be documented.

The other data collecting technique that will be used is document review. This collecting technique means that documents from the participating SME will be examined. Document review is a technique that gather and capture the underlying reality about their effort to reach DT. Another advantage with document review is that the collected information is not affected by the researcher's values and perceptions (Bryman, 2008). One final reason for why document review is used as a data collecting technique is that it can reveal information that is not identified during interviews (Jacobsen, 2017).

Once the data is collected, the thematic content analysis will be used to structure and present the result to the research questions. There are six different phases in the thematic content analysis method (Nowell et al., 2017):

- **Familiarizing phase:** The researcher looks through the collected data and creates an overview of the data.

- **Coding phase:** The researcher starts to highlight sections in the texts and describes them through a label or a code.

- **Looking for themes phase:** The researcher starts to identify patterns among the labels or codes created in previous phase.

- **Reviewing themes phase**: The researcher reviews the themes and makes sure that they are not vague or irrelevant to the research area.

- **Defining themes phase:** The researcher starts to name and define the identified themes.

- **Presenting phase:** The researcher presents the findings in a structured and coherent way.

3.3. Ethics in research

All research should consider these four ethical principles: The first principle is to protect the interests of participants. The second principle is to ensure that the participants are informed and voluntary to participate. The third principle to consider is to conduct research openly and honestly. Finally, the fourth principle is that the conducted research comply with laws (Johannesson & Perjons, 2014).

- **Protect the interests of participants** means that no participants should be harmed by the study. Precautions should be taken by researchers to minimize or eliminate any risks.

- **Ensuring that participants are informed and voluntary** means that no participants are forced to participate in the research. No bluffing or other deception should not take place. When informing participants, the information

document should contain contact information and name of the researchers, purpose of the study, its design, information about how anonymity will be maintained and if any benefits will be done when the study is finished.

- **Conduct research openly and honestly** means that the work and result of the research is open and without bias. It is also important that all plagiarizing is prevented and if other work from other researchers are used in the research, they should be given proper credit.

- **Comply with laws** means that the research should follow all prevailing laws of the country where the research is conducted.

3.4. Implementation

The procedures for this study are according to the following steps and structure:

1. For starters, everyone involved in the study will be notified of the 4 ethical principles considered in this research. The 4 ethical principles applied are: protect the interests of participants, ensure that participants are informed and voluntary, conduct research honestly and comply with laws.

2. Selection and number of informants. Persons in the participating SME that have had a managing position in current or earlier DT projects will be selected as informants. The goal is to have 5 or more participants to interview.

3. Schedule interviews with informants.

4. Requesting secondary sources to conduct a document review. At this step, documentation related to DT initiatives will be requested for analysis.

5. Preparation of tools prior to the interviews. Control of equipment such as voice recording device before the meeting to ensure a smooth interviewing process.

6. Conduct interviews round # 1: The very first interview will be with the CIO of participating SME and will function as a pilot interview. This is necessary for the study to be able to create semi structured interview templates that ensure the right questions are asked. After this, all the scheduled interviews are conducted.

7. Analyze and structure data to find the challenges of reaching DT. The raw data during this step will be coded to enable analysis and then presented in the best possible way.

8. Answer research question 1.

9. Create SSM models based on the result of research question 1 that show the complex situation in the participating SME. To proceed, schedule new interviews with the informants. During this step SSM models such as Rich picture, Root definition, CATWOE and Activity models will be created.

10. Prepare EAM models that show what an EAM initiative can look like. The EAM example models come from a dedicated EAM book. The intention of using the models are to explain how an EAM initiative can look like and which areas it covers.

11. Schedule a meeting with all informants for presentation of SSM and EAM models as well as for the second interviews to collect feedback and reflections on usefulness of SSM and EAM in their organization.

12. Conduct the interviews with all informants and show the SSM and EAM models. The raw data about usefulness of SSM and EAM will be collected.

13. Based on the informants' reflections, analyzing and categorizing the data and answer research questions 2 and 3.

14. Based on the result of research question 1, create an action plan that answers research question 4. This step will be the final step in this research.

The different steps of this research are demonstrated in figure 9 below. The presentation slides, which were used to present the SSM and EAM, can be found in the appendix of this report.

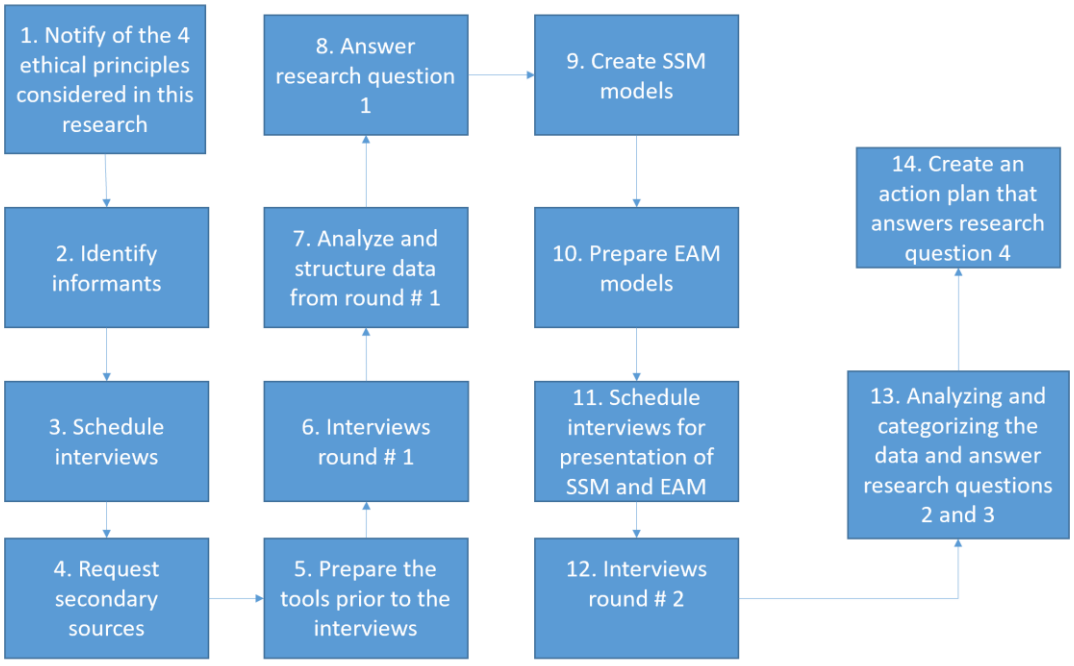


Figure 9. Steps in this research.

3.5. Interview questions

After the pilot interview with the CIO of the participating company, a list of questions was created and could be used when needed during the semi structured interviews to keep the conversations to the topic. But the main idea is to ask as many follow-up questions as possible to identify the encountered challenges when reaching for DT and to use pre-defined questions in as little extent as possible. The questions created after the pilot interview are as follow:

- How long have you worked here?
- How is the attitude toward change in the organization? From the board's perspective but also the employees.
- From a digital perspective, where is the company heading?
- Do you think the company is on the right track with its digital initiatives?
- Is there a clear IT strategy in your organization?
- How do you experience the support from the board before and during the IT-projects?
- How do you think the projects that you have been involved with have been implemented?
- How is the culture in your organization? Does it encourage to be more open to innovation, new ways of working or to new management?
- What challenges have you experienced when you have worked with IT-projects?

The idea behind the questions are to start with more general questions in the beginning. This will make the informants think from a broader perspective on their organizations IT-initiatives. The following questions will narrow down the topic further to challenges the informants experience during their IT-projects. It is important to mention that the questions aimed to narrow down the topic will not be asked in the first place. They will only be used when it is appropriate and necessary to shift the focus of the informants to the research area. Hopefully, the informants will be able to mention the challenges they experience on their own through different follow-up questions.

4. Findings and analysis

In this chapter, the results and the findings of this study will be presented. It is structured so that each sub-chapter reflects each research question, except the last one that represents the artefact in form of an action plan instead.

4.1. Challenges for FOMSMEs toward DT

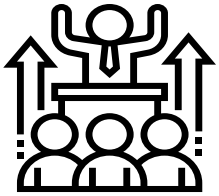
To be able to identify the challenges toward DT in FOMSMEs, interviews and document review were conducted. By following the structured research design and coding the data into understandable categories, the different challenges have been identified. Below there are 12 different figures that each describes and represents different challenges toward DT.

Slow Pace

4 out of 5 informants mention that as a result of the IT initiatives taken, the deadline have been passed and the projects proceed slowly. For example, informant 1 mentions that a project that was supposed to last/cost 30 hours instead increased to approximately 300 hours.

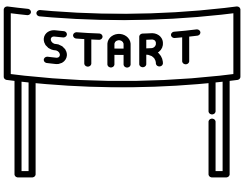
Communication error, both internal and external

According to 4 out of 5 informants, there is a challenge of communication both with internal parts but also with external parts. For example, informant 3 states that if we are saying one thing, then the other part understands it in a completely different way which leads to miscommunication.



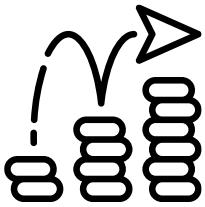
The board shows insufficient engagement and motivation through IT projects

3 out of 5 informants mention that the support and engagement from the board are insufficient and lead to slow pace in IT initiatives. For example, informant 4 thinks that the board is supportive in the beginning but not throughout the projects. Informant 1 experiences that the lack of engagement from the boards leads to uncertainty and lack of driving force in projects.



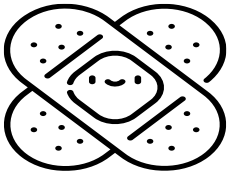
Poor preparation before upcoming IT projects

The next challenge identified was concerning poor preparation before IT projects and initiatives. Informant 3 addresses this challenge during their interviews and this is also confirmed by the document reviewed in this study. For example, informant 5 comments during the interview that requirements that are usually necessary to be identified in the beginning of a project can be detected one year into the projects.



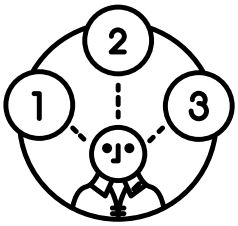
More and more IT systems

This challenge has been identified with the help of informants 1 and 2. They argue that there is a need for new positions and new employments in the organization to utilize the initiatives and projects conducted in the organization. For example, informant 1 explains that they are building more systems to handle but that there is not enough time to handle them.



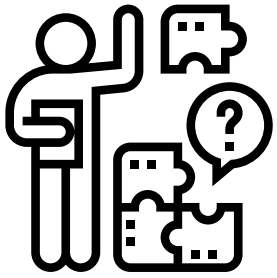
Patching old systems instead of investing in new and reliable ones

3 out of 5 informants highlight the challenge with patching old systems instead of investing in new ones. For example, informant 4 states that the board chooses the cheapest way and tries to patch systems instead of investing in new ones.



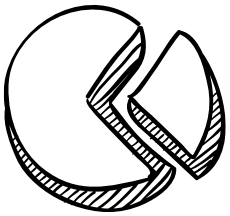
Employees involved in IT projects have too many tasks

3 informants out of 5 say that there is a challenge to make time for IT initiatives and projects. For example, informant 2 mentions that all projects and initiatives come from the employees and departments. Once the board accepts the idea or initiative, the employee with the idea is responsible for running the project while they continue with their regular duties.



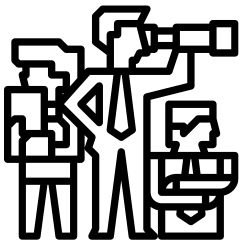
Departments does not consult with the IT department

This challenge has also been identified by 3 informants. This challenge is about departments not using IT department in their IT initiatives. For example, according to informant 1, departments do not involve IT department when communicating with developers, which leads to miscommunication and extension of deadlines.



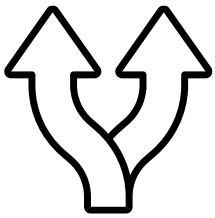
The board focuses on initial costs instead of total

This challenge was identified by informant 1. The board, by focusing on the initial costs such as purchase price, new IT initiatives or investments are very likely to be denied than if the board would focus on the whole life cycle of projects or initiatives instead.



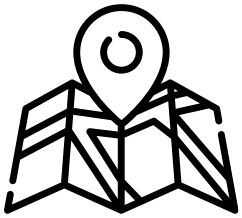
Lack of collective vision in the organization

Informant 3 mentions that there is no clear vision in the organization. The effect of this is that employees and departments get confused. With a clear vision, they will see that there is a continuity in their path towards the organizational goal, which in this case is reaching DT. With one collective vision the road to it also becomes more logical.



Challenging that some departments are behind in taking IT initiatives

Another challenge identified by informants 1 and 2 is the inequality between departments leading to underdevelopment of IT in some departments. Informant 1 reflects that this can be due to lack of time for employees in some departments or that the employees in those departments lack interest in conducting IT initiatives resulting in overwork.



Lack of overview of IT-landscape and strategy

The last challenge identified, which is evident among and confirmed by all 5 informants, is the lack of overview of the IT landscape and the lack of a digital strategy in their organization. According to informant 3, this causes confusion among the employees and departments as they do not know which parts need to be changed and in which order.

To summarize, 12 challenges toward DT in FOMSMEs were identified. In the next sub-chapter, the study will present the result to whether SSM is useful for FOMSMEs to understand their complex situation.

4.2. Usefulness of SSM in FOMSMEs

After collecting and coding data, the following arguments were identified among the informants in response to the question if SSM would be useful in FOMSMEs to understand their complex situation:

Informant 1

- SSM is a good methodology for showing departments that these are the challenges that we have today, and this is how they are connected to each other.
- SSM could be useful in FOMSMEs, but the risk is that it would fail later on because of aspects such as lack of time and culture that exist in the organization.
- "The question is if we can work towards or work after SSM. I actually don't know."

Informant 2

- To use SSM would be ideal, but we work in informal ways and that is a part of our culture and how we conduct IT initiatives.
- SSM would bring greater consensus and cohesion between departments.
- From the board's view, everything that is not related to the manufacturing is unnecessary and not a priority.
- "Everything happens so ad hoc. There is no underlying strategy, you just do it."
- "The organization has been successful in its initiatives so far, then you don't think you need to change either."

Informant 3

- SSM would definitely be useful in the organization. Unfortunately, it would only work if there was someone who actually implemented it and right now such resources are not available.
- Even if some took the initiative to use or implement SSM in the organization, "We have full focus on the production and really nothing else.".
- "People do not have the time nor the opportunity to think in long terms."

Informant 4

- SSM would fit the organization. The models would help the departments to understand the complex situation.

- "SSM provides good context" and would help with an overview of how the challenges are related.

Informant 5

- I believe that SSM would be useful in our organization.
- "It feels a little advanced for this organization and the culture here. It's often a bit simpler here, but the idea is just right"
- SSM would be nice to have. It would be nice to have something to lean on and use.

In the next sub-chapter, the data collected and coded in regard to research question 3 is presented.

4.3. Usefulness of EAM in FOMSMEs

After collecting data and coding it, the following arguments were identified when informants were asked if EAM would be useful in supporting FOMSMEs to reach DT:

Informant 1

- EAM suits bigger organizations than ours where there are more staff with specific roles.
- "Does not feel really applicable to our organization"
- EAM does not fit family-owned manufacturing companies and it would be difficult to hire the people needed for implementation of EAM.
- "EAM feels massive and complex"

Informant 2

- Some parts of EAM is used today in our organization, such as project life cycle. But adapting the whole practice of EAM would be difficult.
- EAM would turn many things upside-down in the end, it would not lead anywhere.
- "Everything would eventually fail because no one would live by EAM principles"
- Employees would still use the informal roads regardless, whether EAM was implemented or not.

Informant 3

- EAM could work, "but I have a really hard time seeing our board get on with this and create the structure from top to down".
- EAM would not work because of how things are operating here. Those who could start the adaption of EAM are too comfortable with the way things are.
- "Maybe this can change but we would never know as long as we have the owner family involved."

Informant 4

- EAM would be nice to implement, but we are not working in that way with long-term visions and strategies.
- "It would not be wrong to run a light version of EAM"
- Implementing all steps of EAM would be difficult to have time for. But in larger organizations it would be possible to implement EAM.

Informant 5

- It would be fantastic if EAM could be implemented in our organization.
- "I like it when things are structured and thoughtful"
- It could possibly be implemented but the organization's culture would not allow it.

Next, the artefact in form of an action plan, which was part of the aim with this study, is presented.

4.4. Action plan for FOMSMEs toward Digital Transformation

Based on the identified challenges, an action plan has been created. The idea is that by addressing the identified challenges, the action plan will help FOMSMEs to reach DT faster and easier.

- Make sure to have an updated overview of the IT landscape and a clear strategy developed in consultation with departments and the board.
    - It is important that the person responsible for creating the overview of the IT landscape and strategy have mandate from both the board and the departments.

    - Update the overview after every IT initiative and check that it is align with the overall strategy.

- Create a clear vision and introduce it to all employees in the organization.
    - Make the vision a part of the culture.
    - Make the vision visible in the organization. Make sure that the employees know where the organization is going and aspires.
- Involve IT department in all IT related projects and initiatives
    - For IT initiatives to be approved by the board, a requirement should be to involve IT department in the projects.
    - IT department should be involved in meetings with external partners to prevent miscommunications.
- The board should show commitment throughout IT initiatives and IT projects.
    - With simple efforts, such as a simple e-mails, the board should keep themselves updated on how projects are progressing.
- Foster a culture that calls for continuous development of business processes.
    - Culture in FOMSMEs need to be changed. Changing the culture in organizations takes time and FOMSMEs need to work hard to promote an innovative culture in their organizations.
- Assign specific hours where employees are given time to run their IT projects or IT initiatives more efficient.
    - Employees need dedicated hours to run their projects more efficiently without having to worry about keeping up with their daily tasks.

With the help of these presented actions, the hope is that FOMSMEs can set aside resources to fulfill each one of them in effort to reach DT. In the next chapter, an analysis of the data presented in this chapter will be taken place.

4.5. Analysis of findings

Among the challenges identified in this study, there were challenges that other studies had also identified. For example, the management issue was identified by Besson and Rowe (2012) and the lack of IT knowledge was identified by Li et al. (2018). These two challenges were also identified in this study. But based on the informants' experiences, the most significant challenges toward DT in the organization was the lack of overview of the IT landscape and the lack of a clear strategy. When presenting SSM for the informants, the rich picture was presented in form of a fishbone diagram. With the help of diagram, the informants were given the opportunity to see how the identified challenges were connected to each other and that most of the challenges could be associated to the lack of overview of IT landscape and the lack of a strategy in the organization.

A straight answer about the usefulness of SSM in FOMSMEs is that it is useful; SSM is useful to use to understand complex situations. The informants' reflections about SSM were positive, but there were some doubts about its implementation in FOMSMEs. Aspects such as strong culture, lack of time and low interest by the board due to SSM's poor connection to production make the implementation and use of SSM in FOMSMEs unlikely.

The analysis of the usefulness of EAM initiative in FOMSMEs is contrasting to SSM. Reflections about the usefulness of EAM are negative among the informants, which has also been the case in previous research. For example, Sonnenberger and Wißotzki (2013) and Timm et al. (2015) identified aspects such as complexity of production, complex relations between departments and complex relations between IT systems as obstacles that could prevent an EAM initiative in industry enterprises. These aspects correspond with the findings in this research – for example, "Everything would eventually fail because no one would live by EAM principles", is what informant 2 claims. Unfortunately, implementation and adaption of EAM in FOMSMEs seem unlikely. Aspects such as the complexity of EAM, the need for change in top management and the existing culture in informal communication channels between employees and departments prevent such organizational changes.

The created artefact will support FOMSMEs to reach DT by guiding them to solve and understand their complex situation. The actions listed in the action plan may help companies deal with their challenges similar to those listed in this study. The idea is to address the root challenges so that other challenges emerging from these can be prevented.

5. Discussion and conclusions

In this chapter, the idea is to conclude the findings of the study and discuss the chosen method. At the end of this chapter, a brief summary of the main points will be presented.

5.1. Discussion of method

The method has contributed to realize the aim and the goal of this research in the best way. The benefit of the chosen research paradigm is its ability to collect empirical data. Informants have been able to express their thoughts and feelings during the interviews. This has been crucial to the study's quality and validity. Data collecting methods and techniques such as the semi-structured interviews have contributed with rich data to and so did the document review technique. Unfortunately, the interviews with the informants were conducted online through Teams due to the Corona virus. The desirable way to conduct the interviews would have been in person, where observations would have contributed positively on the validity of the study. Despite this, there is still a high level of validity.

As for the reliability, it is very difficult to reflect upon it since there are not that many earlier studies that cover the same research area. Because each step in this research has been carefully documented, there is still a high level of reliability. Therefore, other studies with the same research area and with similar types of organizations are likely to have similar outcomes as this one. The research questions have successfully been answered and an action plan has been produced with the chosen method. This means that the accomplishments of the study regarding the aim and the goal have been successful because of the method and a structured approach.

5.2. Discussion of findings

The aims of the study were to identify challenges that FOMSMEs encounter when reaching for DT, analyzing if SSM is useful to understand complex situations in FOMSMEs and to analyze if EAM is a useful management practice for FOMSMEs. Moreover, the goal of the study was also to create an action plan that includes steps that can help FOMSMEs in their effort to reach DT in a traceable and structured way.

Challenges
Each of the challenges identified have been verified by at least two independent informants. This validate that the challenges identified are experienced by several employees. Challenges toward reaching DT such as management issue has previously been identified by Besson and Rowe (2012). Similarly, a lack of IT knowledge has previously been identified by Li et al. (2018). These findings in earlier research confirms the validity of this research.

SSM
All the informants agreed that SSM is useful to understand the complex situation in the organization, which is also stated by Antues et al. (2016) and Checkland & Poulter

(2010). However, the informants were not very sure about its implementation in the organization, mainly because of the existing culture and how they usually work, which is not as structured as in SSM. The main obstacle for an SSMs adaption by FOMSMEs is possibly the culture; there is a need for change in that area for a successful implementation and use of SSM.

EAM
The participating informants are not as convinced as Hauder et al. (2013) and Ahlemann et al. (2012a) about the usefulness of EAM in creating organizational structure and good alignment in organizational layers such as business process, application, information & data and infrastructure. A few problems such as the organization's culture and the board's unwillingness to change the management practice are identified as the major problems that stand in the way of EAM's adaption and implementation in FOMSMEs.

Action Plan
The action plan created in this research will help FOMSMEs to faster and easier reach DT. The actions listed in the action plan are intended to work as solutions to the challenges identified during research question 1, which ensures that the action plan addresses challenges that have been identified by real employees who work at a family-owned manufacturing company that try to reach DT. In the next sub chapter, the main points of the research are summarized and presented as well as future research in this area.

5.3. Conclusions

When FOMSMEs strive to reach DT, complex situations with interrelated challenges arise. In this study, 12 different challenges have been identified and they all have some type of connection to each other. Many FOMSMEs experience problems to understand their complex situation. SSM can help these organizations to understand how these challenges are interrelated and contribute to a complex situation in the organization. In order to implement and use SSM in the organization, FOMSMEs need to change their culture and try to follow the steps of SSM.

FOMSMEs need to change their organizations' culture and their boards' need to consider their unwillingness to change the management practice, in effort to a successful implementation of EAM. Today, in FOMSMEs, the employees and members of the board are used to informal communication channels and unstructured processes. Hopefully, the created artefact can support FOMSMEs to create organizational structure by addressing identified root challenges found during research question 1.

Further research is necessary in this research area. For example, a research that studies the implementation of SSM in FOMSMEs would be interesting to follow. It would be interesting to see if they still think of SSM as useful even after implementing it into the organization. A similar research on EAM would also be interesting to follow. For example, to see if the board members of FOMSMEs still opposes the managerial

change that EAM brings. Unfortunately, this study could not validate the action plan produced in this research. This was also not possible to do with the participating FOMSME or through the reflections of the informants due to limited resources, such as time. A future research that validates the action plan would be interesting to follow.

It would also be interesting to conduct similar research as this study, but instead of using only one book to present and explain the concept of EAM, the future research could perhaps use stories of real cases of EAM initiatives. It would be interesting to see if the reflections of informants working in FOMSMEs would differ.

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7. Appendices

Appendix 1 PowerPoint presentation material for presenting SSM and EAM

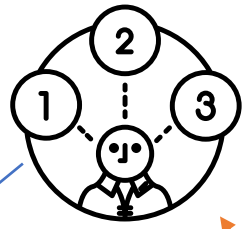
SSM

SSM provides an approach that is systematic in analyzing and understanding complex situations.

Rich picture

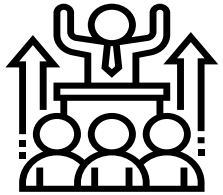
The rich picture is usually a sketch that simplifies the complex situation from an As-Is perspective

Communication error, both internal and external

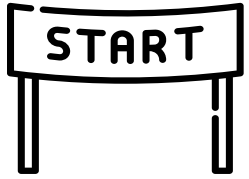


Employees involved in IT projects have too many tasks

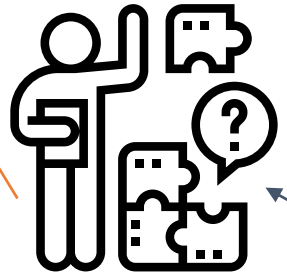
Slow Pace



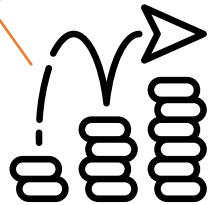
The board shows insufficient engagement and motivation through IT projects



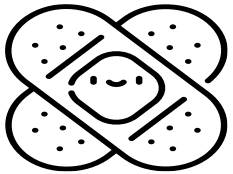
Poor preparation before upcoming IT projects



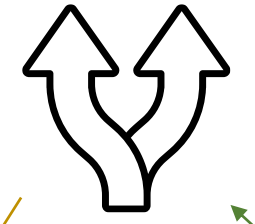
Departments does not consult with the IT department



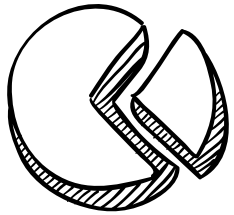
More and more IT systems but less time to handle them



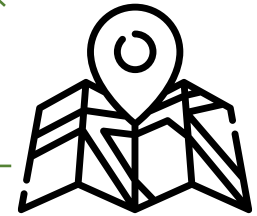
Patching old systems instead of investing in new and reliable ones



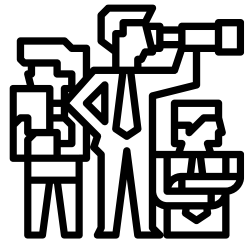
Challenging that some departments are behind in taking IT initiatives



The board focuses on the initial purchase price instead of the maintenance and operative costs



Lack of overview of IT-landscape and strategy



Lack of collective vision in the organization

Root definition

A root definition is a description that in short defines a system of interest in a To-Be state

Root definition

An internal system for employees and departments, by containing up-to dated overview of the IT landscape and the organizational strategic plan, in order to reach digital transformation.

Meaning of CATWOE

Customers:
Those affected by Transformation as victims or beneficiaries

Actors:
Who would do the activities

Transformation:
What elements will be changed by the system of interest

Owners:
Who could stop the process of transformation

Enviroment:
External impact that is given when doing the transformation

Worldview:
What reasons or ideas there are that justify the transformation

CATWOE based on Root definition

Customers:
- Departments
- Employees
- Final client

Actors:
- Board
- Employees

Transformation:
- Clear vision
- Clear strategy
- Better conducted IT initiatives

Owners:
- Members of the owner family

Enviroment:
- Budget
- Culture
- New technology
- Deadlines

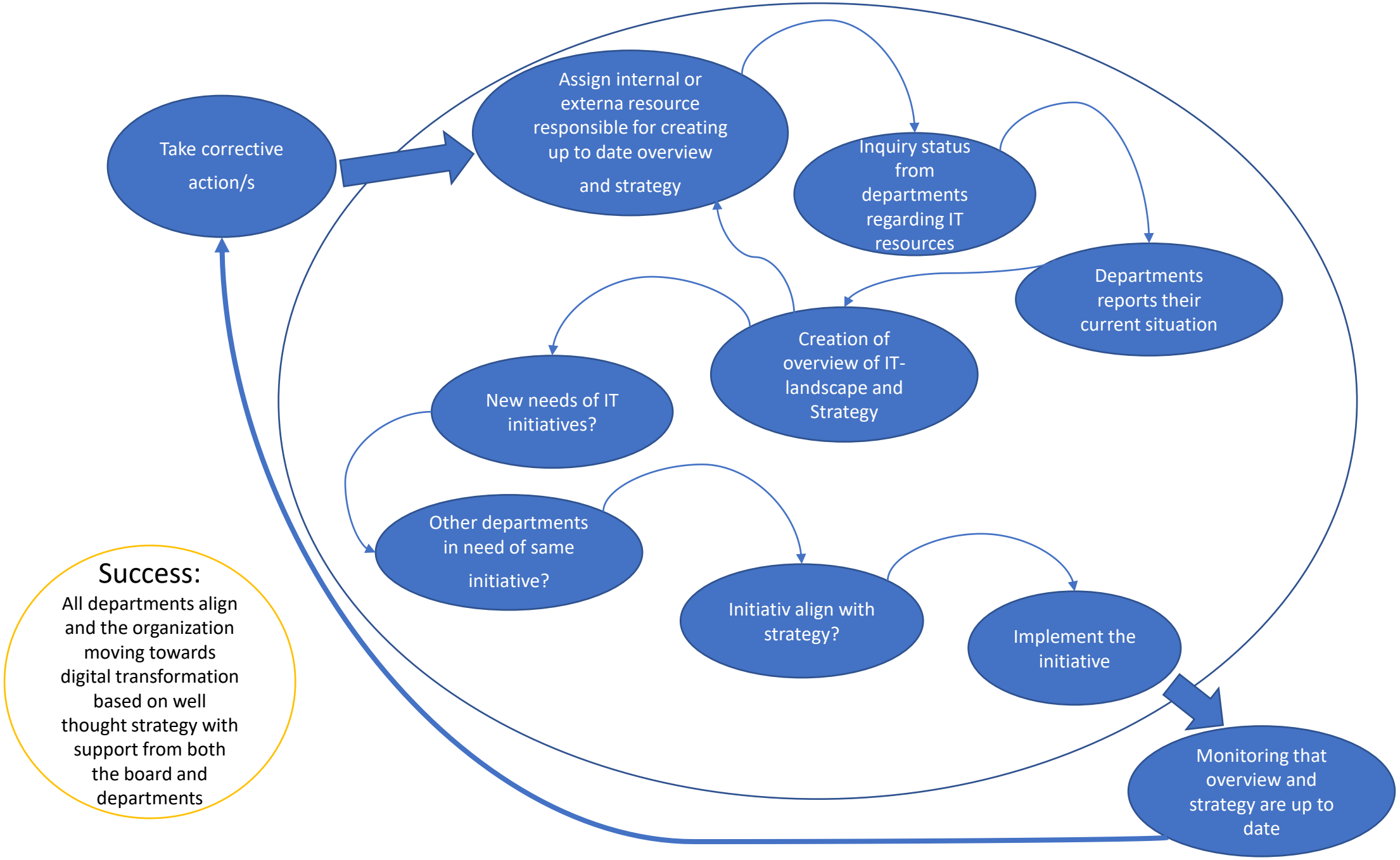
Worldview:
- Align with other departments and shared functions
- More time for IT projects and improved adaptation to deadlines
- Improved services

- Improved implementation of IT initiatives and reduced costs

- An organization that is flexible and utilizes available technology to improve services and products

Activity model definition

Activity models are a set of activities and links that describe the transformation in the system of interest. Activities aim to accomplish the purpose of given worldview.


Take corrective action/s
Assign internal or externa resource responsible for creating up to date overview and strategy
Inquiry status from departments regarding IT resources
Departments reports their current situation
Creation of overview of IT-landscape and Strategy
New needs of IT initiatives?
Other departments in need of same initiative?
Initiativ align with strategy?
Implement the initiative
Monitoring that overview and strategy are up to date
Success:
All departments align and the organization moving towards digital transformation based on well thought strategy with support from both the board and departments

Reflektion

Enterprise Architecture Management- 7 steps for successful implementation

1- Support and awareness from top management.

2- EAM organization and control.

3- Including EAM into strategic planning.

4- Including EAM into project life cycle.

5- Including EAM into operations and supervising.

6- Enterprise architecture framework and tools.

7- Adjustment, EAM introduction and people.

Support and awareness from top management

Create EAM sponsors out of senior executives

Appoint a chief architect which is supported of the majority

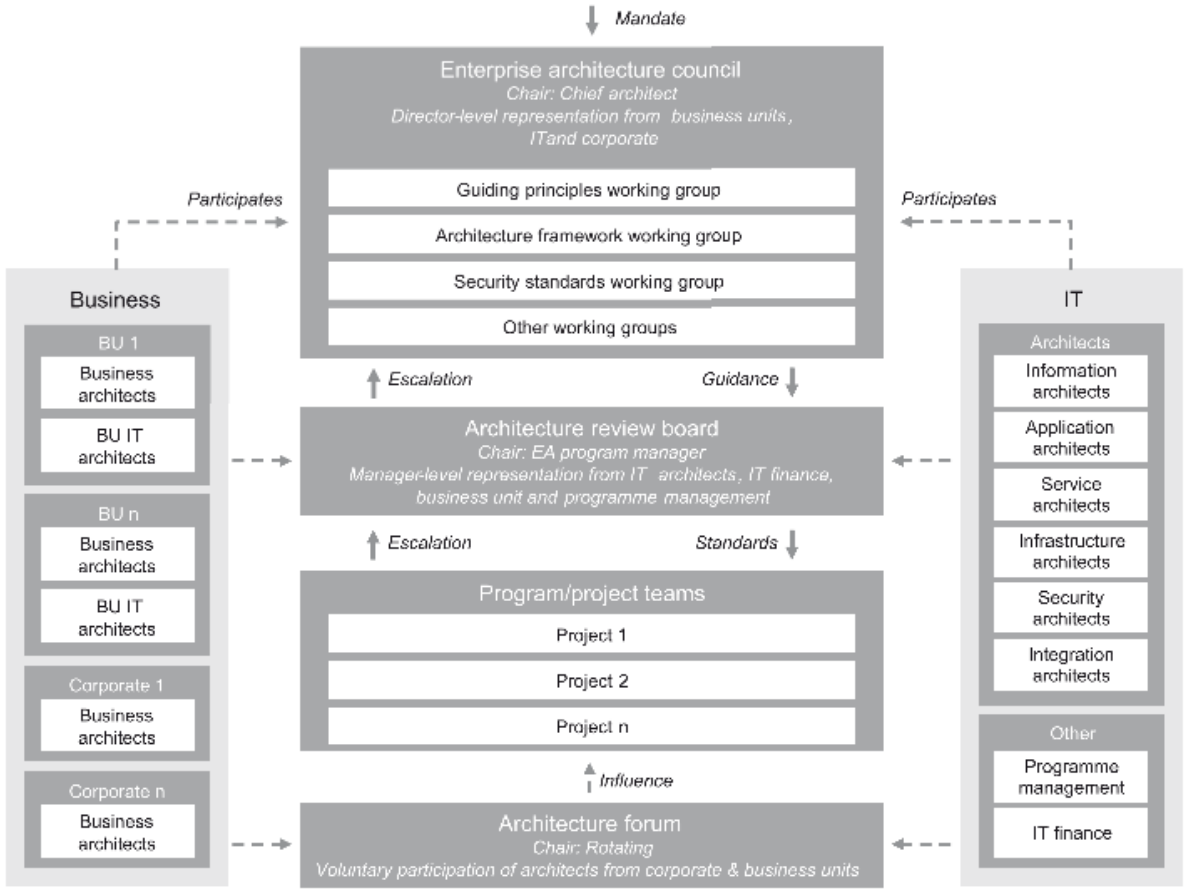
Clarify the goal of business and IT strategy

Have deadlines and plan for a step by step implementation of EAM initiative

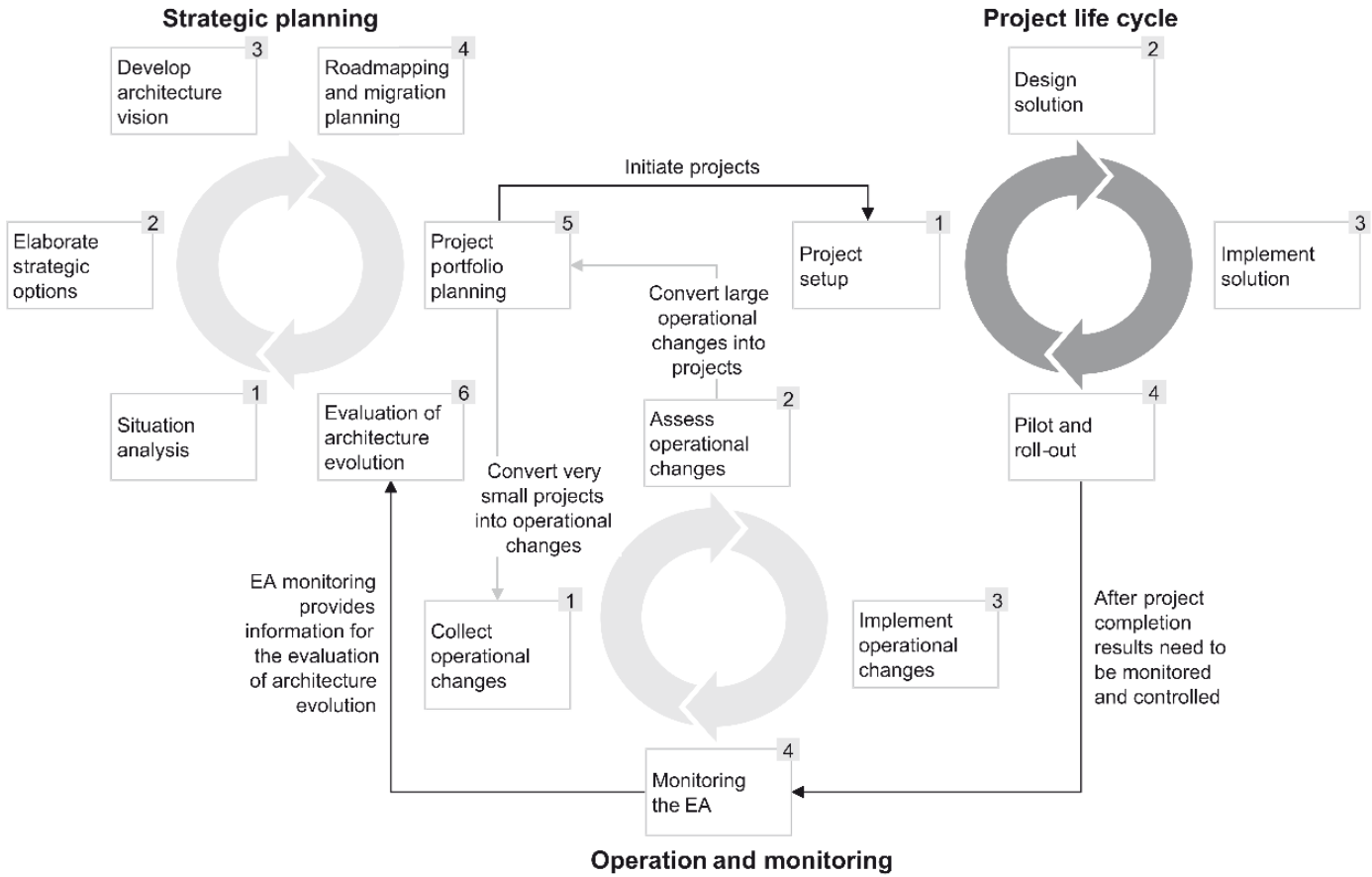
Describe your role and grade of involvement in the EAM initiative

EAM organization and control

With the right governance and structure of organization can an EAM initiative be successful because it leads to right decisions taken at the right place and at the right time with ensured delivery of EAM value to the organization

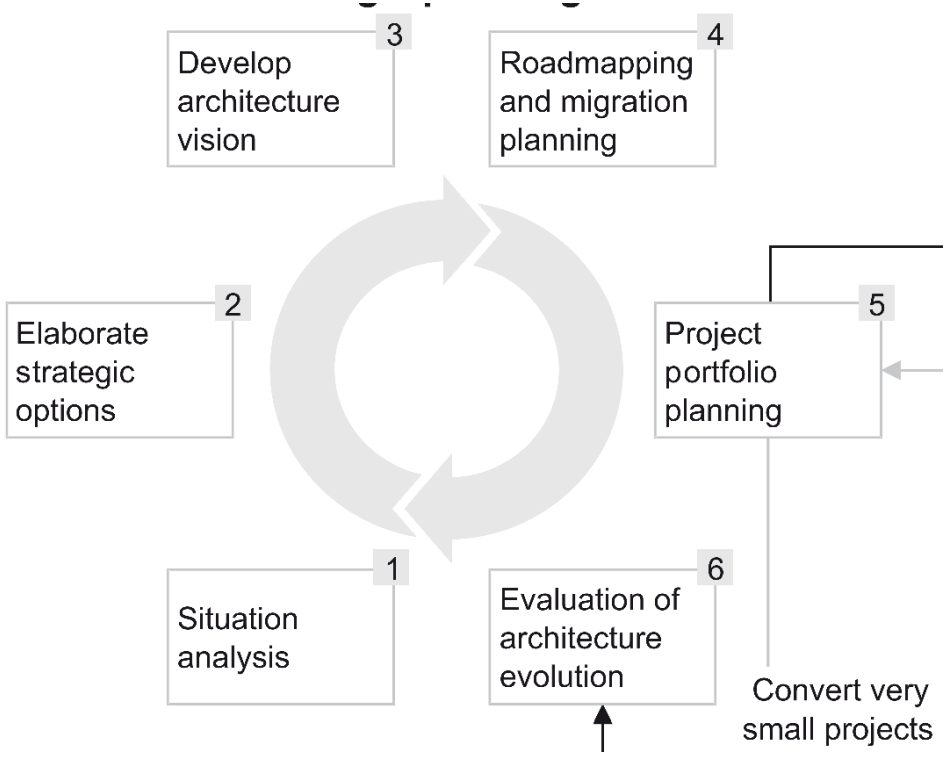


Including EAM into strategic planning
Including EAM into project life cycle
Including EAM into operations and supervising



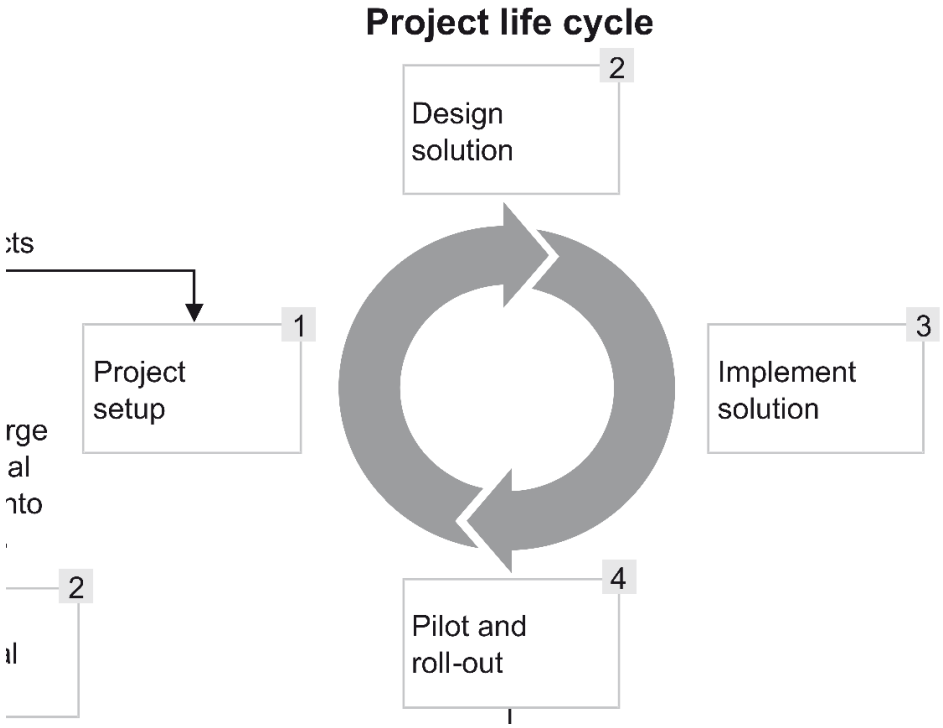
Including EAM into strategic planning

Benefits from this area lead to better alignment between business processes and their strategic goals, better change cycles in areas such as business & IT and more organizational flexibility and agility



Including EAM into project life cycle

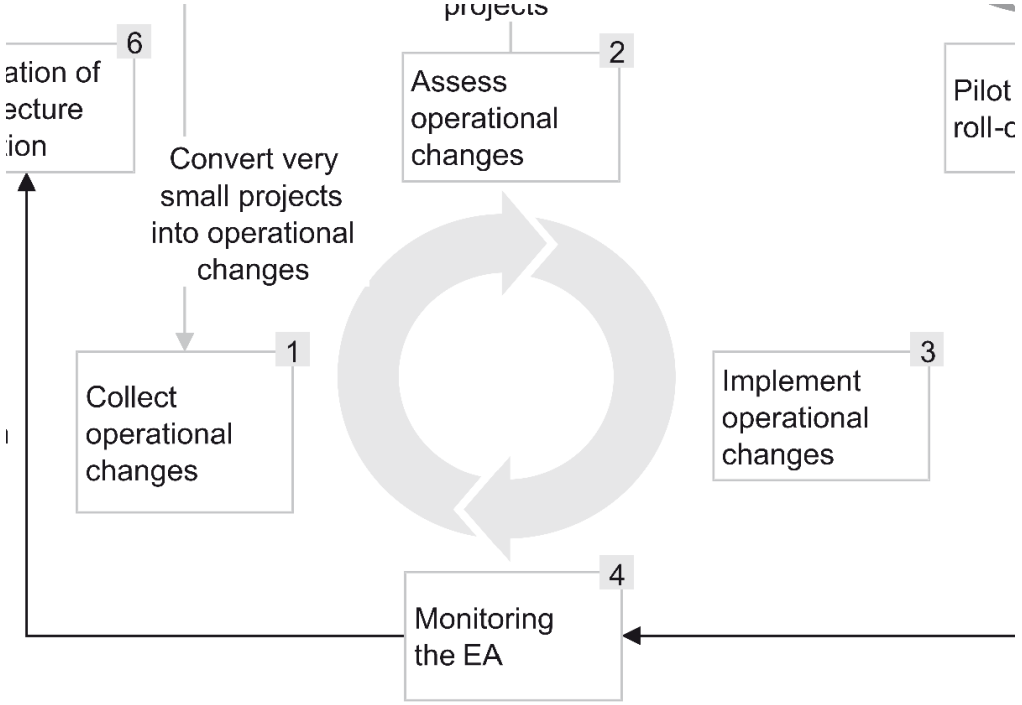
1. Project has been described and approved. It focuses on allocate resources required by the project to successfully be implemented.
2. Designing the project so that it is aligning with overall architecture. Detailed models containing architectural components, choice of technology, touchpoints and changes in process and organizational structure.
3. Implementing all activities designed in step 2.
4. Piloting and launching the project. It can be challenging, especially for larger organizations. But with pilot testing on one of few units, managers can test if the concept works or not. Once the project is proven as functional and working, it is handed over to the next area of EAM which are operations and supervising.



Including EAM into operations and supervising

Including EAM into operations and supervising is important because changes occur daily in operations.

1. Implementing efficient procedures to manage operational changes. For example, implementing processes based on IT Infrastructure Library (ITIL, see figure 8).
2. Implementing monitoring functions such as KPI for evaluation of current EA status to confirm whether operations are following the overall architectural strategy or not.
3. Use the benefits of EA documentation to understand complex relationships between operations.



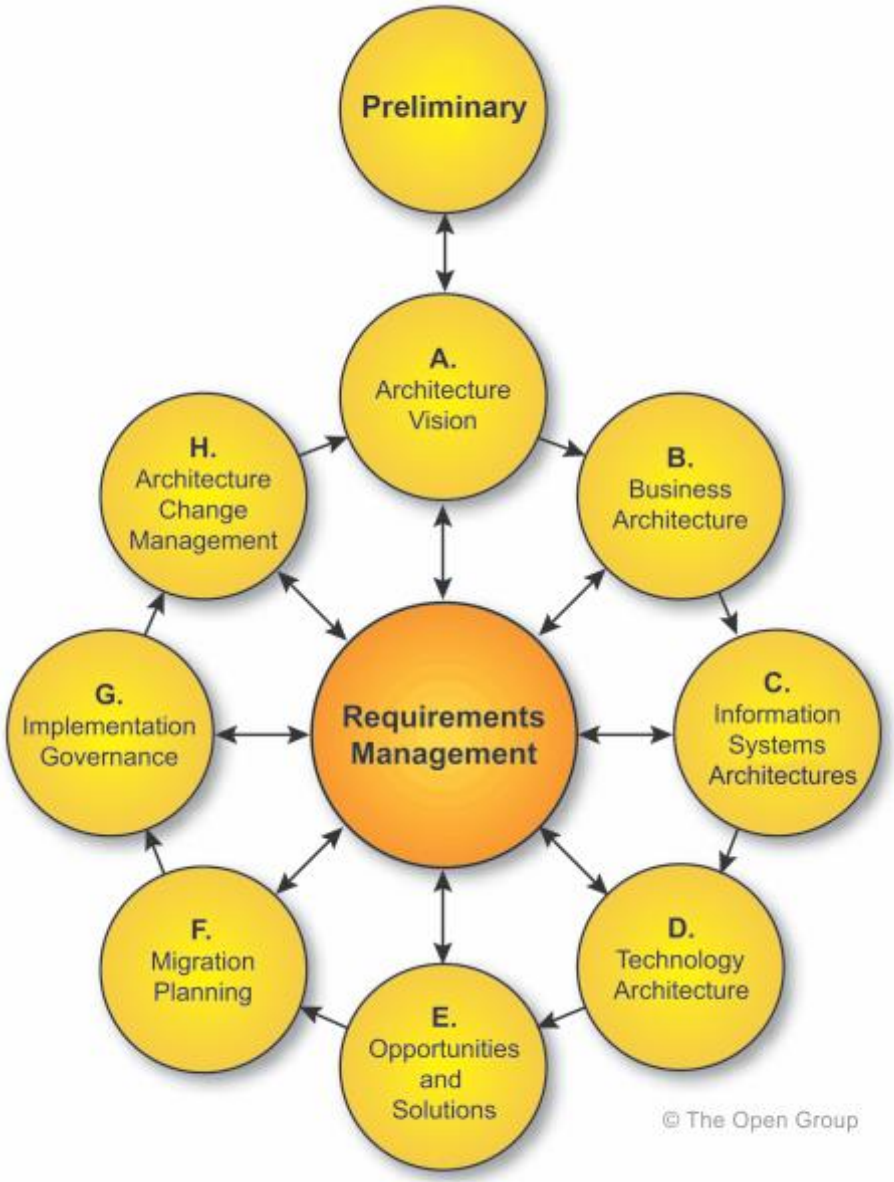
Operation and monitoring

Enterprise architecture framework and tools

It is difficult to select the right EA framework for their own companies. A mix of several EA framework are thereby recommended to use

The use of an EA framework is not the primary focus in this area, however the documentation of EA is.

EA frameworks can provide suitable models based on purpose and perspective of the stakeholder. Frameworks are guidelines on structure that forms architectural artefacts. It does also describe the relation between artifacts and provides comprehensive approach regarding the artifacts.



Adjustment, EAM introduction and people

- For a successful EAM initiative is the adjustment of employees/people in organization toward following EAM practices important.
- To not recognize the adjustment of people in accepting EAM, leads to rejection by both employees and senior executives in the end.
- Because key users and important EAM stakeholders are the ones who eventually decide a new management approach's success or failure, aligning EAM practices with stakeholders' needs is a critical success factor.
- Advantages that come with EAM acceptance involve
  - Quicker practice of EAM
  - Less conflicts and limited escalation risks
  - Avoidance of negative impact on organizational culture
  - Substantial employee satisfaction
  - Likely decrease of operational costs

Reflektion