CHALMERS
UNIVERSITY OF TECHNOLOGY

Strategic alignment for digital transformation

The fit between the use of technology and business objectives

Master's thesis in Quality and Operations Management

Sultan Almashalah
Veronica Poblete Osses

DEPARTMENT OF TECHNOLOGY MANAGEMENT AND ECONOMICS
DIVISON OF SUPPLY AND OPERATIONS MANAGEMENT

CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2020
www.chalmers.se
Report No. E2020:112

REPORT NO. E2020:112

Strategic alignment for digital transformation

The fit between the use of technology and business objectives

Master's thesis in Quality and Operations Management

Sultan Almashalah

Veronica Poblete Osses

Supervisor: Carla Gonçalves Machado

Examiner: Peter Almström

CHALMERS
UNIVERSITY OF TECHNOLOGY

Department of Technology Management and Economics
Division of Supply and Operations Management
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2020

Strategic alignment for digital transformation: the fit between the use of technology and business objectives

Sultan Almashalah
Veronica Poblete Osses

Report no. E2020:112
Department of Technology Management and Economics
Chalmers University of Technology
SE-412 96 Göteborg
Sweden
Telephone +46 (0) 31-772 1000

Gothenburg, Sweden 2020

Strategic alignment for digital transformation: the fit between the use of technology and business objectives

SULTAN ALMASHALAH
VERONICA POBLETE OSSES

Department of Technology Management and Economics
Chalmers University of Technology

ABSTRACT

Digital transformation and fast-emerging technologies have important ramifications for the strategic alignment between digital strategy and business strategy. It is no longer a matter of dealing with technologies in isolation from the business strategy; instead, using and arranging technologies in line with the norms, culture, and values that are shaping the business. The purpose of this thesis is to identify how manufacturing companies can achieve strategic alignment between digital strategy and business strategy. A qualitative research was performed by interviewing nine experts from the Swedish manufacturing industry as primary data and analysing several contemporary reports from major consultancy firms as secondary data. The qualitative research involves the understanding of the enablers, inhibitors, and challenges to strategic alignment, and how to achieve strategic alignment. Our findings suggest that building digital capabilities and digital culture that supports digital leadership are the main enablers (inhibitors if lacking) for strategic alignment. Furthermore, manufacturing companies are struggling in building the right resources and competencies to use digital technologies to serve business objectives. The results show that linking strategic alignment to change management is an appropriate approach to build the right digital mind-set that encourages digital-business strategy alignment. The study also found that misalignments between resources, developed digital strategy, and business strategy rises as companies move forward in their digital transformation. As a result, a process model for achieving strategic alignment during the process of digital strategy creation was developed. The model is comprised of alignment actions in three phases (formulation, implementation, and controlling and monitoring) such that these alignment actions are the dynamic capabilities of the organization (sensing, seizing, and transformation) that align and realign resources in each phase to the changes in the business environment internally and externally.

Keywords: Strategic alignment, Digital transformation, Digital strategy, Managing technology, Digital business, Digitalization

ACKNOWLEDGEMENTS

We would like to thanks all people whose support has been a landmark in completing this thesis. Without your valuable comments and insights, the goal of this thesis would not have been accomplished.

Special thanks to our thesis examiner Associate Professor Peter Almström for guidance and feedback, and experts interviewed for their valuable additions on this thesis.

We would like to convey our deepest gratitude to our thesis supervisor, Ph. D. Carla Gonçalves Machado, who believed in us. Thanks for your continuous support and motivation for us even when the road got tough.

The authors wish to acknowledge the support and love from their respective families and friends during this study. Without your wholehearted encouragement, it would be difficult to complete this study.

Sincerely,
Sultan Almashalah and Veronica Poblete Osses
Gothenburg, August, 2020

Table of Contents

List of figures

List of tables

1. Introduction

This chapter aims to introduce the reader to the study and to describe the current discussions about digital strategy alignment and digital transformation. The goal is to examine the thesis topic and to give a background about why this is an important area to study and followed by a problem formulation and the purpose of the study along with the research questions.

1.1 Background

The manufacturing industry has changed significantly over the last centuries. The scale, breadth, and ramification of manufacturing processes have changed dramatically from the very basic handicraft processes to smart systems and facilities. The technological part was the main feature of the industrial revolution. At first, operationalizing the production by using the power of water and steam. Then, producing products in mass by the discovery of electricity. Later, minimizing the human-machine interaction by automating production processes through the use of information technology and electronics. Now, the world is living in the era of digital revolution, i.e. the Fourth Industrial Revolution, in which production machines and facilities are exchanging information, generating actions, and controlling processes in real time through using different information and communication technologies (Akdil et al., 2018; Morrar & Arman, 2017; Demirkan et al., 2016).

Changing market dynamics and the Fourth Industrial Revolution arousing the manufacturing industry and forcing many companies to transform their business principles into Industry 4.0 principles, i.e. digital transformation (Akdil et al., 2018). Going to digital transformation to meet customer demands is the new industry trend in terms of the growth potential, differentiation, and added value created for the customers (CGI, 2017). In business, the term digital transformation is used to describe a radical institutional change with a completely new business ecosystem by leveraging different digital technologies to all aspects of the business (Deloitte, 2018). From literature, Demirkan et al. (2016) state that:

> *"Digital transformation is the profound and accelerating transformation of business activities, processes, competencies, and models to fully leverage the changes and opportunities brought by digital technologies and their impact across society in a strategic and prioritized way"*

Over the last years, the way of thinking about technology in business has been changed and evolved to include organizational, environmental, and social aspects. However, this has introduced a higher level of uncertainty about the needed capabilities and strategies that will cover these aspects and enable digital transformation (Salkin et al., 2018). According to the results of a survey conducted by CGI (2017), companies are reporting digital transformation as a business priority that needs a strategy to drive this transformation. The coevolution of technology and the business strategy needs to be a continuous development process such that affords new opportunities for growth and expansion (Salkin et al., 2018).

The opportunity to reimagine the market digitally is essentially defined by a strong digital approach that cultivates a society capable of evolving and inventing the new ways of operating

(Deloitte, 2015). In other words, technology will not improve business digital transformation and will not add competitive advantage on its own, it will need a structural change and development agenda to link and align digital strategy principles to specific business domain and definite business strategy, both in the short-term and long-term (McKinsey, 2017; Carr, 2003). According to industry-wide study performed by Deloitte (2015), maturing digital companies concentrate their efforts on incorporating emerging digital technologies such as cloud computing, big data analytics, and industrial internet of things, in the context of changing how their businesses operate. Whereas the less-mature digital companies concentrate on addressing specific market issues through individual software technology.

With the fast-emerging technologies, companies have many options for digital resources to choose from, therefore, companies should develop a digital strategy to guide their digital transformation for needed digital recourses (Mckinsey, 2017; Yeow et al. 2018). In this context, Yeow et al. (2018) define digital strategy as a plan that uses digital resources that serve the needs of the business to achieve short-term and long-term business objectives. Developing a successful digital strategy offers guidance for executives to drive digital projects, measure their success, and then re-guide those efforts if required. Having a strategy-driven digital transformation helps in combining varied of products and services into applications, strengthening products and services offerings with digital knowledge and competence that help in addressing market challenges, and increasing value across products life cycle. Therefore, the process of creating digital strategy will be acting as a driver and foundation of the digital transformation that provides a radical and innovative change in business models (Ross et al., 2017).

Organizations face enormous shifts in their organizational and strategic structures in reaction to technological developments and environmental dynamism. In other words, organizations need to change their strategies and organizational structures over time to chase “alignment” between *what* the organization is trying to achieve (purpose) and *how* the organization will achieve it (strategy) (Yeow et al, 2018). A significant challenge in digital transformation is to align the digital strategy with the business strategy (Ross et al, 2017). Although 96% of executives in the survey of CGI (2017) state that they have developed and created a digital strategy, only 10% have delivered enterprise-level outcomes. This indicates that many businesses do not recognize strategic alignment in their digital strategy creation process (Deloitte, 2015; CGI, 2017).

In recent years, increased digitalization of the manufacturing industry and fast-emerging technologies have important ramifications for strategic alignment, it is no longer a matter of dealing with technologies in isolation from the business strategy; instead, using and arranging technologies across multiple elements of the business, not only at the strategic level but also at the functional and resources level (Ross et al, 2017; Yeow et al, 2018). Demirkan et al. (2016) emphasize the alignment of digital strategy with the business strategy as an important criterion for optimizing the overall business. In this context, a study performed by Capgemini (2012) on companies that have developed digital strategy showed that companies with high digital strategic alignment are 9-26% more profitable. In the same report, companies with higher

strategic alignment showed more focused investments and engagement of employees in identifying new potential prospects.

Yeow et al. (2018) emphasize that digital strategy should support the goals and objectives of the business strategy and leverage the opportunities associated with digital technologies and their impact across business functions. In other words, digital strategy is naturally cross-functional and therefore impacted by growing organizational capabilities. Porter (1996) states that strategic alignment includes a series of continuous actions that align the moving goal of the developed strategy. Therefore, strategic alignment is not an occurrence but a cycle of continuous organizational adaptation and improvement. Put together, fitting the digital strategy to a specific business environment is becoming extremely necessary, because if not, no real value can be provided. On the contrary, lack of strategic alignment will enhance ambiguity in realizing the benefits and values of the organizational capabilities and therefore the origin of exceptional performance (Porter, 1996).

1.2 Problem formulation

The initial literature review indicated that strategic alignment is a widely explored area by scholars, in particular, the business-IT strategic alignment, where the scope and the fit of the technology the business use is defined as a function detached from the norms, culture, and values that are shaping the business. For instance, many authors discuss and focus their strategic alignment models on the development of IT capabilities to benefit business objectives, e.g. Broadbent et al. (1996), Burn (1997), Sabherwal et al. (2001), and Wagner (2007). However, important aspects of alignment are not considered such as communication and knowledge sharing (Alaceva & Rusu, 2015).

Although the topic of digital transformation is trending over the past 20 years, far less research has been conducted on the strategic alignment between the digital strategy and the business strategy. According to Yeow et al. (2018), a lot of misalignments occur between the digital strategy and resources when companies are moving towards developing a digital strategy, and hence, deviating from business objectives. In the same study, the authors argue two main reasons why strategic alignment with regards to digital strategy is challenging: first, the dynamic context of the digital strategy makes it difficult for companies to entirely articulate their digital strategy; second, digital strategy is multi-functional per se, so alignment demands that technological and business resources be concurrently built and reconfigured through several organizational processes.

Chanias et al. (2019) emphasize Yeow et al. (2018) findings stating that the digital strategic alignment is a constant cycle of coordination due to the moving target of digital strategy. In this context, the sense of strategic alignment is still relevant, but in a new way to cope with the dynamic context of the digital strategy.

1.3 Purpose and research questions

Given the background and the problem presented above, it is conspicuous that companies should understand how to link their business objectives, values, and goals with the emerging dynamic strategy that is associated with digital transformation. According to Berghaus & Back (2016), the digital transformation process is not linear and there are different possible strategic actions. Companies should understand the difficulty of these actions and how to prioritize them in order to build the base for successful and strategically aligned digital transformation (Berghaus & Back, 2016). Therefore, this study is aimed to investigate the strategic alignment for companies in their digital transformation journey, to gain an understanding of the potential prospects and threats.

The purpose of this thesis is to identify how companies can achieve digital strategic alignment between digital strategy and business strategy in the manufacturing industry

To fulfil the purpose, three research questions have been developed. The questions do not cover all potential facets of the strategic alignment between the digital strategy and business strategy but offers a strong base for fulfilling the purpose.

Research questions:

RQ1: What are the enablers and inhibitors for digital strategic alignment?

RQ2: What are the challenges manufacturing companies are facing in the digital strategic alignment?

RQ3: How can digital strategic alignment be achieved in manufacturing companies?

1.4 Scope

The meant audience of this thesis are management and innovation students, academic personnel and industry professionals interested or involved in the topic, for instance digital strategy leaders, chief digital officers, digital strategy management consultants or strategy planners. Accordingly, the reader is believed to have basic management expertise.

Few restrictions on the reach of the study were rendered to retain emphasis on the key subject and finish the analysis within the planned 20-week time period. The focus of the thesis is the digital strategy and its alignment with the business strategy in the context of the manufacturing industry. The meant area of study is on the business unit level, not corporate level. In other words, the scope will be focused on the strategic alignment types that are developed within business unit boundaries, such as business alignment, IT alignment, structural alignment, and strategic alignment (Henderson & Venkatraman, 1993). Any other type of strategic alignment involving contact with forces beyond the business unit boundaries will be not considered, for instance, contextual alignment (Henderson & Venkatraman, 1993).

These constraints influence the study breath, for instance, the deep technical investigation of the technological, IT, security aspects of the topic will be also not further considered. As it is deemed an analogous field to digital transformation problems that require a radically specific frame of reference and thorough analysis into scientific evidence. The expected 20-week time period restricts the volume of research in terms of the amount of scientific evidence and empirical data that should be collected and evaluated.

This study is part of an on-going project called SMART-PM, Sustainable Manufacturing by Automated Real-Time Performance Management. SMART-PM is funded by the Swedish agency for innovation (Vinnova) and is performed with the participation of companies from the Swedish manufacturing industry and institutes from academia and research.

1.5 Thesis outline

Chapter 1: Introduction

The first chapter aims to introduce the reader to the study and to describe the current discussions about digital strategy alignment and digital transformation. The goal is to examine the thesis topic and to give a background about why this is an important area to study and followed by a problem formulation and the purpose of the study along with the research questions.

Chapter 2: Methodology

The second chapter discusses and describes the methodological decisions and the authors' approach on how the study was run. The chapter explains the study's research approach, describe the different phases of the workflow, how the analysis was performed, how the data was gathered, and discusses the study's legitimacy and reliability.

Chapter 3: Theory

The third chapter aims to provide the reader with the theoretical knowledge of the topics covered in this study. These topics will provide the background necessary for common understanding and will also serve as a guideline when discussing findings and results.

Chapter 4: Empirics

The fourth chapter includes findings supporting the research questions. It begins by looking at two case studies on how to formulate a digital transformation strategy and how to achieve alignment between the business and digital strategy. It then introduces contemporary reports from consultancy firms referring to enablers, inhibitors and challenges of digital strategic, alignment. In concludes by presenting the findings from interviews with the expert panels.

Chapter 5: Analysis

The fifth chapter aims discuss the enablers, inhibitors, and challenges of achieving strategic alignment for digital transformation. It also introduces a model on how this alignment can be achieved. Supported on the findings from the empirics, it provides an analysis for each of the research focus areas supported both by the theory previously introduced and the observations from the interviews to the expert panel.

Chapter 6: Conclusions

The sixth chapter aims to answer the three research questions based on the analysis and discussion. It also introduces limitations to the research by mentioning directions for further research.

2. Methodology

The second chapter discusses and describes the methodological decisions and the authors' approach on how the study was run. The chapter explains the study's research approach, describe the different phases of the workflow, how the analysis was performed and the data gathered, and discusses the study's legitimacy and reliability.

2.1 Research approach

The research approach of the thesis is divided into five sections, namely, the direction of research, research strategy, the time scale of the study, empirical data types, and the scientific approach. The intension is to give the reader a full perspective on how the authors approach their research. Figure 1 summarizes the selected research approach.

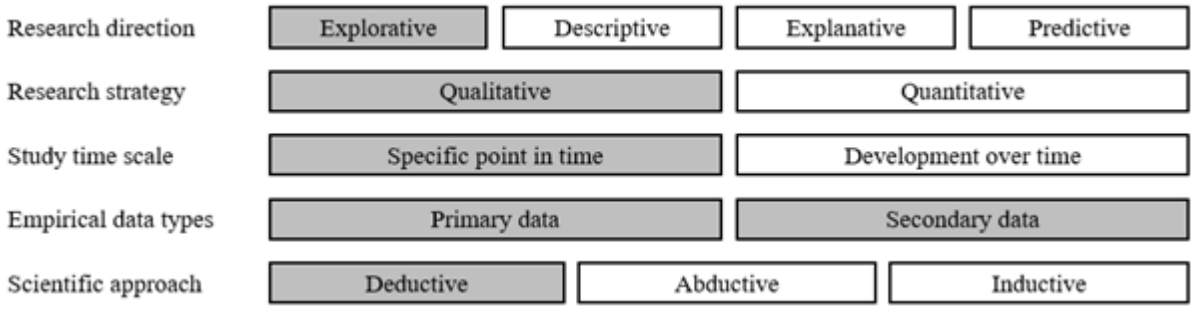

Figure 1: Research approach summary

Discussion and explanation for each section of the selected research approach is provided in the following pages.

2.1.1 Research direction

The objective of the study is to identify how companies can achieve strategic alignment between the digital and the business strategy in the context of the manufacturing industry. Also, the study targets to identify the enablers, inhibitors, and challenges of the strategic alignment that manufacturing companies are facing in their digital transformation journey. Therefore, the research direction of the study is explorative in nature.

The explorative direction of research is generally selected when it is challenging to determine what the exact problem is and what knowledge is required to address it. Also, the explorative research is usually used as a pre-study that provides a summary about the problem for further investigation (Lekvall & Wahlbin, 2001). This is valid for this study as there have been a few research conducted on investigating the topic of strategic alignment for digital transformation. Moreover, the study can be used to obtain perspective and understanding about the strategic alignment in terms of the digital strategy and business strategy to provide guidance for decision taking and a framework for potential implementation.

Furthermore, according to Lekvall and Wahlbin (2001), there are other three research directions, namely, descriptive, explanatory, and predictive. Depending on what kind of inference the authors want to draw from the research, the appropriate research direction is

selected. Descriptive study is applied when information regarding specific topic exists and want to describe the "what" regarding the subject being studied rather than specifying the causes behind it. Explanative research or the causal relationship research as describe by Lekvall and Wahlbin (2001) is used to study the cause-and-effect relationship between two or more variables. Therefore, this type of research requires a deep understanding of the topic being researched. The last research direction, predictive research, is used to predict and forecast future phenomena based on deep knowledge. Also, predictive research can be used to build on the explanatory research findings i.e. relationships between different variables.

The timeframe of the study limits the depth of the knowledge gained about the strategic alignment and digital transformation. Therefore, owing to the lack of deeper knowledge of strategic alignment between the digital strategy and the business strategy, the explanatory and predictive research directions were not considered possible. Moreover, the research about the topic of strategic alignment between digital strategy and business strategy is lacking, thus, the descriptive research direction was not considered.

2.1.2 Research strategy

According to Lekvall & Wahlbin (2001), the two most frequent approaches of doing research are through either quantitative or qualitative research strategy.

The research strategy used in this study is qualitative research because of the following reasons. Firstly, the study aims to get an understanding of the underlying views, causes, and motivations of the digital strategic alignment and to provide perspective or to help build concepts or theories for future quantitative research. In addition, the study is based on soft data, for instance, documents and unstructured interviews which are then evaluated with data gathered from the literature (Merriam, 1994; Lekvall & Wahlbin, 2001). Secondly, according to Lekvall &Wahlbin (2001), the qualitative research strategy is indicated when the research topic is poorly understood, which aligns with the topic of this study.

Quantitative studies are used to measure the problem of the research by gathering data represented in numerical form or data that can be converted into functional statistics using statistical methods. This research strategy is used to measure beliefs, actions, and other identified factors and then generalize effects from a broader group of samples (Merriam, 1994; Lekvall & Wahlbin, 2001).

The qualitative research strategy is more appropriate for this study because a quantitative strategy will indicate that this study will evaluate the problem on the basis of a collection of defined metrics to determine their effects. Moreover, the study is explorative which aims to determine the metrics of the parameters that affect the problem.

2.1.3 Study time scale

According to Lekvall & Wahlbin (2001), the timeframe of the research plays a vital role in how authors approach their research results. Accordingly, the research can be performed either by evaluating the research problem based on the current situation or by monitoring the research problem over a period of time. The first is called a *specific point in time* research, while the latter is called a *development over time* research (Lekvall & Wahlbin, 2001).

The focus of this study is to explore how the strategic alignment between the digital strategy and the business strategy is perceived based on the current situation of the manufacturing industry, and not to examine how strategic alignment developed over a period of time. Therefore, the study's time scale is *a specific point in time*. The explanations for this are the digital transformation topic is currently evolving rapidly, and because the time frame of the study was limited to 20 weeks. Once the concepts of the strategic alignment for digital transformation have matured, conducting *a development over time* research will definitely be an interesting approach for further studies, which will offer a deeper perspective into the real transformation phase.

2.1.4 Empirical data types

Data used for research was classified into two types, namely, the primary data, and the secondary data. The first is the type of data that is collected directly and considered new information. The latter is the type of data that is collected by others and considered existing information (Lekvall & Wahlbin, 2001). This study uses both, the primary data and the secondary data. The primary data gathered by interviews with experts from the manufacturing industry. The interviews were designed to cover the different aspects of the strategic alignment and to obtain a holistic perspective and viewpoint on different associated fields. In other words, interviews were conducted to cover the factual and the meaning level of the topic (Lekvall & Wahlbin, 2001).

Furthermore, different sources – such as journals, articles, case studies, research reports, and publications – were used to supply the study with secondary data to gain a broader dataset of thoughts and views and to link the literature with the primary data. The sources used to collect secondary data were from consultancy companies and Google scholar.

2.1.5 Scientific approach

Researchers can apply primarily two different reasoning approaches in scientific studies, namely, the inductive and the deductive approaches (Lekvall & Wahlbin, 2001). The inductive reasoning implies that the research is built on empirical observations with the aim of developing theory. In other words, the theory is absent in the inductive approach and the research conclusions are used to generalize or transform study results (Saunders et al., 2009; Lekvall & Wahlbin, 2001). In contrast, the theoretical framework is the departing point in deductive reasoning. In other words, the deductive reasoning implies that the research conclusions are drawn for corroboration or falsification of the used theoretical framework by testing and evaluating theory using empirical findings of the study It can be challenging to determine whether a study uses one approach or the other, therefore, during the course of the research process different aspects from deductive and inductive approaches can be used. This is widespread in a third reasoning approach called the abductive approach, where the departing point is empirical observations deviated from theory with the aim of developing new understanding, therefore, the research conclusions are drawn for suggestions and predictions (Saunders et al., 2009; Lekvall & Wahlbin, 2001).

Since the research reasoning can be viewed as a sliding scale between inductive, deductive, and abductive, this study is strongly deductive, partly inductive, and not abductive for the

following reasons. Firstly, the study is deductive because it is focused on the development of a framework in the frame of reference, which is used to collect and explore the empirical data. In other terms, the frame of reference is used as a starting point to draw conclusions by examining the empirical material. Secondly, the study is partly inductive due to the theory about the strategic alignment between the digital strategy and the business strategy is very few in literature. However, the study does not aim to develop new theories or predict future directions, which is why the authors may claim that the scientific approach of the thesis tends to be deductive.

2.2 Research Process

The research process is the journey from a purpose or research (problem) to a conclusion (results). This process can take several routes, which can in many cases result in loops where previous steps must be repeated. Nevertheless, if the process is seen as a linear one, the following steps can be identified (see Figure 2).

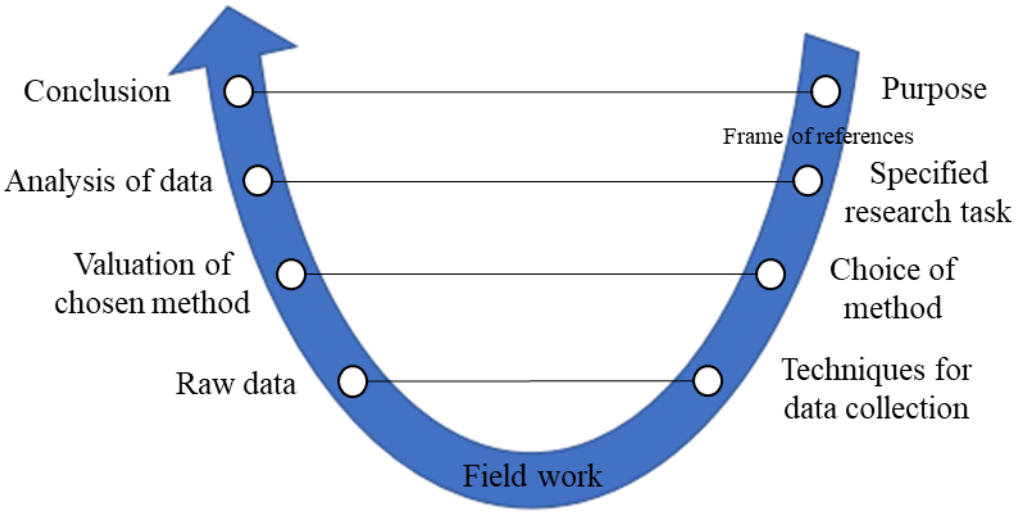

Figure 2: The research process. Adapted from (Säfsten, 2015)

The thesis research followed the structure described in the perspective from Figure 2. A brief narrative for each step is detailed below using a systematic investigation approach described by Eriksson and Wiedersheim (2001):

- The first step was to identify the problem to address with the research. This was done in conjunction with the supervisors, as they had identified the need for a study such as this from an ongoing research project.
- Once the purpose of the research was narrowed, the focus of the study was specified through the research questions.
- The work approach (choice of method) was scheduled considering resources (time, budget, knowledge), methodology requirements (validity, reliability and impartiality), and the audience for the study (Who are the results for? What will they gain from this?)

- The raw-data collection came from two main sources: the literature review and interviews with various field experts. The research relies heavily on theory. Hence, the literature review section is quite extensive. Then, findings from the literature were contrasted with findings from interviewing experts in the fields of research, and the method followed was evaluated.
- The next step included the analysis of the results and drawing conclusions from the findings.
- Finally, recommendations were developed according to the analysis and the conclusions, along with reflections from the students regarding the process of the research and next steps for future investigations in this field.

Expert Panels as a Research Method

The qualitative method used in this research was the expert panel and the data collection method used for this panel were interviews. The use of expert panels is a preferred method for combining existing knowledge and being able to draw conclusions and recommendations from a selection of research questions (Waltz et al., 2014).

This section describes three different approaches presented by Waltz et al. (2014) for the use of expert panels, along with the one resulting more suitable for this thesis.

- The first of the three approaches was presented by Powell et al. (2014), and it refers to a web-based Delphi process to find agreement among the experts and conclude various implementation strategies from their observations. The purpose of this method is to achieve consensus among the experts by differentiating isolated implementation strategies. This is reached by detecting, developing and testing implementation strategies. The challenge for this approach is the use of inconsistent terminology and insufficient description of the strategies in the literature. Hence, it usually takes several iterations of the questions in order to gain refinements in the agreements (Waltz et al., 2014).
- The second approach introduced by Waltz (2014) uses a conceptual chart to recognise interrelationships among the selection of strategies grouped. This is referred to as concept mapping, and it connects the strength of the panel of experts to shape one concept. In this method, observations are usually grouped by similarities. This method can be implemented online and asynchronously. The advantage of this method is the capability to describe in a qualitative matter how the target audience debates a broad scope of topics (Waltz et al., 2014).
- Lastly, the third approach described by Powell et al. (2014) leverages from the link and engagement within the experts to describe fit recommendations for implementing a strategy. Here, all experts from the panel expose frequent and accurate challenges they see every day, along with advantages. Then, through the use of an iterative process of assessing the validity of each scenario, experts come with recommendations (Waltz et al., 2014).

For the purpose of this thesis, the approach followed was the second one which is related to the use of conceptual mapping. Through interviews, experts were asked their opinion regarding

strategic alignment based on what they had observed in their field of expertise. In some cases, the members of the panel worked in different fields and their observations were specific to that particular industry. However, it was still possible to find consensus and similarities among their observations. In fact, since the experts had different areas of expertise, this increased the validity and reliability of the findings since it repeated a pattern across various fields and experiences.

2.3 Literature Material

The authors have conducted literature review in order to get a profound and better understanding of the thesis topic and to build the foundations for the literature-based frame of reference. Table 1 presents, in summary, the selected areas from the literature and the reasons for selection.

Table 1: The selected literature areas

Selected area	Reason for selection
Business strategy and Digital strategy	Before being able to talk about strategic alignment between business and digital strategy, both concepts are explained in detail in order to allow the user to differentiate between them and understand to a certain depth what each concept involves as part of a company's overall strategy.
Digital transformation and organizational change	In order to become more digitalised, companies much go through a digital transformation process. In this section, guidance on effective approaches for achieving the goal of becoming more digitalised are presented. Additionally, any transformational process will put stress over employees. A section regarding change management and how to tackle the most common constrains are highlighted.
Strategic alignment	To understand how businesses align their organizational objectives and goals with their vision; to understand the measurements and the dimensions of the strategic alignment that determine the organizational performance; to gain knowledge about the different strategic alignment models and frameworks used in literature.

'Chalmers University online library' was the main search engine used in this thesis to explore, search, and collect scholarly references for the literature review. The first phase of the literature review was collecting and categorizing the literature material of the selected areas in Table 1. The research keywords used for that purpose was the following: *Business Strategy, Digital Strategy, Digital Strategic Alignment, Strategic Alignment Model, Digital Transformation, Digital organizational change, Digitalization of business, and Sustained Strategic Alignment.* At the beginning of collecting the literature material for the Strategic Alignment related keywords, the literature was very IT-technical concentrated, and less management focused. Therefore, in order to solve this problem management aspects of the Strategic Alignment were included in the search.

The process of collecting literature material was conducted in two steps. The first step was to determine the relevancy of the collected material which was performed by scanning and skimming the abstract and conclusion sections of the collected material. Then, the authors used a five-point scale to rate the collected material such that the "5" represents the material with the highest relevancy to the thesis purpose, and the "1" represents the lowest relevancy to the thesis purpose.

The second step was to categorize and label the collected material into the selected literature areas. Then, the authors read fully and in detail the categorized material for academic relevancy check and to build the literature-based frame of reference. The academic relevancy check was conducted to ensure that the content material is published by academic institutions to secure the highest quality as academic institutions evaluate the information production prior to publishing. Moreover, a series of sessions with the thesis supervisor as well as thesis opponents were utilized to improve the quality of the theory chapter.

Figure 3 illustrates an overview of the frame of reference gathering.

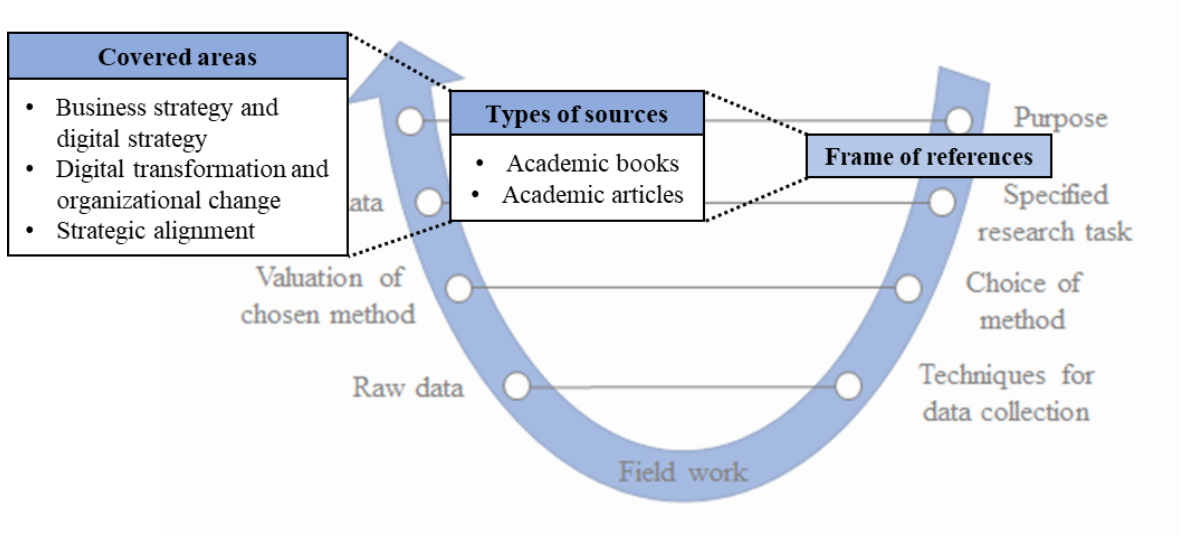

Figure 3: Frame of reference overview

Throughout the gathered information for the frame of reference, there are many potential strengths and shortcomings which need to be addressed in terms of source quality. On the one hand, the wide age range of the selected sources offers a balance between new and conventional viewpoints which may lead to a more objective viewpoint. However, the digital strategic alignment is still a new area in academic research and not yet well developed, which makes the task of finding references challenging. Owing to this, the references search has been shifted towards the underlying and well-developed concepts of digital strategic alignment, such as IT-business strategy, IT strategic alignment, and IT impact on business.

On the other hand, the limited number of scholars who searched the topic of digital strategic alignment in academia can affect the frame of reference negatively through subjectivism. To avoid this, the main sources are paired with complementary sources such as case studies and reports from consultancy firms that represent the underlying and well-developed concepts of digital strategic alignment. Moreover, due to the limited timeframe of the thesis, some relevant

insights in the academic material may have been missed. To minimize this impact, a substantial amount of time was intentionally expended on designing keywords and gathering academic material.

2.4 Empirical Material

The empirical material collected for the study was based on the theoretical framework which was developed based on the literature-based frame of reference. The focus of the gathered empirical material is the *enablers, inhibitors and challenges of the digital strategic alignment*, and *digital strategic alignment achievement*. Moreover, the areas of focus of the gathered empirical material are digital strategy, digital transformation, and strategic alignment. Two data collection methods have been used in the thesis to collect the empirical material, namely, *documents and records (Reports and examples of digital strategic alignment from industry)*, and *interviews*. Each type of data collection is further discussed below.

The various sources of empirical data are intended to be input evidence for the research, and the specific forms of information gathered have been utilized to gain viewpoints and perceptions of the stakeholders interested in the strategic alignment between the digital strategy and the business strategy. The collected opinions and viewpoints are meant to provide a realistic and factual perception as possible about how to achieve the strategic alignment between digital strategy and business strategy. Figure 4 shows an overview of the empirical material gathering.

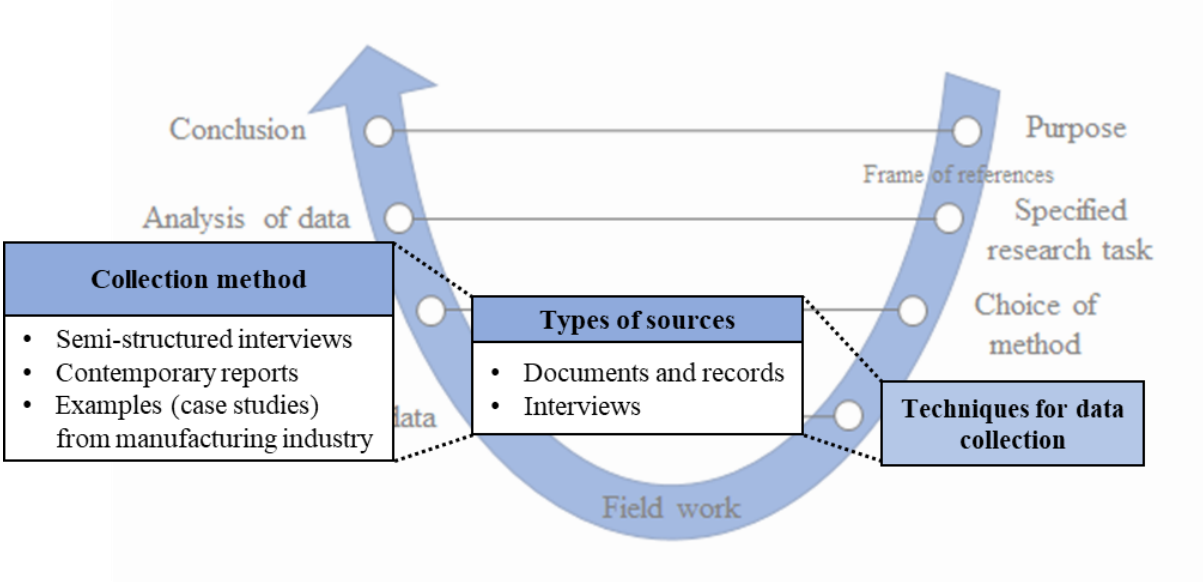

Figure 4: An overview of empirical material gathering

The first data collection method used is the *documents and records* which consist mainly of contemporary reports and case studies conducted by major consultancy companies such as Deloitte, PwC, BCG, Capgemini, and Mckinsey. The case studies and reports were selected based on their subject and outcome on digital strategy creation, digital transformation, and strategic alignment achievement. The selected reports consist of surveys, projects, and

interviews conducted by consultancy firms and conclude their point of view about the subject. The case studies consist of examples of digital strategic alignment from the industry and how companies have achieved a higher degree of strategic alignment. The selected cases are from the manufacturing and telecommunication industry which are strongly linked with the thesis purpose. The purpose of providing some examples of strategic alignment is to gain a better understanding of how strategic alignment is perceived in the industry. Section 4.1 and 4.2 discuss and summarize the outcome of this collection method in line with the focus of the empirical material.

The second data collection method used is *interviews*. During an interview, the researcher engages in a conversation with interviewee(s) with the purpose of finding out more of a topic. Interviews can be unstructured, semi-structured or structured: unstructured interviews are selected when the researcher has strong knowledge and understanding about the topic being researched; semi-structured interviews are selected when the view or reality might differ from one social context to another (criticalist paradigm or a constructivist paradigm); and structured interviews are recommended when the view of reality is one and it is independent to humankind (positivist/post-positivist research paradigm) (Waller et al. 2016).

Semi-structured interviews were adopted for the study since it is more appropriate to the explorative nature of the study (Waller et al. 2016). In other words, Semi-structured interviews fit more when the purpose is to explore different opinions and viewpoints (Waller et al. 2016). The interview guide for the semi-structured interviews was prepared by the authors based on the knowledge gained from the literature-based frame of reference. To ensure flexibility and discussion during interviews and to allow the interviewee to build further on their answers, the authors designed the interview guide with open-end questions. As a result, most of the answers during the interviews were a result of a discussion on an expansive topic. This helped in covering the three areas of focus of the interviews. Figure 5 shows the interview areas of focus.

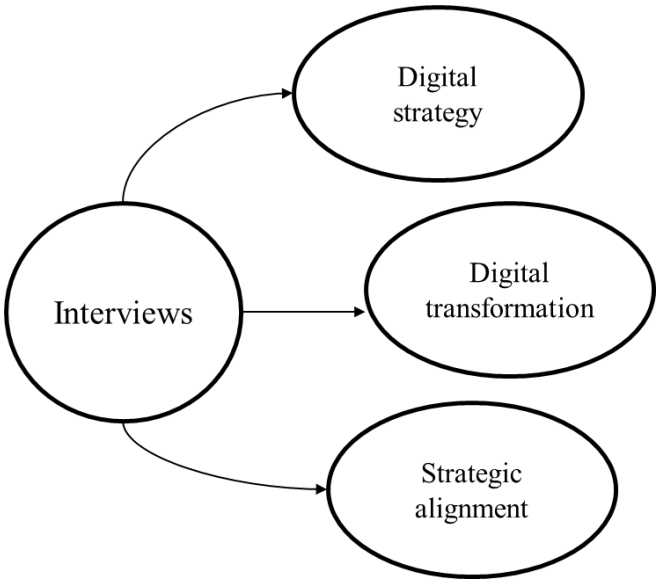

Figure 5: Interview areas of focus.

Communication during interviews can occur online or in writing, face-to-face or mediated, live, or asynchronous. All options work best in certain contexts yet are not exempt from limitations (Waller et al. 2016). Due to limitations outside of this research, all data gathered through online interviews as it was not possible to meet face-to-face. According to Malterud et al. (2016) and Waller et al. (2016), interviews must be planned considering the time available, allow for some delays, and if the interviewee wants to ask some questions before starting. Therefore, all experts were contacted via e-mail attached with a brief presentation about the thesis topic, interview guide questions, and time schedule sheet. All interviews have been conducted after one week from each expert response which allows some time to review the interview guide questions.

Interviews can take place individually or in groups. Focus groups become useful when you are interviewing a few people at once and there is a structured interview prepared regarding a topic (Waller et al. 2016). An advantage of group discussion is people can build on ideas of others or come across a different point of view which encourages positive discussion (Zaharia et al. 2008). Nonetheless, there is a risk where the group's dynamics have influence over the answers. For example, if there is a figure of authority or a strong personality, they could influence others' opinions even if they do not entirely agree (Guest et al. 2017). Individual interviews are useful when exploring a new topic. Individual interviews allow in-depth analysis, higher potential for insights, and less bias than with focus group interviews (Waller et al, 2016)

All interviews have been conducted individually except for one which was conducted in a group of two people. The reason why this interview performed in a group of two is that both interviewees are participants in the SMART-PM Project and working together in the same department but at different organizational levels. Therefore, it was advantageous to perform it in a group to encourage positive discussion.

As mentioned earlier, the thesis is part of the SMART-PM Project which includes a number of participant organizations from the Swedish manufacturing industry and academia. The authors, along with the thesis supervisor recommendations, selected the interviewees who their profile and experience fit the purpose of this study and cover the interview areas of focus. However, some of the interviews were conducted with respondents from other organizations to cover all three areas of focus. A respondent summary can be viewed in section 4.3.

According to Kvale (2008), forming an interview setting is important to keep interviewees focused. Therefore, during interviews, both researchers were present; one led the interview and asked questions and the other took notes for further discussions. The interviewees were directed by the authors at the start of the interview about the purpose of the interview which gave the interviewees the opportunity to ask clarifying questions before going deeper into the interview. In line with the selected research method, the authors focused their questions during the interviews to target the interviewee's own opinion not their company's point of view. All conversations have been recorded after granting permission from the interviewee. This led to everyone being able to concentrate primarily on the interview purpose, as the recordings required less emphasis on making notes during the interview. All interviews have been

transcribed by the authors and sent to the interviewees for a review such that some corrections were done immediately during the course of data collection phase.

The process of collecting empirical data has strengths and weaknesses that need to be considered to ensure the highest data quality. The conducted interviews along with the collected documents have served the purpose of the thesis perfectly within the 20-week timeframe. Moreover, the interviews included experts from the manufacturing industry and academia, which allow the authors to build and draw connections between how digital strategic alignment is perceived in both sectors. Also, this has helped in building a strong base for the analysis of the academic material and the empirical material. However, the reliability and validity of the interview data can be affected by the authors' subjectivism, bias, or lack of interviewing skills (Waller et al. 2016). To avoid this, an empirical data revision has been conducted with the interviewees by sending the transcribed interviews for facts correction. In addition, the authors have shared their opinions and experiences with the interviewees to ensure the common understanding of the subject and to become a part of the interviewing frame.

2.5 How the analysis was conducted

The analysis is divided into three sections to explore each of the research questions. The sections are: (i) enablers and inhibitors of strategic alignment in digital transformation, (ii) challenges for developing an adequate digital strategy which supports the main business strategy, and (iii) achieving strategic alignment. Figure 6 shows how the analysis is structured:

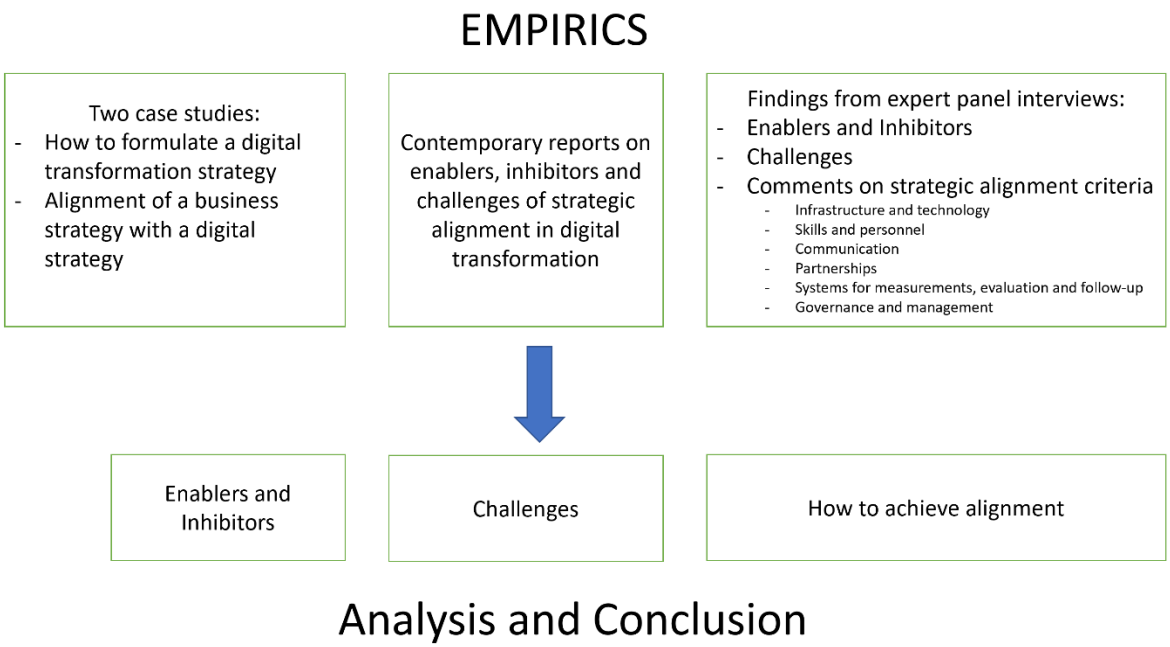

Figure 6: Structure of the analysis.

The empirical data gathered consists of two cases studies on how to formulate a digital transformation strategy and reaching alignment between the business and digital strategy. Then, it continues to introduce contemporary reports from consultancy companies on the enablers, inhibitors, and challenges of achieving this alignment. Finally, it presents the findings

from the interviews with the expert panels on these areas, and additionally it captures their comments on other strategic alignment criteria. All this is then used in the analysis to answer the three research questions based on the theory and findings from the expert panel.

2.5.1 Ethical implications of interviews

For this research, several interviews were conducted with field experts. There are four main research requirements when it comes to handling data collection through interviews: information, consent, guaranteeing confidentiality and utilization of findings (Waller et al. 2016). Below are mentioned the ethical implications of interviews for this thesis study, along with a brief description on how each of these requirements was achieved.

There are few ethical implications to keep in mind when conducting interviews. Participants need to be informed of the purpose of the research, there must be transparency if the conversation is being recorded and their approval for this needs to be requested before the interview begins (and in some cases even in writing), anonymity needs to be guaranteed if necessary, and the finding from the interviews must not be taking the interviewees voice out of context.

Ways to mitigate the impact of these implications are to obtain consent from the interviewee and inform them promptly that the interview will be recorded, especially if this might affect their willingness to participate as part of the research. Additionally, clarifying the purpose of the research can be achieved with an interview schedule where goals of the study are specified. In order to protect the identity of the participants, no elements which would let others identify them should be included.

Finally, when possible, the interviewee can be asked to read how their answers were interpreted just check their point of view was not misunderstood or taken out of context. This last action is not always possible due to time and budget restrictions or the inability to contact the interviewee (Waller et al. 2016).

For this thesis, all interviews were conducted online and live, some individually and others in groups. The conversations were recorded, and anonymity was guaranteed to all interviewees. It was possible to review with each participant if the finding reflected their thoughts so the subjectivity of the researches did not influence the results, and that the data captured is aligned with what the respondents intended to say.

All interviewees were informed via email of the purpose of the study. Additionally, they received the questions prior to the interviews along with a short presentation of the project. Finally, at the start of the interview, both researchers introduced themselves and explained the main objective of the study and that they would not be a part of any other commercial purpose.

The interviewees need to provide consent that they agree with the process and how the interview will take place. This needs to happen before the actual interview, and ideally in written to avoid misunderstandings. Then, at the start of the interview, each participant was asked if they felt comfortable being recorded in order to go back to their comments during the analysis. All agreed and recording began only after they had said so.

The participants of the interview had all been part of a previous study where they were representing their companies. However, for the purpose of this study, it was not relevant the place where they work but rather the industry and expertise that they as professionals had. Hence, any elements which would help identify their place of work were omitted.

No sensitive information which would help identify one of their clients during the examples given was published, and only general references were done at an industry level and not company level. Also, the names of the interviewees were also left out of the study, and only their field of expertise was mentioned.

Lastly, the utilization of the findings argues that the data collected for the purpose of one study, including sensitive and personal data, cannot be disclosed to third parties (Waller et al. 2016).

All respondents were informed on how the findings from the interviews would be used as part of the study, and that they would not be a part of any other commercial purpose.

Before publishing the final research, all interviewees were provided with a copy of the research in order to have evidence that neither their personal data nor place of work was disclosed in the results. Additionally, they had the opportunity to review if their point of view was captured correctly and not taken out of context.

2.6 Methodology Discussion: Validity and reliability

There has been debate regarding the use of qualitative research methods. In contrast to quantitative research, qualitative research is perceived as being more abstract and subject to the researcher's interpretation, resulting in an interesting but also challenging approach for certain studies (Ali and Yusof, 2011).

The validity of a study will cover if a research project is exposed to subjectivity or if it measures correctly what the study should focus on (Lekvall and Wahlbin, 2001). The most common dimensions of validity are internal and external. The internal validity will assess how effectively the results are consistent with reality, while the external validity will see how applicable these results are to other scenarios (Merriam, 1994).

When comparing quantitative studies to qualitative ones, the validity of qualitative ones are generally higher since the researchers can enrich their data by asking very specific questions or using observations. This provides them with the opportunity to see beyond the written data, allowing for deeper observations to be uncovered (Lekvall and Wahlbin, 2001).

In the case of this study, the findings of the research can be applied to several business scenarios, and it is not specific to one particular industry. Furthermore, the interviewees work across multiple areas of business, and their observations are comparable, which suggest that there is consistency between the observations and reality. This results indicates a high validity.

The interview questions were prepared according to the main principles of strategic alignment. The interviewees were selected with the purpose of covering experts from different areas and industries. This allowed gaining several points of view to one same question. The purpose of aiming to interview people with different roles and different industries was to assess if there

was consistency in their observations and see if conclusions could be made across various industries.

Another concept considered in the discussion is reliability, which is the extent to which results from the study can be consistent is frequently tested (Lekvall and Wahlbin, 2001; Merriam, 1994). High reliability reduces the bias of a study. This concept is better observed during quantitative data, where the researcher can compare numeric results and see if they are similar. However, for qualitative studies, the reliability can be lower. When it comes to interviews, the responses can be affected by several external factors such as the mood of the interviewee or even their time availability. Nonetheless, for the purpose of this study, the researchers understand that the concepts are clear to all interviewees and were described in detail during the interviews. The low variation in the readings from the respondents suggest that the terminology used was of common understanding and consistent.

3. Theory

This chapter aims to provide the reader with the theoretical knowledge of the topics covered in this study. These topics will provide the background necessary for common understanding and will also serve as a guideline when discussing findings and results.

3.1 Business Strategy and Digital Strategy

The concept of strategy has evolved throughout the centuries. The word comes from the Greek meaning "art of the general", having a military connotation to it (Bracker, 1980). Mintzberg and Quinn (1991) consider that strategy was an organizational aptitude even 2500 years ago connected with abilities such as leadership, administrative skills, public speech and power). Still, it was after World War II where strategy became a core pillar in the business environment, re-restructuring and increasing the complexity on how business was organised (Bracker, 1980). Strategy today acts as a link between external environments and the business world (Porth, 2002).

From a business perspective, strategy refers to the long-term plan of action of a company. This direction includes managing resources, people, and building relationships with various stakeholders (Johnson et al. 2014). Grant (2016) comments on this que scope has shifted from merely focusing on forecasting towards finding direction, strengthening a brand, and finding ways for increase profitability and differentiation. Grant (2016) highlights four elements which most successful strategies have: well-defined long-term goals, knowledge of the external environment, capabilities and internal resources, and effectiveness in the implementation.

A strategy has three main elements: Strategy formulation, strategic planning and strategy deployment (Nickols, 2008). During the formulation, a plan of action is detailed in order to reach the short, mid and long-term goal and objectives. Then, the planning refers to the list of activities which will be conducted at different levels of the business (such as enterprise, business unit or functional level) in order to follow the actions. Finally, the strategy deployment describes how the plan will be rolled out. Figure 7 shows how all these elements are put into action under the strategic management, which is responsible for overseeing the processes. Additionally, all items are englobed by a strategic thinking mind-set. This is referred by Nickols (2008) as the nested concepts of strategy.

Figure 7: The nested concepts associated to strategy. Adapted from (Nickols, 2008).

A strategy can be applied to a variety of areas and levels within an organisation. The most common levels referred to corporate strategy, business strategy and functional strategy (Slack & Lewis, 2017). For this thesis it is important to define the concepts of business strategy and digital strategy, since the aim of this thesis is to study the strategic alignment between both.

Slack & Lewis (2017) present the concept of strategy as a cycle of two models, the business model, and the operating model. The former sets the overall purpose and objectives for the latter, while the latter defines how business model will be achieved. The concept of business model is broadly similar to the concept of business strategy, however, business model implies what the business strategy should be and how to achieve it. The operating model is a collection of functional strategies that represent the organizational design which defines the needed resources and capabilities to achieve business strategy, for instance, the organizational structure and style. Figure 8 shows the concepts of the business model and operating model and their hierarchy.

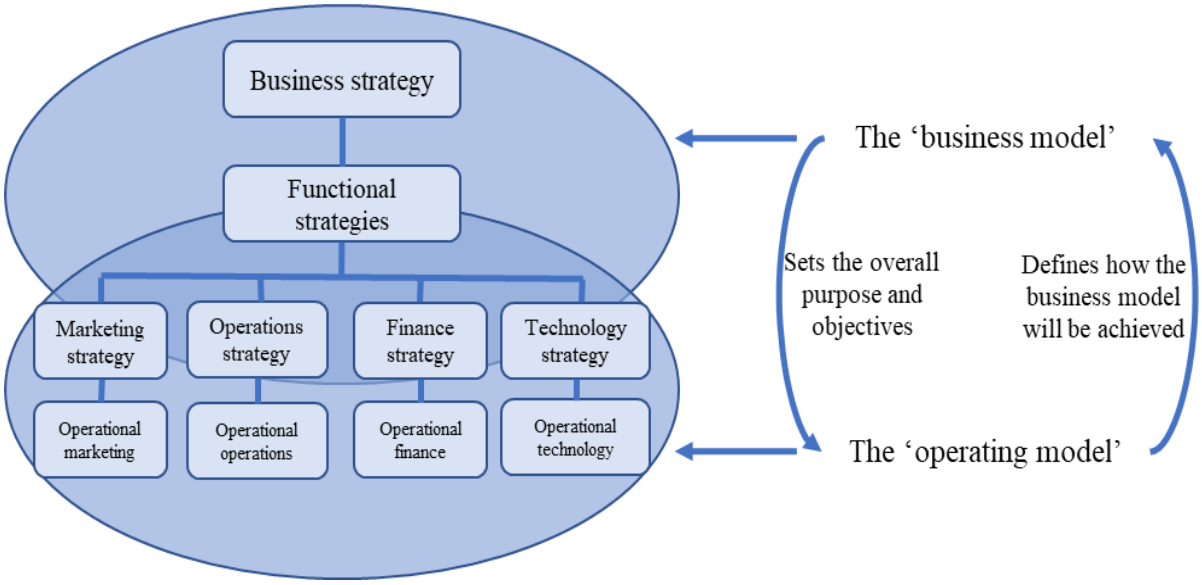

Figure 8: Business and operating model concepts. Adapted from (Slack & Lewis, 2017)

Strategy is what makes a company competitive. A business strategy is mostly used for a company to locate themselves on the map and aim to differentiate from their competitors (Grant, 2016). The people responsible for a business strategy are senior managers, while a corporate strategy is usually defined by top management and partners (Grant, 2016).

It is an approach to making decisions in order to create a sustainable competitive advantage in the marketplace, providing a plan of action and direction on how to compete, which services and products to concentrate on, and how to create a value proposition which is meaningful to the end user (Patel and Cespedes, 2016).

Business strategies are deployed at a division level (Johnson et al. 2014). A competitive strategy incorporates a wide assortment of tactical and strategical decision making tools and procedures, which range from levels of investment in production, distributions, and facilities, pricing, investments in research and development, handling suppliers, contracts and customer

service and management (Shapiro, 1989). Moreover, Slack & Lewis (2017) state nine common elements for business strategy described as follows:

1. *Value proposition*: what the business can offer to the market;
2. *Target customer segments*: identified by the value proposition;
3. *Communication & distribution channels*: how can business reach out the customers;
4. *Relationships*: describe the rapport of business with their customers;
5. *Core capabilities*: describe the needed capabilities to achieve the business model;
6. *Configuration of activities*: describe how to design the activities to achieve the business model;
7. *Partners*: describe the partnerships with other businesses that helps in achieving the business model;
8. *Revenue streams*: describe the revenue channels generated by the business model;
9. *Cost structure*: describe the structure of costs generated by the business model.

Successful organisations need to have operational effectives and a coherent strategy. The strategy should adapt to include best practices in the industry. A good strategy will recognise distinctive activities and how they fit into the mid-term/long-term plan, along with the trade-offs involved. On the other hand, in order to be consistent a coherent strategy must incorporate the three following components: objectives, scope and competitive advantage (Patel and Cespedes, 2016).

Before reaching the level of digitalisation and connectivity available for businesses today, the technology side of a strategy was referred to as IT strategy. Afterwards, along with technological improvements, this concept expanded beyond just information technology. Still today, several businesses refer to their IT strategy instead of talking about digitalisation.

It is important to make a distinction between both. Even though they are related, digital strategy does not equal an IT strategy. The main reason is that the IT strategy considers technology in isolation while a digital strategy relies on digital connections (such as cloud computing or big data analysis) where interactions among various stakeholders is key (McDonald, 2012).

Between the 1980's and until the start of the early 2000's, IT strategy has been kept mostly at a functional level (such as manufacturing, Finance, Sales, Marketing, Human Resources), and it must be coordinated accordingly with the organisation's business strategy (Bharadwaj et al. 2013). This alignment point of view was achieved by the business strategy overseeing the IT strategy, disregarding the importance of IT in influencing a business strategy and altering processes and scope (Henderson and Venkatraman, 1993).

Since the beginning of the twenty first century, significant improvements in information and data management, communications, and connectivity have unbridled new functionalities. Hardware and software are more affordable and have reached better levels of price versus performance. Simultaneously, connectivity has become more reliable and covers more areas of the globe, allowing (and in a way also forcing) for organisations to adjust their industry structures to this new era of digitalisation or industry 4.0 (Bharadwaj et al. 2013).

Traditional business is being redesigned by the introduction of emerging technologies. Hence, the strategies are also affected. Boundaries such as distance, time and functions are now becoming global processes, allowing for work to be take place across multiple stakeholders more now than ever before (Banker, 2006; Kohli and Grover, 2008; Rai et al. 2012). Advances in technology serves as a tool for facing and adapting turbulent environments. These improvement in capabilities have also caused for the pace of technology to shift faster than before, forcing organisations to adapt quickly or be left behind. The communication channels between organisations and their customers and stakeholders have also transformed from a more formal way of communication to several platforms in social media and networking (Susarla and Tan, 2012; Pavlou and El Sawy, 2010).

Moreover, as products and services become more inserted in technology, it is harder to separate a digital offering from core IT infrastructures. Digital platforms are generating new ways of business strategies, making digital strategies just as relevant as a business one. Nonetheless, we often see that a digital strategy is still considered aside from the business one, or as a subordinate (Orlikowski, 2009). This thesis project refers to the alignment between both, and how this can be achieved. It will also make reference to the concept of digital transformation as a way to increase the level of digitalisation within an organisation in order to cope better and benefit from the emerging new technologies promptly in order to gain competitive advantage and differentiation in the market.

Improvements in price against performance for computing capability, bandwidth, storage and software, the future of technology will heavily rely on cloud computing (Bharadwaj et al. 2013). Barnett (2017) describes five different scenarios where companies can benefit from cloud computing and obtain a competitive approach: real-time data enriches customer service, enables managers to know what is happening in a blink, increases operational efficiency, keeps employees motivated by showing where attention is needed and where goal are being achieved, and by identifying performers with an outstanding record and those needed help or encouragement. The IT strategy's role needs to go from being aligned yet subordinate to the business strategy at a functional level to a combination of IT and business into the term of digital business strategy (Bharadwaj et al. 2013).

Additionally, Bharadwaj et al. (2013) have gathered four key themes which serve as guidance when thinking of a digital business strategy, aiming to provide a framework for planning this accordingly to external digital trends and changes in the organisation (see Figure 9). These four themes are the following:

1. Scope of the digital business strategy
2. Scale of the digital business strategy
3. Speed of the digital business strategy
4. Sources of business value creation and capture in the digital business strategy

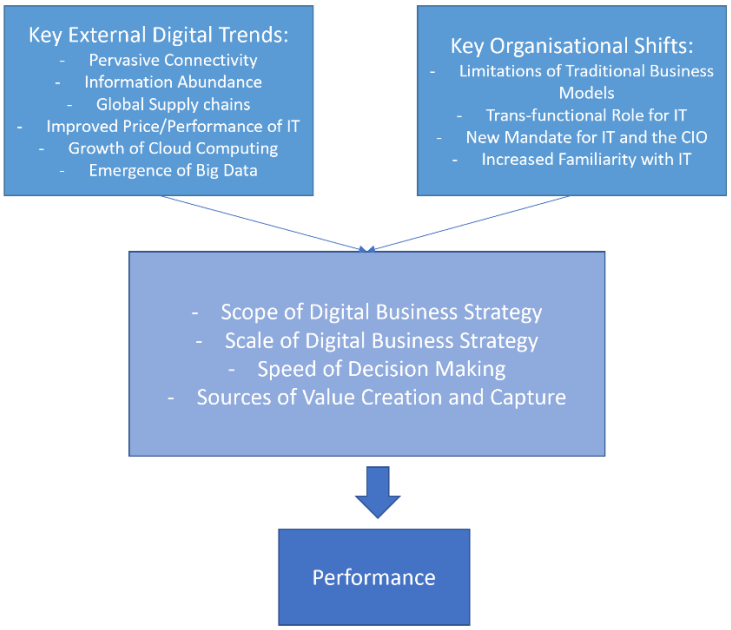

Figure 9: Four key themes for digital business strategy. Adapted from (Bharadwaj et al. 2013).

Bharadwaj et al. (2013) state that the performance of the digital business strategy is directly linked with the scope, scale, decision making speed, and value creation sources. The four themes of the digital business strategy cannot be identified unless the external digital trends are linked with the current organizational shifts. Slack & Lewis (2017) emphasize this idea by highlighting the importance of achieving synchronization between market-based strategy and resources-based strategy to identify value propositions.

3.2 Digital Transformation

This section describes how companies can address the process of changing their digital strategy in order to become more digitalised, along with recommendation on how to build a strong digital strategy which is aligned with the company's long-term goals.

The digital age has enabled industries to significantly improve the efficiency and effectiveness of their processes, resulting (in most cases) in significant savings. Yet, it has also created several challenges as many companies battle against the disruptive changes across all industries. Where there is a strong focus towards customers and business to consumer (B2C) relation, there is evidence to suggest they might experience with a higher impact over their organisational structure the effects of the digital age in comparison to those with a business to business (B2B) focus (Berghaus and Back, 2016).

Yoo et al. (2010) describes digital transformation as the development of digital technologies to improve existing processes, and the exploration of digital innovation which can potentially transform the business model. Also, digital innovation brings changes which transform process, products and strategies, making companies reconsider their organising logic.

Berghaus and Back (2016) describe the stages of digital business transformation by applying a digital maturity model (DDM) to organisations in Switzerland and Germany. The DMM they

selected had nine dimensions of study: (1) customer experience, (2) product innovation, (3) strategy, (4) organization, (5) process digitization, (6) collaboration, (7) information technology, (8) culture & expertise, and (9) transformation management. In their findings, they authors argue that even though digital affinity and testing with digital technology are already widespread in companies, a tactically formulated transformation and usage of enhanced data analytics in business processes are less common (Berghaus and Back, 2016).

Several decision makers battle with the challenge of developing a feasible digital transformation strategy. Since strategic transformation compromises a vision, strategy, planning and implementation, a DMM can offer a starting point and guidance by providing an overview (Davis et al. 2010). A MM is built by dimensions of interest and criteria, which define areas for improvement and action, and maturity stages (or level achieved) to guide the growth towards maturity or the ideal stage (Becker et al. 2010).

In their study of organisations in Switzerland and Germany, and by applying a DMM, Berghaus and Back (2016) observed five stages in the process of digital business transformation. These stages are: Stage 1 – Promote and Support, Stage 2 – Create and Build, Stage 3 – Commit to transform, Stage 4 – User-centred and elaborates process, and Stage 5 – Data-driven enterprise. The authors also identified three main areas of discussion which became important to consider in the development of this thesis project. These three discussion points are details below.

Firstly, when it comes to digital transformation within a business, digital commitment and affinity among employees are important requirements that habitually pre-exist inside the personnel (Berghaus and Back, 2016). For instance, digital collaborating between employees and external partners and co-workers, knowledge of digital products, and promoting digital innovation inside the firm, are examples of digital commitment.

Secondly, there is a need for strategic collaboration and synergy between the business and IT in terms of digital data. Real-time data can now be capture instantly. Yet, companies usually struggle when making use of the available information or it is unclear who takes ownership over the data (Berghaus and Back, 2016).

Thirdly, Berghaus and Back (2016) agree digital transformation was more managed intuitively rather than strategically among the companies from their study. Additionally, they observed that companies which have been confronted early by digital disturbance commonly reach a higher level of transformation in comparison to latecomer industries such as manufacturing. An explanation for this could be the lack of flexibility some manufacturing companies have in terms of adapting their current technology to latest ones. The large investments, and the fact that the current technology is not completely obsolete yet, might resist change so early.

Formulating a Digital Transformation Strategy

In the business world today, integrating and developing new technologies has proven to be one of the biggest challenges. There are no industries immune to the impact of digital transformation. The entire business strategy and models need to be reshaped and constantly tested (Downes & Nunes, 2013).

Once companies have visibility of how digitalised they are, using a maturity model assessment for instance, they would need to focus on a digital transformation strategy to reach their target goals. Forming those guidelines is not simple and there is not enough clarity over which aspects to prioritise. This section introduces recommendations on how to formulate a digital transformation strategy from a study conducted by Hess et al. (2016) in the communications industry in Germany. The results of their study, and the applicability of their recommendations to the manufacturing industry will be discussed further in Section 4.1.

Incorporating new technologies has a high priority, and almost 90% of business chiefs across the UK and the US claim that digital technologies and IT will make considerable strategic impacts to their whole business in the upcoming decade. It is known that a tactical digital transformation should be a priority. Yet, businesses lack guidance on how to adopt this as a competitive advantage (Bonnet et al. 2012).

Digital transformation has influence over several (if not all) areas within a business. However, managers often lack clarity over which elements to consider in their digital activities. There is a risk of ignoring valuable solutions for a company's situation (Lee et al. 2015).

In their research on how German companies defined their digital transformation strategies, Hess et al. (2016) identified four key dimensions in every digital transformation effort:

1. Use of technologies – refers to the tactic and ability to investigate and develop new digital technologies.
2. Changes in value creation – suggests the effect of a digital transformation over a company's value proposition.
3. Structural changes – refers to alterations in administrative structures, processes and skills required for managing with the developing new technologies.
4. Financial dimension – relates to the ability to fund digital transformation attempts, as well as a proactive approach towards battling main business activities.

Hess et al. (2016) suggest that even though the areas of focus for digital transformation might be identifiable, there is a lack of well-defined guidelines for implementation. As a result, the authors derived eleven strategic questions which employees responsible for the digital transformation within a company should be asking. The questions have been divided into the four key dimensions previously introduced by the authors and are displayed in Figure 10.

Figure 10: Key decisions for a digital transformation strategy. Adapted from (Hess et al. 2016).

For each of the key questions there is a set of suggested possible answers (also shown in Figure 10). The results of this study, and the recommendations on how to achieve a more effective digital transformation strategy will be discussed in Section 4.1. Since Hess et al. (2016) looked at companies in Germany in the area of communications, along with the results it will be discussed the applicability of their recommendations and conclusions to industries such as manufacturing for instance.

3.3 Strategic Alignment

Alignment is a well-established topic in the literature that emerged from the concept of seeking "fit", "synergy", or "support" between organizational capabilities and business strategy to achieve the long-term purpose of the organization. The purpose of a company generally does not change over time. However, the company's strategies, resources, and structures do. Therefore, many business practitioners and researchers link business performance by the degree of alignment between strategies and organizational capabilities. In recent years, emerging technologies and competences and increased levels of digitalization have important ramifications for alignment, such that companies are striving to achieve alignment for the effective and efficient utilization of technologies and strategies (Yeow et al, 2018; Slack & Lewis, 2017; Avison et al, 2004; Luftman & Brier, 1999; Henderson & Venkatraman, 1993).

The term alignment has been defined using different synonym terms in literature, such as Luftman & Brier (1999) define it as *harmony*, Henderson & Venkatraman (1993) define it as *linkage*, Weill & Broadbent (1996) define it as *integration*, and Porter (1996) defines it as *fit*. In general, the term alignment is defined as "*the degree to which the needs, demands, goals, objectives, and/or structures of one component are consistent with the needs, demands, goals, objectives, and/or structures of another component*" (Nadler & Tushman, 1980). The definition of alignment has been extended over time to include customers. Slack & Lewis (2017) define alignment as the line of fit between the market requirements, such as customer needs, and resource capabilities, such as resource efficiency.

According to Henderson & Venkatraman (1993), there are five types of alignment, namely, *business alignment*, *IT alignment*, *contextual alignment*, *structural alignment*, and *strategic alignment*. They are classified based on the sorts of resource arrangements required and the operating context. All the mentioned alignment types operating within the organization boundaries except the contextual alignment, which requires a sort of interaction with forces outside the boundaries of the organization. The types of alignment are briefly described below:

- *Business alignment*: is the alignment between organizational resources and structure and business strategy. In other words, the support that organizational resources provide to achieve the short-terms as well as long-terms business goals (Henderson & Venkatraman, 1993).
- *IT alignment*: is the alignment between IT resources and IT strategy. In the same manner, as in the business alignment, the well-developed IT resources support the deployment of the IT strategy and vice-versa, the IT strategy guides the IT resources (Henderson & Venkatraman, 1993).
- *Contextual alignment*: is the alignment between the business strategy and the competitive environment that the organization operates in. According to Henderson & Venkatraman (1993), the external forces, such as industry context and culture, can affect the formulation of the business strategy, hence, organizations must maintain the alignment between them to achieve business objectives.
- *Structural alignment*: is the alignment between the organizational resources and the IT resources. In other words, the arrangement of organizational and IT resources that drive

competitive advantage and encourage business performance benefits (Henderson & Venkatraman, 1993; Brown & Eisenhardt, 1997).

- *Strategic alignment*: is the alignment between the business strategy and the IT strategy. Strategic alignment deals with IT as a cross-functional department that affect the organizational performance (Henderson & Venkatraman, 1993). In other terms, the formulation, implementation, and controlling of the IT strategy must be congruent with the formulation, implementation, and controlling of the business strategy to ensure performance benefits.

The term *strategic alignment* is used in this study and literature review. Figure 11 shows the alignment model with the interactions between business alignment, IT alignment, contextual alignment, structural alignment and strategic alignment and organizational performance. This model represents a fusion of several tested models in the alignment research (Brown & Eisenhardt, 1997). One of these well-tested models is the Strategic Alignment Model (SAM) which will be adopted in this study to understand further the topic of strategic alignment.

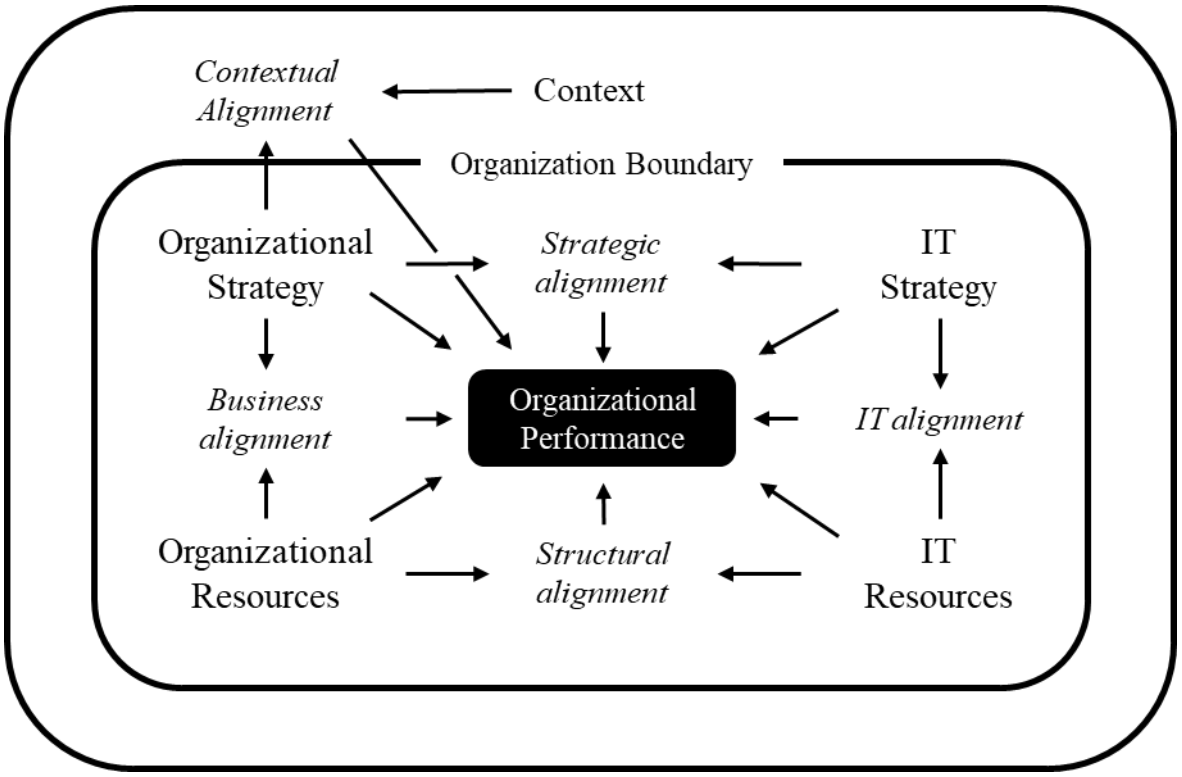

Figure 11: Alignment model. Adapted from (Henderson & Venkatraman, 1993).

Although the topic of strategic alignment is well-established in literature, yet the debate about why alignment is important is still enduring (Avison et al, 2004). A study performed by Sabherwal et al. (2001) revealed that the more strategically aligned organizations have more return on investment and more flexibility in acting upon changes and uncertainties. In the context of digitalization, a study performed by Capgemini (2012) revealed that strategic alignment has a direct impact on digital innovation by increasing the level of people engagement in the process of digital strategy creation.

Strategic alignment is a major focus for many researchers in the field of information systems (Sabherwal et al, 2001). Accordingly, many definitions for strategic alignment have been developed in literature. Table 2 summarizes some of strategic alignment definitions found in literature and their sources.

Table 2: Strategic alignment definitions

Definition	**Source**
The strategic fit and functional integration of the business strategy, IT strategy, organizational infrastructure and processes, and information systems infrastructure and processes.	Henderson & Venkatraman, 1993
"*The fit existing between business strategy and information systems strategy that impact business performance and the information systems effectiveness*"	Chan & Huff, 1993. Page no. 345
The continuous synchronization between the twelve alignment components i.e. business scope, distinctive competences, business governance administration structure, organizational processes, organizational skills, technology scope, systematic competences, IT governance, IT architecture, IT processes, and IT skills.	Luftman & Brier, 1999
"*The degree to which information technology mission, objectives, and plans support and are supported by the business mission, objectives, and plans*"	Reich & Benbasat, 2000. Page no. 82
"*How different digital technologies are arranged with respect to all elements of business in such way to best support the fulfilment of business short-term and long-term purpose*"	Trevor & Varcoe, 2016. Page no. 1

The multiple interpretations and various literature viewpoints of strategic alignment made it evident that more work into strategic alignment is required to clarify the multiple aspects of strategic alignment. The literature offers several various models and frameworks that illustrate the concept of strategic alignment, however, the two most influential models are the MIT90's model which is developed by Morton (1991) and the Strategic Alignment Model (SAM) which is developed by Henderson & Venkatraman (1993). Strategic Alignment Model by Henderson & Venkatraman (1993) is applied in this thesis since it has been used and interpreted by the majority of researchers in the field of strategic alignment (Chan & Reich, 2007a).

Comparing the different aspects of the MIT90's model with the SAM, SAM provides a clear link between the internal aspects of IT, i.e. IT processes and infrastructure, and the external aspects of IT, i.e. IT strategy. It reflects the IT ability to support business strategies as well as influence it. This enhances the position of IT strategy from the conventional role as a purely supportive function to a foundational function in the process of business strategy creation (Chan & Reich, 2007a).

As the technologies evolve over time, the role of IT has been evolved from its traditional supportive function towards core strategic function in the process of strategies creation (Chan & Reich, 2007a). Therefore, there were a huge need for a model that represents the concept of the new IT role. Henderson & Venkatraman (1993) argue that the misalignment of IT infrastructure with the business needs is the main reason behind not realizing the value of IT capabilities in the process of strategy creation. SAM has been widely recognized by researchers in the field of strategic alignment (Lee, Kim, Paulson, & Park, 2008; Bricknall, Darrell, Nilson & Pessi, 2007).

The two building blocks of strategic alignment concept by Henderson & Venkatraman (1993) are *strategic fit* and *functional integration*. The former provides the strategy needs in two domains, external and internal domains, while the latter provides the linkage between business and information technology domains. The internal domain is related to three components. First, the administrative structure component which is related to the nature of structure used in the organization, for instance, functional, matrix, agile, or divisional organization. Second, the processes component which is about the explanation for current business process designs and/or redesigns. Third, the skills component which is meant by the development of people competencies that are needed for the state of strategic alignment.

In contrast, Henderson & Venkatraman (1993) illustrate the external domain as the business environment in which the company operate in and competes. The external domain is meant by the strategic decisions regarding the chosen business strategy and it is concerned with the distinctive strategies that provide the competitive advantage in the market the company operates in. In addition, it is meant by the selection and use of business processes that are important for winning the competitive advantage.

Henderson & Venkatraman (1993) argue the fit between the external and internal domains within the business domain is vital to ensure competitively. In other words, winning businesses are the ones that able to fit internal organizational arrangements with the external competitive position. Henderson & Venkatraman (1993) emphasize on adopting the idea of strategic fitting within the IT domain between the internal IT capabilities and IT position in the marketplace. It is equally important to fit external and internal domains both in the business and IT domains to ensure strategic alignment.

The second building block is functional integration which is the integration of the business domain & IT domain. The need for this kind of integration for strategic alignment is to understand how the decisions made in the IT domain improve or diminish the decisions made in the business domain and vice versa. According to Henderson & Venkatraman (1993), functional integration can be on a strategic level within the external domain or on the operational level within the internal domain. The former called *strategic integration* and the latter called *operational integration*. Strategic integration is the connection between business strategy and IT strategy. In other words, it deals with the support that the IT strategy provides for the business strategy and how the business strategy is translated into actions within the IT strategy. Operational integration links the IT infrastructure and processes with other business infrastructure and processes. Operational integration is important to ensure operations coherency (Henderson & Venkatraman, 1993).

Figure 12 shows the strategic alignment model and its four domains.

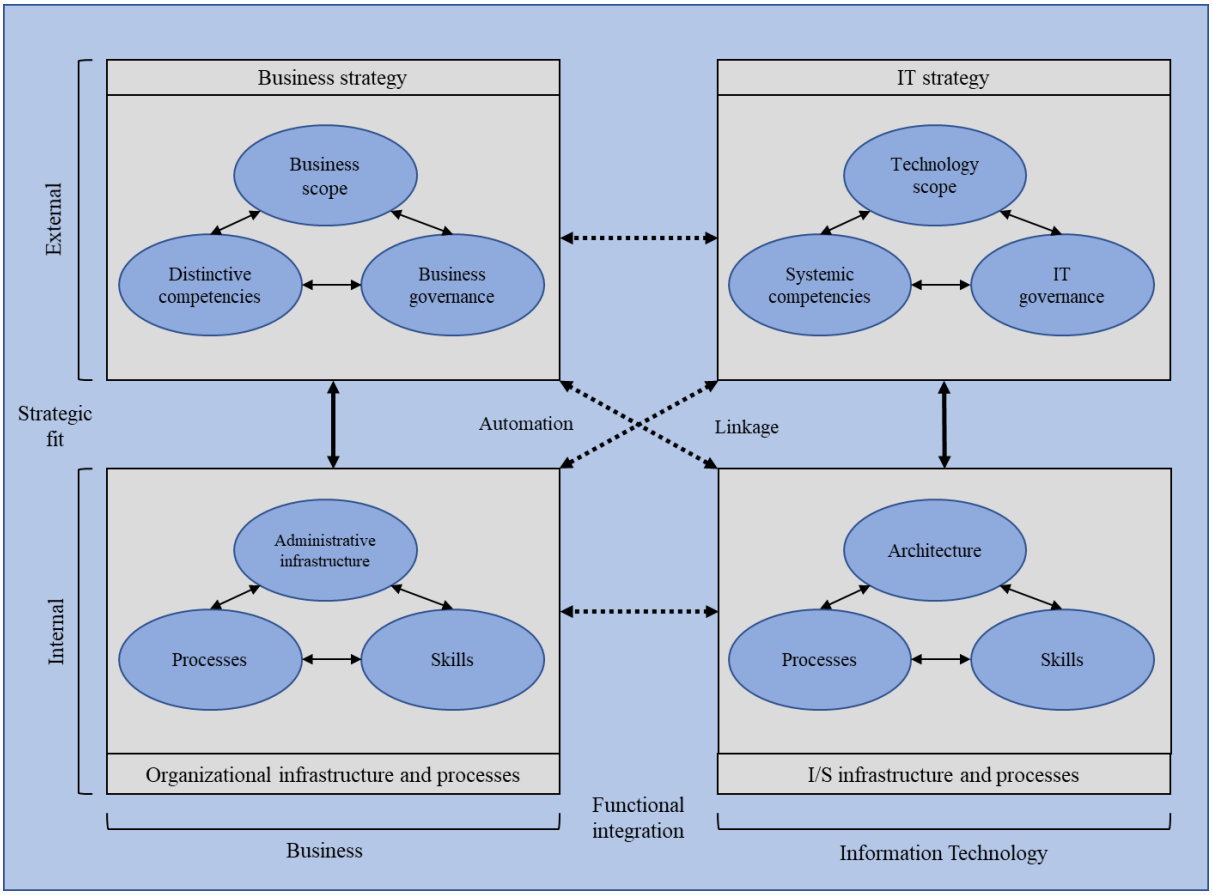

Figure 12: The strategic alignment model (SAM). Adapted from (Henderson & Venkatraman, 1993)

According to Henderson & Venkatraman (1993), strategic alignment is not possible unless the four domains are in "fit" and "integration". Each domain shown in figure 11 has three components that must be in connection to ensure winning strategic alignment. Many other researchers (Lee et al, 2008; Schlosser et al, 2012; Coltman et al, 2015) have emphasized on the logic of strategic alignment presented by Henderson & Venkatraman (1993) that is all decisions in the four domains must be managed in correspond to each other for effective management of strategic alignment.

Coleman & Papp (2006) describe the twelve components of the strategic alignment model as follows:

- *Business Scope*: refers to all the activities being performed by the business within the business environment. This may include end-to-end supply chains, i.e. suppliers, customers, products, processes, competitors, and markets.
- *Distinctive Competencies*: refers to the core competencies that are needed for the business to achieve a competitive advantage in the business market. Core business competencies are research and development, product quality, cost, and price.
- *Business Governance*: refers to the rules and policies used to manage business processes and provide support for top management decision making.

- *Administrative Infrastructure*: refers to the style of managing the business, this includes the organizational structure and the management style.
- *Organizational Processes*: refers to the management of current business processes, this includes process improvement activities.
- *Organizational Skills*: refers to the management of people's competences, this includes the hiring process, training, coaching, and culture.
- *Technology Scope:* refers to the needs and requirements of all technologies being used in performing business.
- *Systematic Competencies*: refers to a mix of IT competencies such as knowledge, skills, and attitudes that are required to give business accessibility over information that is important to run business strategy.
- *IT Governance*: refers to the rules and policies used to manage information technology infrastructure, systems, and processes. It also includes how IT is managed with other business functions and how the IT projects being performed.
- *IT Architecture*: refers to the design and plan of IT infrastructure, system, and processes that is required to meet business needs.
- *IT processes*: refers to the management of current IT processes.
- *IT Skills*: refers to the human skills that are needed to run IT processes on the operational level.

Henderson & Venkatraman (1993) claiming that strategic integration or functional integration alone is not enough to ensure strategic alignment, therefore, cross-domain relationships and multivariate interactions are a must to achieve both, the strategic fit and the functional integration. The logic of strategic alignment as argued by authors is possible when three out of four domains are in alignment. This means that any improvement in one domain cannot be carried out without affecting at least two other the remaining domains in any way. Based on that, the authors argue four cross-domain relationships, namely, *strategy execution alignment perspective*, *technology transformation alignment perspective*, *competitive potential alignment perspective*, and *service level alignment perspective.*

Alignment perspectives are possible when three domains are in interaction. The three domains are classified based on where the change happened i.e. the driver (Henderson & Venkatraman, 1993), and which domain is impacted less or more by the change as *anchor domain*, *pivot domain*, and *impacted domain*. These domains defined as follows:

- *Anchor domain*: is where the change happened and start. This domain drives the change in the other domains by providing the needs that are important to achieve strategic alignment. This domain considered the strongest domain (Luftman et al, 1999).
- *Pivot domain*: is the operational level of the change where it runs. Changes in this domain affected directed by the changes initiated in the anchor domain. This domain considered the weakest domain as it affects and gets affected by the other two domains (Luftman et al, 1999).
- *Impacted domain*: is the domain with the greatest impact from the initial change in the anchor domain. There is a debate about the right definition of the impacted domain. Henderson & Venkatraman (1993) defines it as the horizontal direction of the

perspective such that there is a driver for the change (the vertical direction of the perspective) and impact only. Luftman et al. (1999) define it as the third domain after the weakest (i.e. pivot domain) such that the anchor domain and the pivot domain are always adjacent to each other.

The first alignment perspective is *strategy execution*. The strategy execution perspective is the classical, hierarchal, most common view of strategic alignment (Henderson & Venkatraman, 1993). In this perspective, the business strategy is the anchor domain for the organizational processes and IT processes. The design of infrastructure for both business and IT is driven by the choices being made in the business strategy domain. According to Luftman et al. (1999), organizational infrastructure is the pivot domain and IT infrastructure is the impacted domain. Figure 13 shows the strategy execution alignment perspective.

According to Henderson & Venkatraman (1993), it is important to identify roles for both the business domain and IT domain to ensure the success of this alignment perspective. The top management role in this perspective is *strategy formulator* which is to design and articulate the decisions and choices to tackle vital market issues, manage resources, and devise and communicate business strategy. The role of IT in this perspective is *strategy implementer* which is a supportive function to the decisions being made in the business strategy.

In other words, IT management focus is reactive and responsive to the changes being made in the business strategy. IT management design the technological and infrastructure that is needed to support the implementation of the business strategy. The performance of this type of alignment is measured by financial measures such as cost centres. Therefore, IT focuses on performance efficiency by cost reduction mainly.

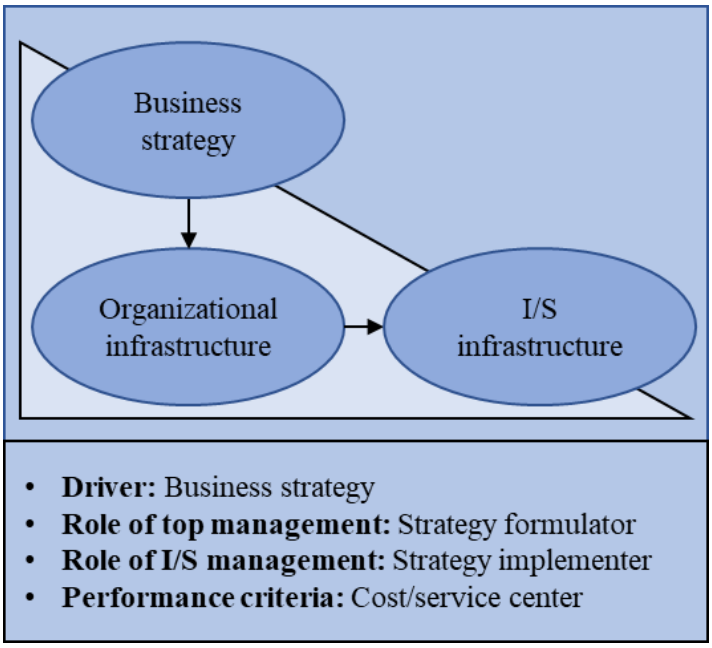

Figure 13: Strategy execution alignment perspective. Adapted from (Henderson & Venkatraman, 1993)

The second alignment perspective is the *technology transformation* perspective. This perspective is also top-down like the strategy execution perspective that means the business

strategy is the driver of changes. In other words, business strategy is the anchor domain (Luftman et al, 1999). The impacted domain is the same as in the strategy execution domain - the IT infrastructure, however, the difference between the first perspective and the second perspective is the pivot domain which is the IT strategy in this case (Luftman et al, 1999). Figure 14 shows the technology transformation alignment perspective.

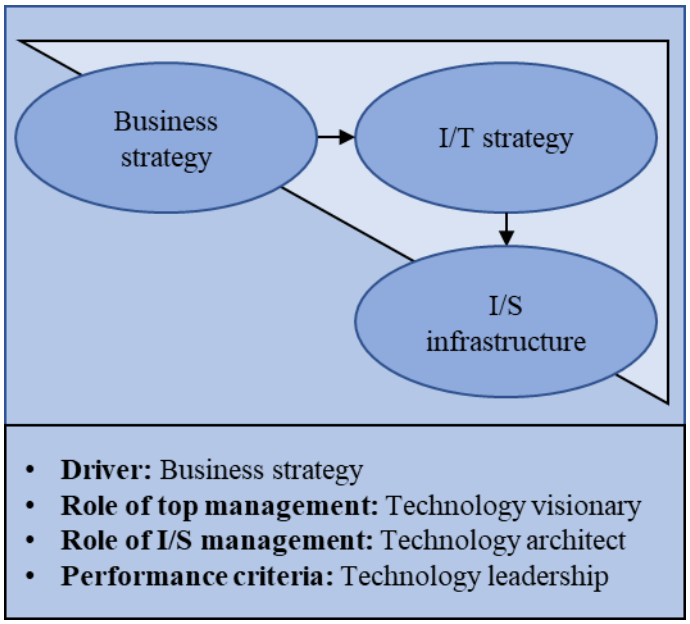

Figure 14: Technology transformation alignment perspective. Adapted from (Henderson & Venkatraman, 1993)

The role of top management in this perspective is *technological visionary* such that business executives describe how technologies can be used by the company. Both the demand of the company and the capabilities and drawbacks of the current IT systems need to be addressed by the business executives. In addition, business executives must ensure that the applied infrastructure, processes, and people can be modified to endorse such technological choices (Henderson & Venkatraman, 1993).

The role of IT management in this perspective is a *technological architect* such that the IT executives plan and operate the infrastructure that the business executives have identified. The IT emphasis is to bring value to the company by eliminating the non-adding value activities and delivering the needed technological leadership to support the technological vision identified by business executives (Henderson & Venkatraman, 1993). The performance of this perspective is measured by the value IT adds to the product and/or service the company provides and compare it with competitors in the IT marketplace.

The third alignment perspective is competitive potential. IT strategy is the anchor domain in this perspective such that drives how to improve business strategy with the support of organizational infrastructure to enable new potentials for technology (Henderson & Venkatraman, 1993). In other words, competitive potential alignment refers to the use of technologies to enable the business strategy to win a competitive advantage. The enablement of business strategy is done by changes in the business scope, distinctive competencies, and business governance. The result is a new business strategy enabled via current and/or emerging

IT technologies. The pivot domain in this perspective is the business strategy, while the impacted domain is the organizational infrastructure. Figure 15 shows the competitive potential alignment perspective.

The role of top management in the competitive potential alignment is *business visionary*. Business executives must learn how to use IT to improve the current situation of the business. Therefore, it is important for business executives to be conscious of the value of IT such that their strategies are provoked to emerging business opportunities and they are willing to determine the competitive impact that IT will have on their business initiatives (Henderson & Venkatraman, 1993).

The role of IT management in this perspective is a business architect (Luftman et al, 1996) and catalyst (Henderson & Venkatraman, 1993). IT management must be part of the top management team to ensure that business executives are informed of the innovations and how technologies can be utilized to shape organizational and business decisions. IT management reflects on how the business utilizes technology for the purposes of shaping its market plan and build strategic advantages

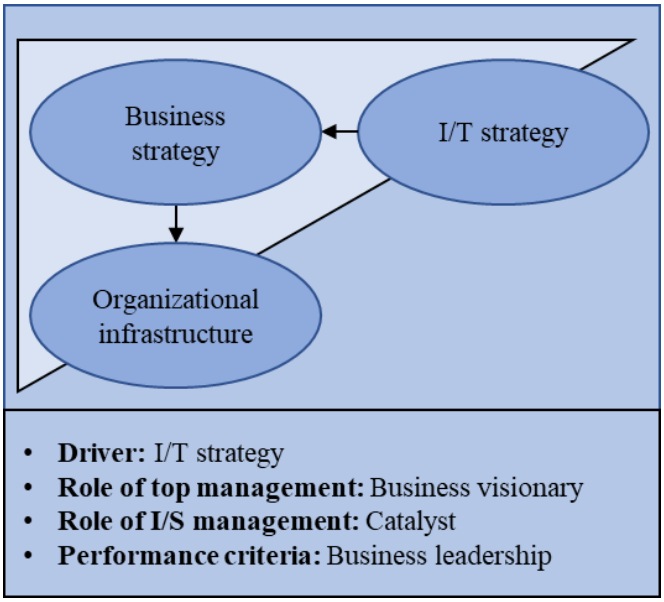

Figure 15: Competitive potential alignment perspective. Adapted from (Henderson & Venkatraman, 1993)

The strategy reflects on how to increase visibility and seek possibilities to make better use of IT. The performance criteria for the competitive potential alignment perspective is based on business leadership. For example, using qualitative and quantitative measures such as revenue increases and customer relationships to review the performance of IT technology application (Henderson & Venkatraman, 1993).

The last alignment perspective is the *service level* perspective. This perspective focuses on how IT can improve current business infrastructure such that IT strategy is the driver for these changes. The strategic fit between the external and internal environment of IT creates the right IT infrastructure that meets customers' (marketplace) demand. The functional integration between the IT domain and the business domain builds resources to be responsive to the

changing marketplace environment. The business strategy role in this perspective is indirect in terms of providing directions towards business needs. The pivot domain is IT infrastructure that impacted directly with the changes that happen in the marketplace. The impacted domain is the organizational infrastructure that impacted the most by the changes in IT strategy (Henderson & Venkatraman, 1993). Figure 16 shows the service level alignment perspective.

The role of top management in this perspective is a *prioritizer.* Since the business strategy quadrant is not impacted directly by IT strategy, the role of business executives is prioritizing the IT projects with the goal of optimizing short-term and long-term business objectives. The IT management plays vital role in this alignment perspective as an *executive leadership* by identifying and implementing IT projects that provide the fit and integration for all domains. IT domain in this perspective is like a business inside a business responsible on identifying market needs and delivering services to internal business domain. The performance criteria is custom satisfaction that reflects how much their needs are supplied. This criteria reflects the good harmony between IT and business domains such that providing the end-user with the right products and/or services.

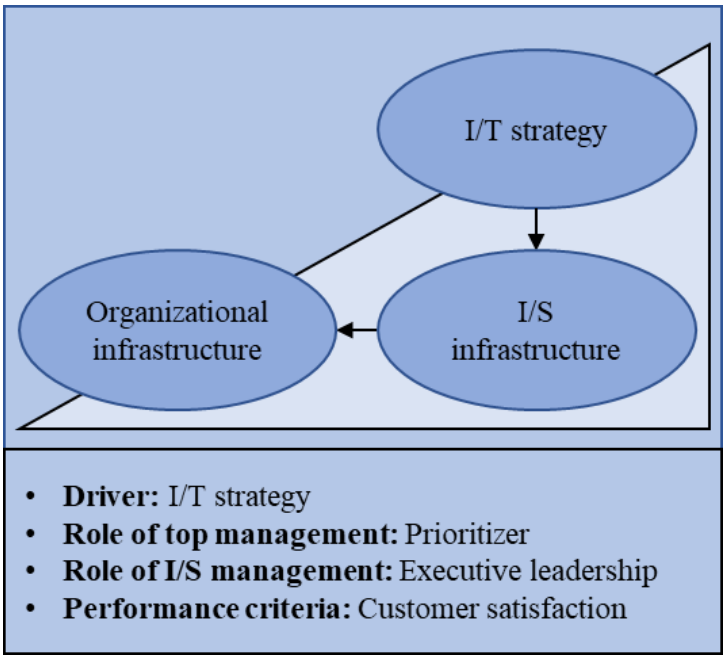

Figure 16: Service level alignment perspective. Adapted from (Henderson & Venkatraman, 1993)

3.4 Change Management

All transformational process requires changing the status quo. However, change does not always go smoothly. There is often evidence of resistance to the introduction of new technology. Reasons for this could be the need to become educated and trained to the fear of become obsolete or replaced by a machine. Whichever is the reason behind this resistance, it is something which cannot be ignore. This section covers the problems often seen when change is introduced and how to address them.

Beckhard and Harris (1987) described the process of change as the shift between a current state (A) to a future state (B), connected through a transition state (C). It is during this transition state that managers should set their focus.

Nadler and Tushman (1997) claim that most design failures are really a malfunction of implementation. When looking at the dimensions from the IMPULS model it was discussed that the employee engagement was key for leading any change at an organisational level. With regards to organisational change, the authors discuss there are three common problems:

- The problem of power: There is a latent demand of shaping the political dynamics related to the change taking place.
- The problem of anxiety: The necessity to encourage and motivate a positive behaviour as a response to changes.
- The problem of organizational control: The importance of being efficient and logical when managing the transition state.

These problems are frequently seen when undergoing a transition from the current state to a future one. Nadler and Tushman (1997) list a set of action which organisations can take in order to address each of the three problems. These recommendations are listed below.

- Shaping Political Dynamics
    1. Get key power groups to support you: Identify key players and influence relationships. Use participation and bargaining deal to motivate people to follow up with change, and isolate or remove (only in extreme cases) those who fight against the transition.
    2. Display clear leadership in support towards change: Convey the vision of the future state, incorporate reward systems, offer support and resources for adapting to the change, remove roadblocks, and keep those affected/involved in this change informed of what is happening.
    3. Use symbols: Communicate the message through the use of support material such as charts, symbolic acts or language signals for instance.
    4. Build in stability: Send a consistent message and allow time to prepare for the transition, keep points of stability (do not change everything at the same time), be clear to communicate what will not be affected by this change (so people can feel comfortable that at least some things will remain the same). All these measurements will help prevent defensive reactions, conflict and reduce the level of anxiety among team members.
- Encourage Constructive Behaviour
    1. Highlight what is creating dissatisfaction with the current state: Provide evidence of why it is important to move away from the current situation by presenting an environmental and economic impact and be transparent on how people will be affected.
    2. Gather an acceptable level of participation in planning and implementing the change: Create opportunities for people to engage and participate, so they feel a part of the change and become role models for others.

3. Recompense preferred behaviour: Provide informal recognition and feedback to those who perform as expected. Note that the rewards do not necessarily need to be monetary incentives.
4. Allow enough time to separate from the current state and move forward: Generate instances to vent emotions and allow enough time for acceptance. Once the change has been completed, mark the occasion with a milestone so people know there is no turning back to the previous state anymore, and they look towards the present/future.

- Manage the Transition
    1. Communicate a clear picture of the future state: Reduce uncertainty and build a design as complete as possible. Communicate with clarity how things will operate and do so throughout several channels.
    2. Use reliable points of leverage: Schedule the change to happen in an organised matter, keep a realistic timeline, anticipate to potential pitfalls and problems, and allow time and resources for dealing with unexpected delays.
    3. Implement transition devices: Assign a transition manager, develop a plan, allocate resources accordingly, and design specific transition devices such as dual systems and backups.
    4. Collect feedback during and after the transition state: Track progress and evaluate the success. To gather this information, use interviews, surveys, focus groups. Use formal and informal channels and encourage people to participate in this evaluation process.

Psychologist Schein (1996) explains the reasons for why transformational learning is so challenging. Organisational learning can be perceived as brainwashing; it is not fun, and people face pressure into adopting new values. Companies provide "golden handcuffs" to employees, which in some cases have no other choice but to accept. Schein (1996) says that every time we learn something new, there is a cleansing of the mind. Something we previously knew now needs to be replaced with new information (often) imposed by the employer.

Schein (1996) also argues that this learning process will create two types of anxiety: learning anxiety and survival anxiety. The first one is related with the fear of trying something new. This is often observed as an initial resistance towards doing things differently or doing completely new tasks instead. The second type manifests itself when a person realises that in order to make it, they will need to change. The author highlights that, when these types of anxieties are present, the learning process can only happen is the survival anxiety is greater than the learning one. In order to achieve this, organisations can either increase the survival anxiety (easier) or reduce the learning anxiety (harder). Nonetheless, even though it is easier to achieve the first one, it can create strong resistance towards learning. On the other hand, it is more difficult to reduce the learning anxiety by having leaders teach their employees and making their message transparent and credible. Once credibility is gained, this leads to a safer environment where opposition is reduced. When entire organisations are expected to go through change, top management must be coercive and persuasive. They need to impose the new beliefs and practices efficiently and make their employees comfortable with the learning process (Schein, 1996)

4. Empirics

This chapter aims to present findings supporting the research questions. It begins by looking at two case studies on how to formulate a digital transformation strategy and how to achieve alignment between the business and digital strategy. It then introduces contemporary reports from consultancy firms referring to enablers, inhibitors and challenges of digital strategic, alignment. In concludes by presenting the findings from interviews with the expert panels.

4.1 Examples of strategy alignment: Case studies

In this section, two case studies are discussed to support the thesis outcome. Examples of enablers and inhibitors for achieving strategic alignment are mentioned within the cases.

The first case study discusses the results by Hess et al. (2016) and the application of the 11 strategic questions previously described in Section 3.2. This study refers to formulating a digital transformation strategy by providing guidelines for managers when defining a digital strategy. Additionally, findings and best practices when formulating a plan are detailed.

A clear strategy for implementing and using digital technologies is vital for future business success. The authors make a distinction between an IT and a digital transformation strategy, where the first usually handles technology in isolation while the second impacts the organisation as a whole and has impact over interactions with competitors, suppliers and clients. During interviews with managers at each company, the authors answered 11 strategic questions divided into the four key dimensions (previously included in Figure 10). For details on the answers per question for each of the companies from the case study done by Hess et al. (2016), refer to Appendix 1. The results from this study are then contrasted with observations from the expert panel regarding strategic alignment in the Swedish market.

In addition, a second case study by Yeow et al. (2018) is discussed to make emphasis on achieving alignment of a business strategy with a digital strategy. Here, it is considered that strategies are dynamic. Hence, the alignment process should be a process of continuous review and improvement. Once a digital strategy is formulated, the challenge lays over the alignment process. This is usually not addressed in a dynamic context. Due to environment dynamism, a strategy is constantly facing change. Additional tension arises in the alignment process due to this moving scenario. The development and complexity of technology would suggest a more iterative alignment process with the business strategy by engaging in continuous improvement and adaptation procedure.

Since the literature regarding strategic alignment introduced in Section 3.3 is relatively recent, it is vital to identify best practice cases for companies to refer to. The purpose of describing the first case study is to provide guidelines for managers on how to effectively formulate a digital transformation strategy in their business, what to focus on and how to ask the correct questions. Then, once the strategic transformation is formulated, the second case study focusses on reaching the alignment between the business and digital strategy. Both studies are complementary and offer a full picture of what is recommended for having the correct transformation strategy in place and succeeding when it comes to the strategic alignment.

Case I: Formulating a digital transformation strategy

This case study looked at three companies with different business models and strategic role for technology. Hence, their attitude towards digital transformation is different. Altogether, the three cases offer a vivid illustration of various alternatives for digital transformation strategy. The four key dimensions when formulating a digital transformation strategy are listed below along with the most relevant findings for each one.

- The use of technology

This dimension requires that managers assess how innovative and proactive their IT divisions are in their attitude to new technologies. New technologies offer opportunities which are crucial for gaining competitive advantage. Yet, the role of IT varies significantly across businesses.

From the case studies, the authors conclude some companies see IT as an enabler of new commercial prospects, while other see IT as a support for previously specified requirements. Hence, in some companies, new technologies are a driver, whereas in others it is business-related matters driving this and technology comes in as support. More conservative companies opt for adopting recognized and widely used solutions. In contrast, others are early adopters of technology solutions at an early stage of progress. An even more extreme approach is to become an innovator and introduce new solutions rather than choosing among existing ones.

When evaluating how ambitious a company should be in terms of seeking for new technologies, they need to consider the existing competence, their spending in technology and the size of their business. Reacting late to new emerging technologies might make it difficult to catch-up, and there is a potential risk of going out of business. Instead, companies need to evaluate their IT investments with the technological ambitions they have.

- Changes in value creation

Changes on how value is created derive from how each digital technology impacts a company's business model. This goes beyond moving from analogic offerings to a digital environment. Today, several companies want (or need to) explore the possibilities digital technologies offer in order to move into new business areas. The people responsible for a company's strategy need to understand to which extend they should diversify their enterprise into the digital realm. The highest level they can achieve will depend on a business' size and background.

From the case companies, the authors noticed that the size of a company is key to determine the digital diversification level to be obtained. Larger corporations diversify their traditional models in order to leverage from the various offerings which digital technologies present. Smaller and medium size companies instead focus on stability and their core business when it comes to selecting the appropriate digital technologies to support them.

Guaranteeing funds is crucial for businesses to be successful in the long run. Hence, it is key to explore for new sources of profits. Companies need to brainstorm on how they can create value in order to increase their revenues by introducing new digital services or products.

- Structural changes

Any business transformation will impact a company's structure, and digital transformation is not the exception. Management needs to decide if the newly enabled functions or operations because of adopting a digital technology should be integrated to current structures or kept separately to the core business. In addition, new competences and knowledge will be needed to implement and operate this technology. The success of any transformation strategy will be dependant of top management support and the devotion of those needed as part of the strategy. As previously mentioned, when referring to change management, no change is successful without the commitment and engagement of their stakeholders.

When studying the case companies, the authors concluded that the CEO (chief executive officer) is fully responsible for introducing a digital transformation strategy. The implementation of the strategy is delegated to senior managers. The CIO (chief information officer) may also manage a digital transformation, which is most common when the focus of the change is around business processes. For companies with customer interfaces, the CDO (chief digital office) will work together with the CIO. The CIO will look after the infrastructure necessary, while the CDO handle the technologies involving digital services and products at an interface level. Both should dynamically communicate with each other to coordinate efforts and initiatives to implement the strategy.

The integration of new activities to existing ones offers the advantage that it usually requires less restructuring. If there is similarity between the current and new business, this is possible. Nonetheless, if there are no strong synergies between both, this can result counterproductive. On the other hand, when companies organise these new digital business activities as a separate item to their previous operations, they can draft structures to fit these activities instead of having to adapt to existing ones. This approach drives innovation and increases flexibility. The risk of this method though is that boundaries between new and old operations can grow wider.

The need for new skills and knowledge will most likely happen as a result to changes in business processes, products and/or services. Managers need to correctly map the current talent and technology capabilities and recognise the new competences needed.

- Financial dimension

Lastly, the financial component plays a strong role in the transformation activities. By increasing the financial pressure on the core business, management can see an urgent need for action. Almost all activities will consume a financial resource, even if this is done through consuming employees' time. Hence, its importance for digital transformation strategies.

The competitiveness of actual core business will guide the commitment from top management to embrace the necessary efforts for digital transformation attempts. If current core activities generate enough profits, management will not see transformation as so urgent or justifiable to involve in high risks. However, there is evidence to show that rapid market changes or taking action too late can be disastrous to companies. Earning profits is not enough anymore and remaining steady can result in business failures. The recommendation from the authors is to

consider digital transformation with seriousness and the importance it deserves, to act sooner rather than later, and anticipate to changes in the market instead of waiting for them to react.

The purpose of all transformation strategy is to create value, which then translates into increased profits. Nevertheless, companies should consider that these are not always noticed in the short term since there is often a high level of investment needed.

Financing for digital transformation efforts can come from internal or external sources. The successful implementation of any change will depend on the sufficient financial support. The benefits from any digital transformation should be clearly expressed to those responsible for investing. When companies are already facing challenging financial scenarios, obtaining additional funds for transformation will be limited.

After gathering the findings from all four key dimensions, the authors identified strategic questions for the people responsible of digital transformation to take into account. However, it is important to understand that there is not a one-size fits all answers to them. Each question is supposed to generate a discussion around decisions needed to formulate the transformation strategy. There are a handful of potential answers describing the different scenarios (See appendix 1). The best starting point for formulating an organisation's digital transformation strategy is to begin by asking yourself the correct questions. By drafting on successful approaches implemented by the three case companies, and answering the questions from an own business context, managers will be provided with a complete and organised approach to going through a digital transformation process, while reducing uncertainty and the complexity usually linked to these transformation strategies.

Case II: Aligning with new digital strategies

The principal challenge when seeking alignment is how companies firmly modify resources in IT and their business to meet with the evolving strategy. This case study argues that a dynamic capability method has the capacity to incorporate, develop and reconfigure skills to tackle rapidly changing environments. The challenges of reaching alignment happen when tensions or resistance to change act as inhibitors to the process. Additionally, what works for one strategy might be deadly for another. There are four areas where conflict usually occurs in strategic alignment: (1) fitting (company identity and where they want to place themselves in the future), (2) discovering (retaining existing competence and learn new concepts), (3) forming (creating new routines) and (4) doing (satisfying demands of external and internal stakeholders).

Yeow et al. (2018) conducted a study to trace various alignment actions implemented to reassign resources over time. They looked at a German manufacturing company which had sales business to business (B2B) (selling to retailers) and was changing their business model to a business to customer (B2C) approach. It was key to develop a new strategy and reconfigure resources while leveraging their existing IT capabilities and developing the missing ones.

During this case study, the authors observed tensions triggered due to the lack of alignment among the existing resources and their new strategy. With the dynamic capability approach, the conflict and tensions influenced the strategy and helped the manufacturing company to

build their resources. Business resources were concurrently reconfigured to sustain the changing strategy to become B2C. In addition, resources are reconfigured, and the strategy is redefined to adapt to environmental changes.

The alignment actions during the formulation stage as largely sensing in principal, since the company aimed to clarify and justify the emerging strategy and make sense of the opportunities selected. Few seizing and transforming actions still occurred in this stage, which is consistent with building the capability necessary for pursing the strategic plan. In the implementation stage, the main alignment actions focused on designing and modifying the resource base to meet the requirements of the strategy drafted in the previous stage. During the monitoring and control stage, seizing and transforming actions continued, yet the principal alignment actions leveraged the new resource base for achieving a B2C strategy in comparison to the previous B2B one. Nonetheless, while alignment actions aim to reduce conflict and tensions between the resource base and the new strategy, these actions itself will create a misalignment.

The tensions observed during the study were the following:

- There was resistance from some employees to change and meet with the demands of the new processes a B2C strategy would involve compared to the previous B2B one.
- Employees were divided between keeping current competencies and learning new ones.
- The feeling of identity created some struggles since some workers had a hard time understanding how their current role would be affected (or even exist) once the new strategy was implemented.
- Finally, people debated between prioritising demands from B2B or B2C customers.

The implications from the research showed that alignments actions are both needed at the start of each stage and to address conflict and tensions in order to achieve the planned strategy and go through the change process as smooth as possible. Unpredictable and evolving issues will occur during the process of alignment. Each alignment action will probably trigger some sort of tension. It is key to anticipate and to manage the change. Recommendations for managing change were previously detailed in Section 3.4.

Yeow et al. (2018) findings from the case study reveal that:

- Differentiated approaches involve alignment actions which could not completely realign the resource base with the new strategy. However, this is still useful when reducing gaps and fulfilling customer needs.
- By tackling conflict or tensions through ongoing iterations of alignment actions, these tensions will shape the strategy and the resource base needed and affect the alignment actions for the following stages.
- Through a dynamic capability approach to cover alignment actions, there was evidence to conclude that the alignment process can impact the performance and competitiveness of a company while implementing a digital strategy.

- Dynamic capabilities can boost the growth and refinement of a digital strategy while this strategy will shape the resource base requirements.
- It is vital to communicate a clear vision of the change and the new strategy approach in all levels of an organization, from top management down.
- Understanding how aligning actions when becoming more digitalised unfolds across various processes results crucial and could be turned into a valuable competitive advantage.

4.2 Contemporary reports

The aim of this section is to provide secondary data to support and complement the literature-based frame of reference and the primary data. It includes reports about strategic alignment, digital strategy, and digital transformation performed and published by major consultancy firms and research institutes. The reports present the cumulative lessons and viewpoints learned from different industry-wide interviews, surveys, and projects.

In 2014, Mckinsey & Company published a report called *"The Aligned Organization"*. The report presents the enablers that bring company purpose, strategy, and capabilities together. Strategic alignment is crucial for a successful organizational transformation, where achieving alignment between company purpose, strategy, and capabilities ensure organizational agility. The result is an organizational environment that focuses more on actions, and less on planning. The report likewise concludes that high-achieving organizations have more sustained performance by providing a clear direction for employees to eliminate the gap between vision and their daily work-life activities. This will keep them motivated rather than cynical.

Organizations usually experience two alignment issues in any transformation journey. First, the misunderstanding of the new vision causes losing short-term goals, which can arise through negligence or contradictory perception. In other words, the new vision decisions may undermine the current organization's key priorities, which eventually hinder the performance of transformation. Second, the dynamics of the organization – technologies, new markets, economics, and people competences – can easily cause resource deviation from the new vision, and therefore organizations can no longer fulfill the new vision. According to Mckinsey & Company (2014), frequent alignment actions are needed to maintain the vision-resources alignment in parallel with the organizational transformation and external conditions (Mckinsey & Company, 2014).

The researchers argue that the process of strategy creation can be an enabler for strategic alignment. The new strategy should be broad enough to handle rapid changing environment, such that it supports and reinforces current resources with the right new way of working. In other terms, the process of strategy creation must be combined with alignment actions that eliminate internal barriers and deviations to ensure strategic alignment on the short-term as well as long-term (Mckinsey & Company, 2014).

The second enabler for strategic alignment is the internal communication, between vision and daily-work activities, and externally, between organization capabilities and market

requirements. Too early communication provides no evidence for people to work on the new strategy, therefore, losing credibility. In contrast, too late communication causes moral damages due to the increase of rumors within the organization. These types of communication considered inhibitors for strategic alignment. Organizations should communicate organizational transformation and vision-resources alignment with a few teams at first. As a result, this will help in refining the new strategy with the current resources continuously rather than discretely (Mckinsey & Company, 2014).

Trevor and Harvard Business Review (2018) published a report called "*Is Anyone in Your Company Paying Attention to Strategic Alignment?"* The report provide a concrete conclusion about who is responsible for strategic alignment. Based on industry-wide research, the report reveals that in many cases no individual is technically accountable for managing company's resources from end to end. In other words, usually company value chain is divided into domains controlled and managed by different individuals, therefore, different domains are optimized in separation rather than in alignment with company strategy.

Strategic alignment is enabled by a new form of leadership, which is called *enterprise leadership*. Enterprise leadership is different from personal leadership such that the former is associated with the arrangement of different company resources as a system, while the latter is concerned with personal development as individual elements. Looking into the organization as one element of moving and linked resources ensure frequent strategic interventions that align business strategy with organizational capabilities, resources, and management systems (Trevor and Harvard Business Review, 2018).

EY (2018) published a report called "*four ways companies can align their people strategy to their growth strategy"*. The report focuses on the people as the main enabler for strategic alignment in the age of digitalization. Fully strategy-oriented people provide a sense of company purpose and awareness of environment dynamics. In the same report, assessing current leadership is crucial to translate strategy into business actions. This will determine the readiness of current people to face the challenges of digital transformation such that removing poorly equipped competences to achieve strategic alignment. In contrast, a misbalance between the right people's competence for the right strategy will inhibit strategic alignment.

Capgemini published a report in 2011 called "*Digital Transformation: A Roadmap for Billion-Dollar Organizations"*. The report discusses the findings from the digital transformation case study conducted in collaboration with the MIT center. In the report, the researchers conclude the challenges that occur during the digital transformation journey and classify them into three categories as per transformation process steps: *Initiation challenges*, *Execution challenges*, and *Governance challenges* (Capgemini & MIT, 2011).

Initiation challenges are the challenges that may happen during the initial phase of digital transformation. A lack of knowledge about the analysis of the current company situation will lead to unclear and unrealistic objectives which eventually cause misalignment of the current company's capabilities and strategy. In other words, the lack of attention to evaluating the current company's digital transformation strengths, weaknesses, opportunities, and threats will keep the top management skeptical about the benefits of digital transformation. This will cause

a bureaucratic management style that does not engage people with the process of transformation, and hence that neglecting an important aspect of strategic alignment i.e. the people as a resource (Capgemini & MIT, 2011).

Due to the wide range of available technologies, not all digital initiatives make sense for all companies. Therefore, one of the challenges in the initiation phase is formulating business cases that guide digital investments. The same report discuss one type of investment that leads to an unclear business case and eventually misalignment between the current organizational capabilities and the new digital strategy. The *economic business case* is the traditional way of investment that evaluates the costs and revenues as well as perform budgeting. The problem with this type of investment is hard to manage in case of large investments, which is typical in the case of technological investments. Economic investments lead to an unclear business case since it focus only on costs and revenues and miss important aspects related to digital transformation investments such as people competences (Capgemini & MIT, 2011).

Many companies take *low-risk experiment* investments as a base of their decision about digital technologies investments. However, there is no universal or one-size-fits-all prescription for winning digital transformation investments. Therefore, companies using this type of investment can easily formulate a strategy that does not fit the current company's capabilities. The researchers argue that this type of investment can be beneficial for learning purposes, not direct implementation (Capgemini & MIT, 2011).

During the execution phase of digital transformation, three challenges face companies in their journey: missing skills, cultural issues, and IT difficulties. People is an important part of digital transformation and usually cause deviation from company objectives and goals. The evolution of technologies requires redefining of roles and skill-set upgradation, and unfortunately, 77% of the companies in Capgemini & MIT (2011) case study have reported skills as a barrier for digital transformation.

Cultural issues play a vital role in digital transformation. About 55% of the surveyed companies reported that a major cultural issue is related to change management, for example, changes from analog measurements to digital measurements can cause resistance to accept the digital transformation. Moreover, managers who cannot think differently to enable transformation are usually locked with a cultural way of thinking that deviates daily-work activities from digital strategy. Empowerment of front-end people is crucial in order to enable objectives alignment as well as digital transformation (Capgemini & MIT, 2011).

Information technology is the foundation for the digital capabilities that enable digital transformation. However, half of the surveyed companies find their information technology and infrastructure are lacking. This will provide a gap between the developed digital strategy and the current digital capabilities, which is as mentioned earlier create strategic misalignment. A strong relationship between IT and business is an enabler to successful digital transformation initiatives (Capgemini & MIT, 2011).

Radical digital transformation is one of the main challenges during digital transformation governance that causes decision-making issues that do not rely on the benefits of current company capabilities. In their case study, 40% of the companies experienced a radical digital

transformation and these companies failed in their strategy-resources alignment due to the sudden radical vision. In the report, the researchers proposed a way to overcome this challenge by having an incremental vision that develops current company capabilities incrementally and as per the need. This will help to build effective digital capabilities that support the developed strategy (Capgemini & MIT, 2011).

Another challenge facing companies in digital transformation governance is coordination. Coordination is fundamental to manage different business processes and to run digital initiatives. The majority of the surveyed companies showed coordination issues between different business processes and no coordination issues within the same process. Therefore, managing digital initiatives is inherently cross-functional and requires different competencies to ensure successful digital transformation (Capgemini & MIT, 2011).

There is no one-size-fits-all direction for achieving digital strategic alignment and many digital leaders struggling in defining the right way to align their digital strategy with their business strategy (Kane et al, 2015). In 2016, Trevor & Varcoe proposed a way to test the company's strategic alignment in the Harvard Business Review report called *A Simple Way to Test your Company's Strategic Alignment*. Trevor & Varcoe (2016) argue that this way of testing is just to provide the right way to start alignment actions and to diagnose the current strategic alignment situation.

The test consists of two questions that are about how well is the company purpose, strategy, and organizational capabilities in line with each other. The first question is "how well does your business strategy support the fulfillment of your company's purpose?" The company purpose as discussed by Trevor & Varcoe (2016) is the endeavor of the company and the business strategy is the guide that directs business towards the purpose. This question gives an indication for top management about the long-term strategic alignment situation and the organizational effectiveness (Trevor & Varcoe, 2016).

The second question is "how well does your organization support the achievement of your business strategy?" This question reveals the strategy effectiveness for top management, in other words, the needed capabilities, resources, and management systems to implement the strategy. According to Trevor & Varcoe (2016), maintaining harmony between the company's processes, culture, structure, and people is vital to maintaining strategic alignment. For example, if the strategic priority is innovation, then culture, structure, processes, and competence must support collaboration and knowledge sharing for winning business strategy.

Trevor & Varcoe (2016) presents the results of these two question in a matrix that shows four different leadership challenges. Figure 17 shows the matrix developed by Trevor & Varcoe (2016). Effective strategy and effective organizational capabilities ensure the *very best chance of winning* of the company. However, strategic alignment is a continual process that requires frequent adaptation with the working environment internally and externally. Achieving a high degree of strategic alignment does not always ensure business winning, but having strategic alignment as a continual process drives continuous business success.

Having a business strategy aligned with company purpose is not enough to ensure strategic alignment. Trevor & Varcoe (2016) describe this as an "organizationally effective" company,

in other words, the company is trying to provide the *best of intentions, but incapable* to operate the strategy since there is a gap between the developed strategy and the organizational capabilities. Siloed companies are a great example of this kind of leadership challenge such that the company's resources behavior runs counter to the company's business strategy which will result in irresponsible employees, and eventually strategic misalignment (Trevor & Varcoe, 2016).

Capable business with the right organizational capabilities that operate the right business strategy is not enough for a winning business. This type of companies is *boldly going nowhere* since there is no clear definition of the endeavor of the company. The unclear direction will result in losing capabilities over time and in running operations randomly, therefore, many employees will leave for a more stable and clear working environment (Trevor & Varcoe, 2016).

The last leadership challenge is the unaligned purpose, strategy, and organizational capabilities. This type of companies is *not long for this world* and in a real crisis even though this is not readily obvious. The organizational capabilities are incapable to achieve the developed strategy, and the developed strategy is not targeting the endeavor of the company, in other words, the company is in a chaotic situation and cannot deliver its strategic priorities (Trevor & Varcoe, 2016).

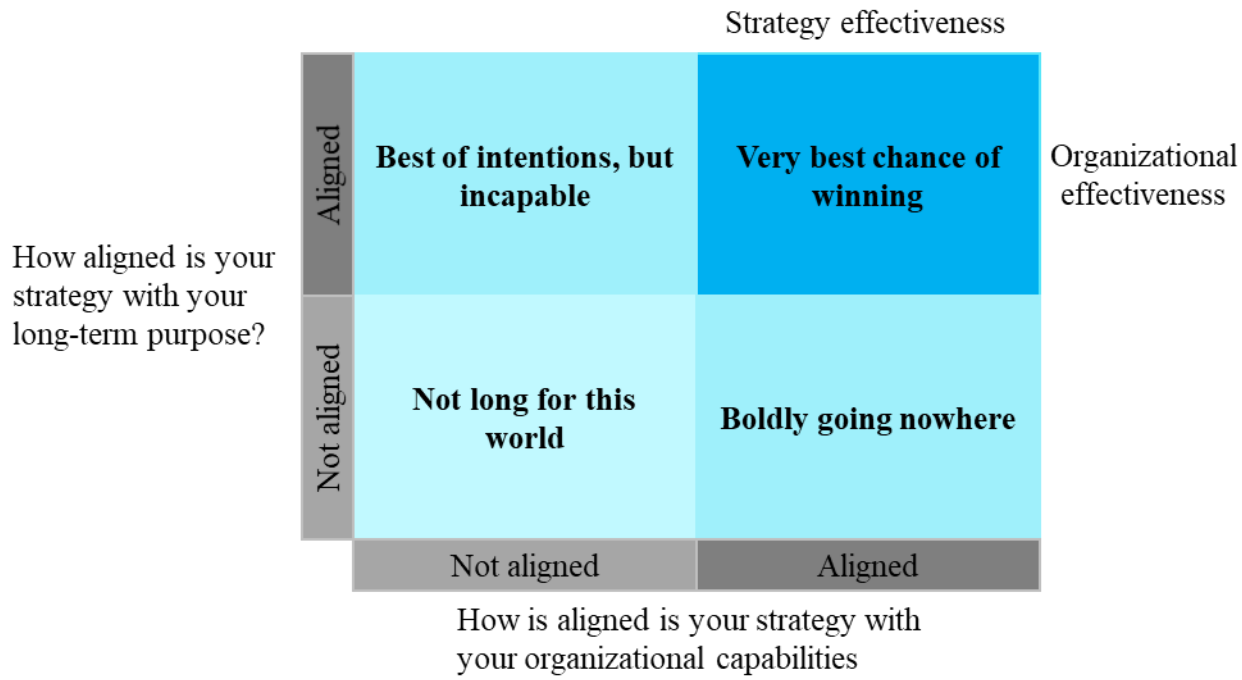

Figure 17: Strategy, purpose, and organizational capabilities matrix. Adapted from (Trevor & Varcoe, 2016)

4.3 Findings from expert panel interviews

The aim of this section is to present the primary data collected from interviews with experts from manufacturing industry. The section summarizes different viewpoints and opinions on digital strategy, business strategy, digital transformation and digital strategic alignment. Nine experts with different area of expertise were interviewed. The experts' opinions and viewpoints represent their own experience and not their company and/or research institute. Table 3 summarizes the interviewed experts and their areas of expertise.

Table 3: Summary of interviewed experts

Interviewee	Position	Area of Expertise
Interviewee 1	Group Manager/ Consultant	Production efficiency; Lean production; Digitalized production
Interviewee 2	Senior Researcher/ Consultant	Production innovation; Business transformation and change management
Interviewee 3	Researcher/ Consultant	Production development and knowledge management;
Interviewee 4	Researcher/ Consultant	Digital innovation management.
Interviewee 5	Researcher/ Consultant	Human-Automation interaction; Smart automation.
Interviewee 6	Researcher/ Consultant	Manufacturing simulation; Digital maturity modelling; modeling and simulation.
Interviewee 7	Professor	Digitalization of production logistics systems; sustainable production.
Interviewee 8	Assistant professor	Operations management; Strategic consensus: production strategy.
Interviewee 9	Manufacturing Technology Manager	Technology management and development; Smart manufacturing and automation; Change management; Cross-functional team leadership

To provide structure, the empirical data in this section is structured in four subsections that focus on enablers and inhibitors, challenges and achievement of digital strategic alignment. The fourth section focuses on the opinions of experts about six dimensions used in evaluating strategic alignment. These dimensions were derived from the theoretical framework used in the literature review section.

4.3.1 Enablers and inhibitors to digital strategic alignment

In the interviews with experts from research institutes and manufacturing companies, several digital strategic alignment enablers and inhibitors were identified. Table 4 summarizes the main enablers and inhibitors for developing an adequate digital strategy which supports the main business strategy described by expert panel interviewed. The identified enablers and inhibitors are discussed in detail in this section.

Table 4: Main enablers and inhibitors for developing an adequate digital strategy according to the expert panel interviewed

Enablers	Inhibitors
Top management support for digital capabilities	Poor top management/digital leaders' relationship
Business understand IT / IT understand business	Business does not understand IT / IT does not understand business
Digital leadership	Lack of digital leadership
IT as a core function	IT as a support function

The responses of interviewees were analysed and grouped into recognizable categories, as shown in Table 5, because interviews were semi-structured with open-end questions. This will help in analyzing theory with the collected primary data and secondary data. Responses were grouped as following:

- Responses by interviewees to the communication between top management and digital leaders were sorted as "Top management support for digital capabilities" and "Poor top management/digital-leaders relationship.
- Responses by interviewees to the translation of business goals into IT goals and vice versa were sorted as "Business understand IT / IT understand business" and "Business does not understand IT / IT does not understand business".
- Response by interviewees to the top management leadership style were sorted as "Digital leadership" and "Lack of digital leadership".
- Responses by interviewees to the involvement of IT in the business strategy creation process were sorted as "IT as a core function" and "IT as a support function".

The communication between top management and digital leaders was ranked as the headmost enabler/inhibitor for the digital strategic alignment by expert panel interviewed. Digital capabilities, as described by interviewees, are a competence mix of research and innovation, information and communication technology, and organizational digital culture that empower someone to work in a digital environment. Clear communication between strategic level and operational level personnel holds a great promise to reveal the value of digital capabilities, define and communicate a digital strategy that meets the needs of the business, and provide the right support for the identified digital projects.

Recognizing digital capabilities as well as developing current employees' capabilities by the support of top management to face the age of digital transformation results in accelerating the growth of in-house digital technologies application and enhancing employees' awareness of the new emerging strategies. Undoubtedly, the gap between current organizational capabilities and the developed digital strategy will be minimal and a higher degree of strategic alignment will be enabled. *"…There are many factors affecting strategic alignment, however, there is no matter if there is no transparent environment that supports and encourages open communication" (Interviewee 8).*

All experts interviewed concluded that information technology is the foundation for digital transformation and therefore mutual understanding between IT and business is crucial to ensure daily work activities are aligned with the developed digital strategy and business strategy. Mutual understanding includes customers, competitors, and suppliers that shape the business environment. Difficulties in understanding the business environment by IT is a critical problem in translating business strategy into clear actions to implement the digital strategy.

The majority of experts interviewed have mentioned that mutual understanding between business and IT depends naturally on culture and shared beliefs of IT/non-IT personnel. In other words, employee's mutual thoughts and attitudes towards an organization's strategic orientation define whether or not the execution of a strategy would be effective. On the one hand, IT personnel must be aware of what, how, why, and when of the digital strategy as well as business strategy. On the other hand, strategic level personnel must be aware of current resources, processes, systems, and capabilities. This will translate and align digital strategy with business strategy effectively and efficiently.

The mutual understanding between business and IT as well as between IT and non-IT personnel can be achieved by building cross-functional teams with different organizational levels personnel. Strategic alignment will be easier to achieve when cross-functional teams on different organizational levels participate in the formulation, implementation, and monitoring of digital strategy and business strategy. Both IT and non-IT resources need to collaborate consistently to leverage current resources in line with the business strategy to build a competitive advantage. *"… Personnel from operational level and strategic level, IT and non-IT should work as a unit to translate strategies into actions" (Interviewee 1)*.

Leadership, both on the individual level and organizational level, is an important enabler for digital strategic alignment. On the individual level, a successful leadership style should encourage digital leaders to be conscious of the business priorities and realize how their role duties support it. On the organizational level, a successful management leadership style should encourage top management to take advantage of their digital capabilities to achieve a competitive advantage. Put together, this type of leadership is called the *digital leadership*. Digital leadership goes beyond the definition of leading a group of people towards common goal, it includes the exploration of new and emerging technologies to make the organization become even more open to their customers' expectations and ever-changing market expectations.

Successful digital leadership allows companies to build workflows and design systems infrastructure that support and accelerate the implementation of these emerging technologies while maintaining current traditional systems and IT operations. In other words, digital leadership seeks the fit of current organizational capabilities and the emerging new technologies to develop the right digital capabilities that achieve business goals. Moreover, one of the benefits of digital leadership is building a digital culture. Various teams within an organization may need different digital tools to enhance their job. Digital leadership makes this happen by empowering people with the right digital tools. In other words, digital leadership changes the way we interact as humans in daily work activities, it keeps people digitally oriented and engaged with the ongoing strategies.

Traditionally, IT has been viewed as a support function of other business functions and/or decisions as it indirectly contributes to the business strategy. However, the role of IT in the era of digitalization has changed and it is nowadays considered as directly linked to a company's generated income. All of the experts interviewed agreed that the role of IT in business has evolved over time. The expanded and increasing usage of data collection, analysis, and processing tools, such as IoT, big data, and cloud computing, illustrate the value of utilizing knowledge within a company as a strategic tool. Therefore, utilizing IT capabilities as a core function within the digital as well as business strategy creation process is essential for winning business.

IT as a core function enables digital strategic alignment in three respects as the experts consulted have stated. First, IT capabilities ensure work agility which provides flexibility and responsivity to adapt to rapid changes in the working environment. This keeps the strategic level personnel and operational level personnel integrated and aware of the activities that are happening on each level. Moreover, the ability to predict and meet upcoming business needs will be enhanced which improves strategic level decision making. Second, IT as a core function ensure an open communication environment as it introduces effective and efficient solutions for collaboration horizontally and vertically. In other words, having IT as a core department gives the advantage of having goal-oriented cross-functional teams. Third, IT improves knowledge sharing internally within the company and externally with suppliers and customers. IT can provide effective solutions for knowledge management by providing the employees on different organizational levels with the needed information to deliver exceptional results.

The inverse of the mentioned enablers is the main inhibitors of digital strategic alignment as stated by the experts interviewed. Miscommunication from top management joint with the mutual misunderstanding between IT and non-IT personnel has been ranked as a top inhibitor of digital strategic alignment. Top management provides the direction that is important to orient resources towards the company's purpose. Communication is crucial for alignment as it provides feedback about the operational level along the strategy creation process. The two-way understanding between IT and non-IT personnel provides quick response and correctional actions that achieve alignment at any point in time. Put together, working as a unity maintain harmony between different teams as well as between different functional levels.

Managing digital strategic alignment inhibitors is challenging since they depend on each other. For example, if IT is viewed as a support function there is a clear link to the absence of communication and mutual understanding. Addressing enablers and inhibitors of digital strategic alignment highly depend on the needs of the business as it is not a one-off solution, it is an ongoing process that focuses on maximizing actions that permit digital strategic alignment and minimizing actions that restrain it.

4.3.2 Challenges and Limitations to digital strategic alignment

Table 5 summarises the main challenges for developing an adequate digital strategy which supports the main business strategy described by the expert panel interviewed. Each of the challenges mentioned is discussed in detail in this section.

Table 5: Main challenges for developing an adequate digital strategy according to the expert panel interviewed

Challenges	Interviewees
Building resources and competences	1, 6, 7, 8
Sharing views, not only within management	2, 5, 8, 9
Lean principles	5, 7, 8
Having good knowledge of your processes and the purpose of the digitalisation, understanding shift in roles and power	2, 5, 6, 7, 9
Developing the right leadership skills	2, 4, 8
Small companies can feel overwhelmed	3
We are still stuck in old thinking	4
Having different cross-functional teams working on alignment without clear communication between them	8, 9

Building resources and competences

Funding and sponsorship from management is referred to as the main constraint. Due to the high uncertainty of the success of emerging technologies beforehand, upper management can be sceptical of the short-term benefits of a developing technology. Previous experience with ecommerce has made executives believe that being a fast follower is less risky, and can sometimes be a better approach, than to be pioneers and assume most of the risk.

In industries with fast changing environments and high uncertainty, executives are being careful about this. Even though there are good arguments for having a level of scepticism and concerns, these should not keep companies from acquiring new (and potentially valuable) digital capabilities. Figure 18 describes how companies are justifying their investments in digital technologies.

ECONOMIC: Traditional capital budgeting processes emphasizing measurable cost or revenue improvements	**BURNING PLATFORM:** "Bet the business" investments made in response to rapidly declining performance in the existing business
STRATEGIC FOUNDATION INVESTMENT: Initiatives undertaken to provide important organisational capabilities, usually without a quantified financial business case	**LOW-RISK EXPERIMENT:** Investments structured with limited size and risk to learn about technologies, customers, or potential capabilities

Figure 18: How digital transformation investments are justified. Adapted from (Capgemini & MIT, 2011)

Nevertheless, there is high potential to add value from already existing investments and IT capabilities, simultaneously investing in new technology. Effective digital transformation does not come from merely investing in new resources. It comes from restructuring a company to enhance existing strengths in different ways.

Sharing views, not only within management

Digital transformation initiatives involve a high level of integration between business and IT. This concept was discussed in detail in Section 3.3 regarding strategic alignment. Both technology and top management should integrate their strategies. Where there is evidence of poor coordination among both, companies struggle to achieve digital transformation. These organisations frequently show problems similar to those not managing IT well and/or having complex IT architectures in place, poor data management, and processes less supported by technology.

In contrast, companies where there is evidence of a strong relationship and coordination between IT and business operations, there IT is used as an enabler for reaching business goals and executives' pay attention to IT demands, digital transformation is reached in a seamless matter. Nevertheless, note that all changes will introduce misalignments. Yet, where there is a strong collaboration between business and IT the challenges will be managed more efficiently (Henderson & Venkatraman, 1993).

Lean principles

Figure 19 illustrates the principles of lean production focussed on the operations function of the manufacturing industry:

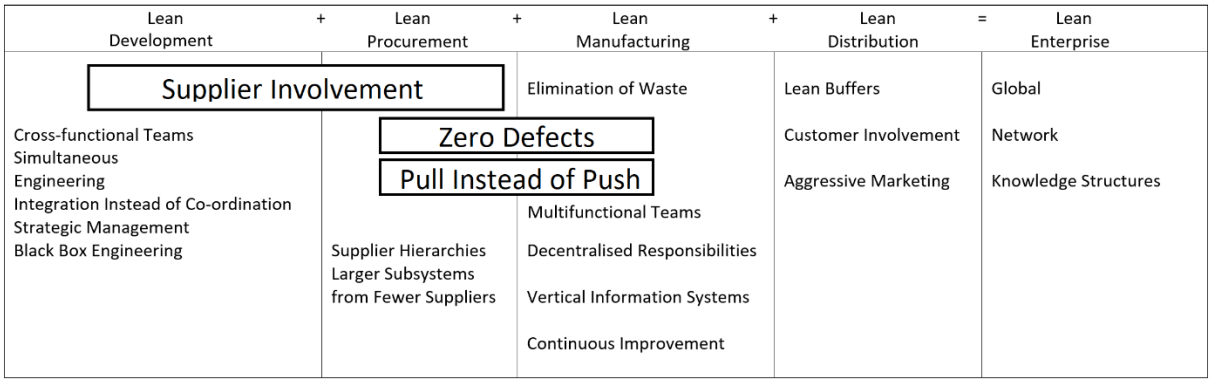

Figure 19: Lean production principles. Adapted from (Åhlström, 2004)

Lean production is formed by a set of principles, where each one covers specific aspects of a manufacturing system. The principles are detailed under each of the boxes in Figure 17. These principles involve a set of activities assumed to shift the target of a company towards their desired state (Åhlström, 2004).

Having good knowledge of your processes and the purpose of the digitalisation, understanding shift in roles and power

While profiting from digital transformation, changes in processes or how decisions are made will create challenges for among employees' roles and power distribution. As mentioned in Section 3.4, top management must transmit a clear message on why change is needed from top-down, and employees should be able to address their concerns regarding how their work becomes affected by this. In addition, besides understanding the impact a new technology or capability will have over a particular role, the entire company needs to understand why there is a need to invest in this and where the vision of the company is going. Senior management should effectively inform the future state and goals so functional teams can enhance their core capabilities towards them.

Smart manufacturing goes beyond increased automation, and also covers simulation, evolution, optimisation, autonomy, while simultaneously allowing companies to operate in a cyber space (Kusiak, 2018). Technology has had a significant impact over manufacturing strategies. However, this should not be perceived as a threat to the role of an engineer or employee. It should instead be seen as an enabler to make decisions while being better informed with real-time data, and benefit from big data analytical tools.

Developing the right leadership skills

Leaders need to develop leadership skills to manage their teams in any environment. They need to communicate effectively communicate both individual and team goals, building relationships across teams, and have people management skills to successfully complete their role. When business environments face changes, the set of core skills remains the same, yet leaders must develop additional skills to adapt. When environments shift rapidly, leaders face challenges in communicating to their teams since they cannot control the pace of the changes. However, there are skills a leader can focus on having today in to succeed in the digital age and manage their teams accordingly. Figure 20 shows eight capabilities for leaders to develop during a more digitalised era described by Elvington (2017).

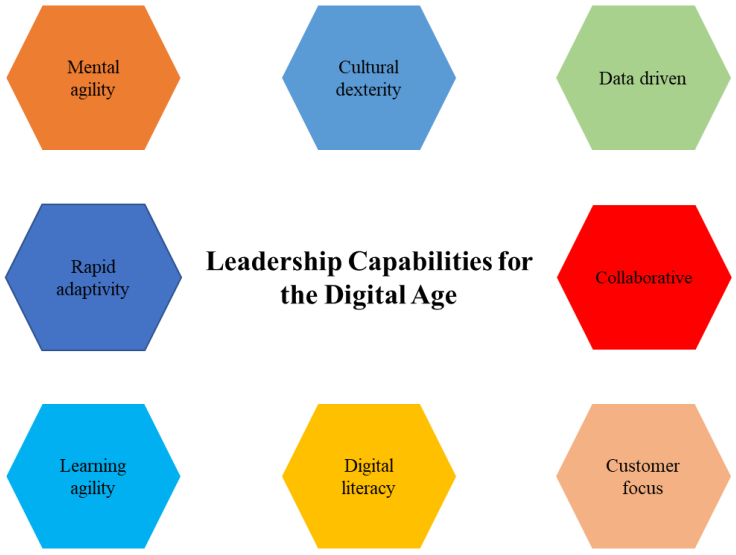

Figure 20: Leadership capabilities for the digital age. Adapted from (Elvington, 2017)

Small companies can feel overwhelmed / we are still stuck in old thinking

Business are constantly facing challenges. Nevertheless, during transformation process, these can become overwhelming. Members of the expert panel claimed both that small companies feel overwhelmed and are stuck in old thinking when it comes to technology. However, Stafford (2016) argues that small businesses have in fact a head-start when it comes to digital transformation in comparison to larger businesses.

Previously, smaller companies struggled with the variety and costs of systems available regarding technology, and this was perceived as a disadvantage. Yet today, larger businesses face a disadvantage since they are stuck in legacy systems which are too costly to modernise. For smaller businesses, there is no need to develop an expensive infrastructure anymore, and they can embrace newer technology with analytics tools incorporated, providing them with a deeper insight of their business processes (Stafford, 2016).

Some of the main concerns for business transformation according to Stafford (2016) are included in Figure 21:

Figure 21: What is holding back business transformation. Adapted from (Stafford, 2016)

Having different cross-functional teams working on alignment without clear communication between them

Lack of abilities to work with a developing technology is the most common challenge faced in this area. Cultural differences, not just among people from different background, but also between different functional teams, become a problem since there is a shift in empowerment and roles due to the introduction of automation. Digital transformation initiatives demand a solid base and knowledge of processes enabled by technology, data management, strong analytical skills, and IT solution deliveries. Yet, several companies fail to provide the capabilities and infrastructure that these transformation processes require (Capgemini, 2011).

When knowledge is divided among teams, members should often collaborate across business functions to solve problems. Cross-functional team interactions are a way of weakening the idea of function specific thinking and promote collaboration and group thinking instead (Young-Hyman, 2017).

4.3.3 Observations from expert panel regarding six strategic alignment criteria

Additionally, the experts from the panel were asked regarding other criteria of strategic alignment identified by Luftman & Brier (1999): (1) infrastructure and technology, (2) skills and personnel, (3) communication, (4) partnerships, (5) systems for measurements, evaluation and follow-up and (6) governance and management. Their observations on these six strategic alignment criteria are highlighted in table 6 and table 7

Table 6: Six strategic alignment criteria and observations made by expert panel

Strategic Alignment Criteria	Observations from Expert Panel
Infrastructure and Technology	- Everyone is curious on what you can do with digital technologies, but there is not enough time invested in understanding the needs and goals from using certain tools - The digital tools selected need to increase value for the customer - Central platforms for sharing information - Merge systems so they work together or in silos - Digital tools can help obtain transparency across the supply chain
Skills and Personnel	- There is not enough competence nor sufficient training, and there is a constant fight between time and budget - Most employees can actively participate and are eager to learn - When new/updated systems are provided, there is not enough training due to time constraints - Some companies have monetary incentives to retain staff with specific technical skills - Smaller companies struggle to get work done, and cannot always focus on the capabilities they need to build - Data analytics skills are becoming more and more relevant
Communication	- Communication is good and needed when it comes to supporting digital technologies in a company - Lack of communication on why a company is moving in one way - Many companies do not have a clear understanding of what digitalisation is - Some companies are afraid of changing as there are many stakeholders involved - Companies should communicate the benefits of what they will gain if a change takes place

Table 7: Six strategic alignment criteria and observations made by expert panel (cont.)

Strategic Alignment Criteria	Observations from Expert Panel (continuation)
Partnerships	- As a company, you should be aware if there are risks of working with a partner, such as cyber security issues - A disadvantage of partnerships is that you have to sometimes share your data, and this could be a competitive risk. Competition can detect your strategy - An advantage is that partnerships can enable faster information sharing, and you can know things quicker and automate a response - IT function should not be supported anymore through partnerships as it is a core strategic asset
Systems for Measurement, Evaluation and Follow-up	- A performance indicator here could be: are we serving the customer in a better way. Do we know them better now? - Reduce repetitive work, attract young people to work at your company, have interesting work - Many companies look at digital technologies as a return on investments. Yet, the payoff is more overall and through time. Instead of thinking as return on investments, you need to think of the capabilities you want to have
Governance and Management	- Companies need to involve as many people as possible to for a digital strategy, building competence and creating a learning curve. This involvement should come from top-down - Smaller companies move faster. Work very strategically and get rid of the waste - Know how to share information to support operators at shop floor - You need to invest in digital technologies to become more competitive, have better information linked to customers and suppliers, less errors and better performance, and an improved way of working - Business objectives should be clear, and then you need to work bac towards the technology needed - Companies need to invest in digital technologies since it is the future. They need to do so in order to stay competitive - Companies should invest in digital technologies not only when they become cheaper, but if it is good and it improves the quality of your goods/services and reduces lead times - It is fundamental to work together in both the digital and the physical world, and this can only be achieved through technology

5. Discussion

This chapter aims to discuss the enablers, inhibitors, and challenges of achieving strategic alignment for digital transformation. It also introduces a model on how this alignment can be achieved. Supported on the findings from the empirics, it provides an analysis for each of the research focus areas supported both by the theory previously introduced and the observations from the interviews of the expert panel and contemporary reports of consultancy firms.

5.1 Enablers and Inhibitors for digital strategic alignment

Communication was the most corroborative and emphasized enabler or inhibitor (lack of communication) for digital strategic alignment from the gathered empirical data. All companies are working towards achieving their purpose by developing strategies and operating and directing resources. The cross between these is the people that develop and operate strategies to achieve a particular purpose. In this context, companies can be defined as an arrangement of people and processes working towards a common purpose. As a result and in line with the strategic alignment definition presented in the frame of reference, effective communication, and open communication channels are vital to achieving digital strategic alignment.

The frame of reference does not stress too much on communication as the most important enabler for digital strategic alignment, however, the frame of reference states that strategic fit and functional integration between business and IT is crucial to achieving strategic alignment. Generally, the actions of fitting and integration require a minimum of two functions, departments, or roles to communicate in order to achieve harmony. The business and IT infrastructures cannot be in line with business and IT strategy without having open communication channels that ensure the alignment of the actions both on the strategic level and operational level.

However, the data collected from the consultancy reports showed the importance of two-way communication for a winning business. Consultancy firms emphasize on the two-way communication between the three main building blocks of any company, namely, purpose, strategy, and organizational capabilities. These building blocks will not be in alignment unless both the strategic level and operational level are communicating. Capgemini & MIT (2011) and EY (2018) emphasize communication to ensure cross-functionality that is dominantly crucial for successful digital transformation. Moreover, communication will enable a strategy-oriented way of thinking for people such that knowing the what, why, and how of the digital transformation.

Put together the technical terms from the frame of reference and the managerial aspects of digital transformation from interviews and consultancy firms' reports, the result is the term digital capability. Digital transformation is not possible without developing the right digital capabilities that support the transformation journey. Hence, digital strategic alignment cannot be achieved without developing the right digital capability that meets the needs of digital strategy and business strategy.

Many consultancy firms define digital capability as a mix of technical and managerial competences such that able to adapt the situation and provide correction actions without deviating from the end objective. Capgemini & MIT (2011) view digital capabilities as enablers for digital transformation because of their willingness to take on ambiguity and commitment to change isolated mindsets while keeping constant customer concentration. Having this in mind, the digital strategic alignment will be possible to achieve.

According to Jisc (2014), digital capability consists of six core activities which they are research and innovation, communication, learning, teaching and assessment, content and information, ICT infrastructure, and organizational digital culture. Research and innovation are critical to have a responsive mindset to digital changes by modeling and solving problems through innovative approaches. Communication is important for knowledge sharing and people engagement. Learning, teaching, and assessment are vital to building digital education throughout the organization. Content and information are about delivering connections and feedback within the organization. ICT infrastructure refers to the technical knowledge of digital technology and infrastructure in light of strategic priorities. And lastly the development of a digital culture that is conforming to the digital and business strategies. Figure 22 shows the elements of digital capability.

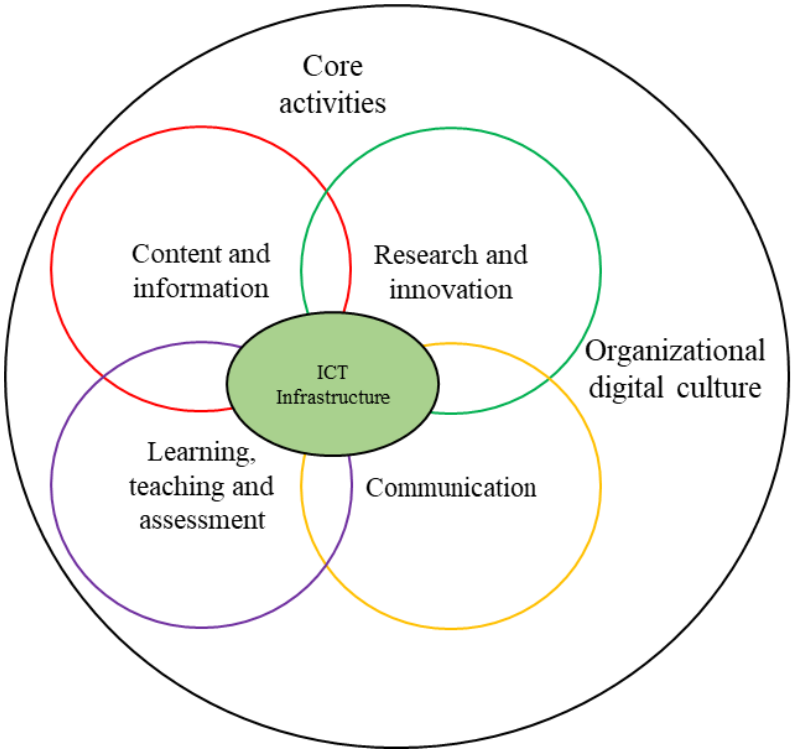

Figure 22: Digital capability elements. Adapted from (Jisc, 2014)

As a result, developing digital capabilities that match the needs of digital strategy and business strategy ensures digital strategic alignment. To enable digital capabilities, top management must appoint digital leaders responsible for developing digital strategy and aligning it to business strategy. The role of top management in this case is visionary to provide direction towards company purpose. Digital leaders' role is to adapt to the changing business environment by utilizing their digital capabilities for the purpose of alignment.

Digital leadership ranked as the second enabler or inhibitor (lack of digital leadership) for digital strategic alignment from the primary and secondary data collected. The changing environment and the dynamics of digital strategy encourage digital leaders to be responsive and proactive. Therefore, building a culture that supports and encourages digital leadership will enable digital strategic alignment. The frame of reference is well aligned with the empirical data collected about the description of the use of digital technologies to achieve business goals as a digital leadership.

The frame of reference encourages executives' leadership that uses information technology to operate guidelines from top management. In other words, the use of digital technologies in line with the business priorities to deliver competitive advantage is one of the characteristics of digital leadership. Data gathered from interviews with experts is in line with the findings of different case studies found in contemporary reports of consultancy firms such that digital leadership demands several skills to make the use of digital technologies in line with business priorities. The set of skills required for digital leadership development as concluded from the collected primary and secondary data are (1) innovation, (2) adaptability, (3) risk-taking, and (4) vision.

In the modern era with such a fast paradigm transition, leadership must be prepared to seek innovative technologies to become more versatile and adaptable to the development of a digital workplace. It might be challenging for digital leaders to overcome old habits and adapt to a new way of working. However, opening up to emerging development technologies offers a major growth prospect. In order for digital leaders to succeed in achieving alignment, the key is to stay updated on emerging innovations and ensure that workers are accepted into a working environment that embraces creativity and takes chances in testing new technologies.

A key skill that digital leaders must acquire is adaptability. Adaptability is important to achieve digital strategic alignment since it provides actions and feedbacks to align any deviations. Adaptability gives digital leaders the ability to act quickly and flexibly to the dynamics of market and customer needs. Therefore, quick alignment actions will take place to keep operations in line with business objectives with the minimal negative impact.

The findings associated with innovation and adaptability skills show risk-taking as an equally important skill that digital leaders must acquire. All of the experts interviewed agreed that empowering digital leaders to act upon their decision helps in providing accurate and realistic decisions. This matches the findings from the frame of reference such that achieving alignment is possible when IT management is responsible for the effective use of information technologies and the role of business is just providing directions. Risk-taking skill empowers digital leaders and engages people with the business strategy.

The last skill must be acquired by digital leaders to ensure digital strategic alignment is vision. The meaning of vision here is the ability of digital leaders to stand out from the rest by understanding the business and facilitating the process of understanding the digital strategy by the business. The best digital leaders, as stated by some of the experts interviewed, are those who act upon their actions by inspiring and convincing people with the purpose of digitalization. This will help business executives to understand digitalization much better and will reduce the amount of ambiguity around the topic of digitalization. Eventually, all digital investments will be aligned with business strategy as well as company purpose.

Enablers and inhibitors of digital strategic alignment are dependent on each other. In other words, one enabler cannot enable digital strategic alignment and one inhibitor can hinder digital strategic alignment. Therefore, business executives and digital leaders should work as a unit to achieve digital strategic alignment by addressing the needs and acquiring the right organizational resources.

5.2 Challenges when aiming to achieve digital strategic alignment

The following section discusses what companies can do to address the challenges identified in Section 4.3.2. Table 8 groups the challenges previously mentioned and assigns one or more of the strategic alignment criteria identified by Luftman & Brier (1999) to each of them. Then, three areas of focus on how companies can improve and tackle these challenges are also included in Table 8 and will be referred to in the rest of the section.

Table 8: Challenges for developing an adequate digital strategy divided into different strategic alignment criteria

Challenges	Strategic Alignment Criteria	How companies can address the challenges
Building resources and competences **Leadership skills** **Lean principles**	Infrastructure and Technology Skills and Personnel Systems for Measurement, Evaluation and Follow-up Partnerships	Digital Maturity Models
Sharing views, not only within management **Feeling overwhelmed and having old ways of thinking**	Communication Governance and Management Skills and Personnel	Digital Culture
Having good knowledge of your processes and purpose of the digitalisation	Communication Infrastructure and Technology Governance and Management	Digital Culture, Change Management
Cross-functional teams communication gaps	Communication	Digital Culture, Change Management
Understanding shift in roles and power	Communication Governance and Management	Change Management

Digital Culture

As mentioned throughout the research, digital transformation is changing the way business work today from systems, technologies, processes and how communication flows across all stakeholders of the supply chain.

From a total of 2135 respondents, McKinsey (2017) gathered the most significant challenges for meeting digital priorities. The results from this survey are shows in Figure 23. When looking at the percentile division of the answers, one third of the respondents mentioned cultural and behavioural changes as a barrier.

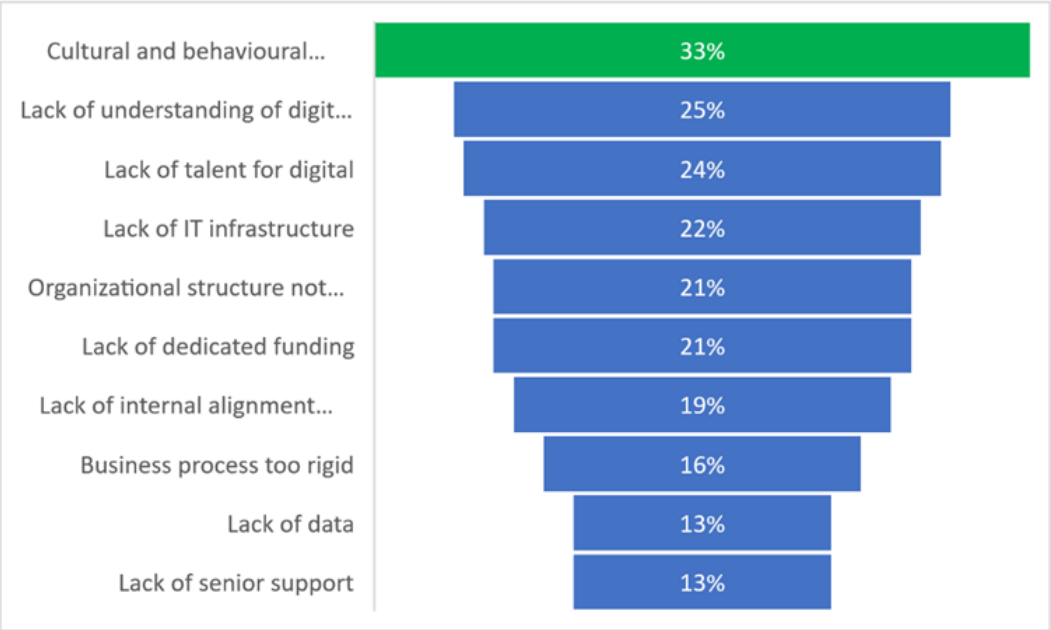

Figure 23: Most significant challenges to meeting digital priorities. Adapted from (McKinsey, 2017)

Developing a culture to support digitalisation becomes an essential part of digital transformation. Engagement does not only need to come from the top-down, yet also among employees by empowering them to assist in nurturing a digital mind-set and leave the old way of thinking behind (Sadiku et al., 2017).

For companies to build a digital culture which connects the gap between top management and the employees, and to welcome collaboration, enhanced innovation, productivity and communication, DMI (2019) explores five useful ways to achieve this:

- Embracing transparency: Everyone is aware of the impact a new digital technology can have over sales, revenue, and productivity. This can be accomplished through newsletters, forums, social media, or trainings for instance. Communication between senior management increases transparency and reduces anxiety towards uncertainty.
- Encouraging collaboration: Share insights between different divisions in a company to increase collaboration. Engage teams outside the common workplace to increase teamwork and boost productivity.
- Extending digital training to all levels of an organisation: Allow for employees to develop their skills and learn new ones, so they can grow as professionals and become more aware of digitalisation. Encourage people to always learn something new.
- Become comfortable with taking risks: Digitalisation comes with uncertainty and risks at time, yet the wins of exploring new technologies can bring significant rewards.
- Aspire to inspire: Digitalisation offers a variety of opportunities for business and employees. In a highly competitive environment, employers must find ways of attracting and retaining employees. Digital technologies can help a company build a culture of big thinking and innovation, becoming an aspirational setting where people want to take part of.

Digital Maturity Models

The use of maturity models allows to map the current situation of a company with regards to a certain topic being assessed. Additionally, they originate a discussion around which improvement actions to prioritise and how to track the progress (Iversen et al. 1999). These models are extremely process focused and towards continuously improving the design of an organization (Wolf and Harmon 2010). In recent years, the interest in these models has increase. As a result, there are several reports around them (Becker et al. 2010).

Maturity models enable visualising how capabilities evolve at each stage/area of business, in contrast to an expected, required or coherent path (Gottschalk 2009, Kazanjian and Drazin 1989). Even though the benefit and usability of these models is quite evident, there are still few aspects of them which have been criticised by several authors. Benbasat et al. (1984) de Bruin et al. (2005), King and Kraemer (1984), and McCormack et al. (2009), all argue that the models usually come across as a one-size-fits-all recipe, oversimplifying reality and neglecting empirical groundwork. They continue to support the argument that models should not focus on a series of levels for achieving a desired state, but rather aspects influencing change and evolution. Regardless of the simplicity maturity models might be associated with, it is clear to all that the basic purpose is to describe phases and suggest a maturation path including improvement measures for reaching a desired/ideal state (Poeppelbuss and Roeglinger, 2011).

Maturity models supports managers in assessing their business' current picture and finds potential courses or action, leading to strategic process improvement in contrast to intuitive decision making or reactions to external disruptions. Nonetheless, there is a limitation to any maturity model, and it is the fact that these models are self-assess, which means that companies rank themselves among the different dimensions considered in the model (Berghaus and Back, 2016). The reason for this is that companies hold a deeper knowledge of their own business. However, answers could be biased or could describe a future picture of the business (where they are working to be) instead of an accurate view today. Additionally, it could result questions have been misinterpreted by the user or that the person completing the model is not necessarily an expert in each area and does not have the knowledge to answer on their behalf.

Industries face challenges regarding latest technological developments, environmental change, society and economy. Organisations faced a need for prompt adaptation and cooperation. Increasing the level of efficiency in processes will not just have an impact at an individual company level. Changes will influence the entire supply chain (Schumacher et al. 2016).

There are things to consider when selecting a maturity model, such as assessment method, areas covered, and cost to name a few. When it comes to Digital Maturity Models, the IMPULS model serves on how these models are applied and the areas of focus for a digital maturity assessment. The IMPULS model offers the advantage of cost since the model assessment is free of charge. This is a huge advantage when compared to models from consultancy companies in which the organisations must pay high prices every time they want to assess their current state. This model offers the possibility for users to track their progress frequently, without additional costs. The model classifies companies into outsider, beginner, intermediate, experienced, expert or top performer. The first two levels are considered newcomers, while the

third is classified as learners and the remaining three items as leaders (Lichtblau et. al, 2016). Details of the dimensions of this model and how to apply it are included in Appendix 3.

Even though a digital maturity assessment itself will not help a company build resources and competence, it will tell them where they are, where they are aiming to be, and what they need to do to get there. A model, such as the IMPULS model, will provide guidelines of areas to focus and resources and capabilities to develop. It also serves as a tool to track performance levels and make strategic decisions towards the goals a company is trying to reach.

Change Management

The main problem companies fail to acknowledge is that digital transformation is not only around technology. It is primarily about people. Siemens (2019) divides the leading challenges for digital transformation into five categories described below:

- Culture: Lack of willingness to embrace digitalisation, even resistance from more traditional companies. Employees need to accept the continuously changing conditions.
- Digital talent: Companies must attract and retain the right talent and skills for the job. In a highly competitive market, this is not so simple. Existing employees need to build stronger teams with are orientated to a common goal across the entire company.
- Speed: Uncertainly and increase in customer expectations will accelerate the speed in which the business moves. This will create stress among employees.
- Evolving target state: The target will continuously evolve because of new emerging technologies, processes, and tasks. Companies need to have a certain degree of flexibility to be able to chase this moving target promptly.
- Cross-functionality: Digitalisation has reduced the distance between stakeholders. However, it has also forced teams to collaborate when in the past they worked almost independently.

Companies need to accept and embrace digitalisation to remain relevant and competitive. There are three key recommendations for a successful digital transformation journey:

- Establish an integrated attitude towards change management from as early as the conceptualisation of a digital concept rather than during the implementation stage.
- Have an agile approach by adding flexibility to your processes to include the learnings from the concept and implementation. Have shorter iterations during your processes and gather feedback after every repetition to introduce and test suggestions sooner.
- Tune the regular change management areas to the framework of digitalisation. These topics consist of leadership, building stronger teams, company culture, change story, improving communication, coaching, shifting roles and increasing knowledge. The topics remain the same yet orientated towards the requirements of the specific digital technologies chosen to incorporate.

5.3 Achievement of digital strategic alignment

The frame of reference used in the thesis showed the strategic alignment as a process consisted from anchored domain, pivot domain, and impacted domain. These domains share a change which could be a deviation from the business objectives. The change initiated in one domain, but the impact of this change is in another domain. To achieve realignment, the actions of alignment must impact the three domains. Therefore, alignment is a process not an end state. The dynamics of digital strategy and the emerging technologies make it impossible to have operations as aligned or not aligned with business objectives. There is always a need for alignment actions to ensure alignment over time.

The collected primary data and secondary data are well aligned with the frame of reference. The reasoning behind this, as mentioned by all of experts interviewed and seen in the two case studies collected, is digital strategic alignment cannot be consistently accomplished as the market environment is constantly evolving, thereby generating new information with the company and causing improvement in the business strategy as well as digital strategy. Viewing digital strategic alignment as a continuous process over time requires frequent alignment actions in parallel to the decisions being taken on the strategic level as well as the operational level. Digital strategic alignment is not a step function moving from "not aligned" state to "aligned" state, if so, a list of actions is needed only once to move from "not aligned" to "aligned" state.

Put together, digital strategic alignment requires dynamics actions that ensure alignment at any point over time. In this context, the dynamic capabilities framework (Teece, 2014) is well applicable to achieve digital strategic alignment at any point over time. In other words, the business dynamic capabilities and digital strategic alignment are interdependent. The design, processing, deployment, and development of both business strategy and digital strategy are outputs of dynamic capabilities. Dynamic capabilities are the ability of the business to refine, develop, and sustain internal skills in the business environment at any point to achieve alignment.

The dynamic capabilities, presented by Teece (2014), include sensing, seizing, and transforming. Dynamic capabilities are defined as follows:

- *Sensing*: identifying, developing and evaluation of technological prospects relative to customer needs. This role involves three stages. First, scanning. Here is where companies explore the technologies available, detect promising opportunities, focuses on key customer and suppliers, and identifies areas where action is needed. This is then followed by a learning stage, in which actions are taken based on the observations of the scanning phase, and more insights are gathered to evaluate alternatives. The third and final stage of the sensing role is calibrating. This involves refining processes and assess actions necessary for pursuing the opportunities chosen (Teece et al., 2014).
- *Seizing*: Once prospects and measures are known, the next step is to assemble resources to capture value from activities. The role of seizing is to enable companies to act on opportunities identified and encourage them to introduce the necessary changes to reach

their targets. The first stage of this role is the design stage. Here, companies' plan and design new processes and structures needed for the identified actions from the previous role. The second stage is selecting the correct plan of action from the alternatives drafted in the first stage. Finally, the third stage refers to committing to the chosen design and compromise to decisions on how this will be executed (Teece et al., 2014).

- *Transforming*: This final role involves reconfiguring administrative resources. This role is crucial to enable the alignment as it modifies the current stage to find a fit with the target of the new strategy. This role has four stages. The first one is leveraging, where existing resources are placed to new uses aiming to gain new capabilities. Followed by this is the second stage, creating. Once current resources are in use, there might be a need to create new talent or processes which did not exist within the company before, in order to serve the customer. The third stage is accessing external resources to fill in the gaps which might still exist. This can be done through partnerships or vendors. The final stage is to release any resource which is not currently of use to the new strategy. In some cases, this might involve letting go of workforce. However, during the first of the stages it would be possible to reallocate them to new tasks before looking at the option of dismissing them from the company (Teece et al., 2014).

Figure 24 shows a simplified framework of dynamic capabilities that illustrate the connections between the higher level of capabilities and actions associated with each one.

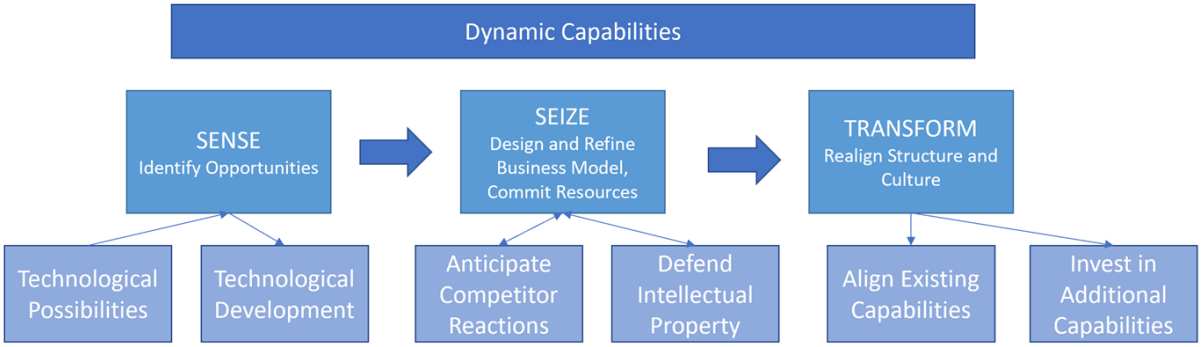

Figure 24: Simplified framework of dynamic capabilities. Adapted from (Teece, 2014)

Dynamic capabilities can ensure alignment through a sequence of actions that were developed based on the needs. However, if dynamic capabilities and strategy creation process combined, some of the dynamic capabilities will be missing in some strategy creation process steps. According to the literature review performed, the process of strategy creation is in three steps, namely, strategy formulation, strategy implementation, and strategy controlling and monitoring. According to the definitions of dynamic capabilities by Teece (2014), sensing and seizing actions will be the most observed in the formulation stage. In the implementation stage, all dynamic capabilities may exist, while in the monitoring and controlling stage, the transformation dynamic capability may is the only one that exists. Therefore, the dynamic capabilities framework is best applied in parallel to the strategy creation process to achieve digital strategic alignment.

To achieve digital strategic alignment at any point over time, dynamic capabilities (alignment actions) are presented in every stage of the strategy creation process. Alignment actions act as a cycle in each stage such that realignment actions will realign any forces that arose during the process of strategy creation. An example of forces is the resistance to change by people. In other words, if there are deviations from the targeted objectives or conflict arose, there will be a misalignment which needed to be addressed with more alignment actions. Once the forces of each stage are sorted, the alignment actions for the next stage can begin. Figure 25 shows how this process looks like in a process flow diagram.

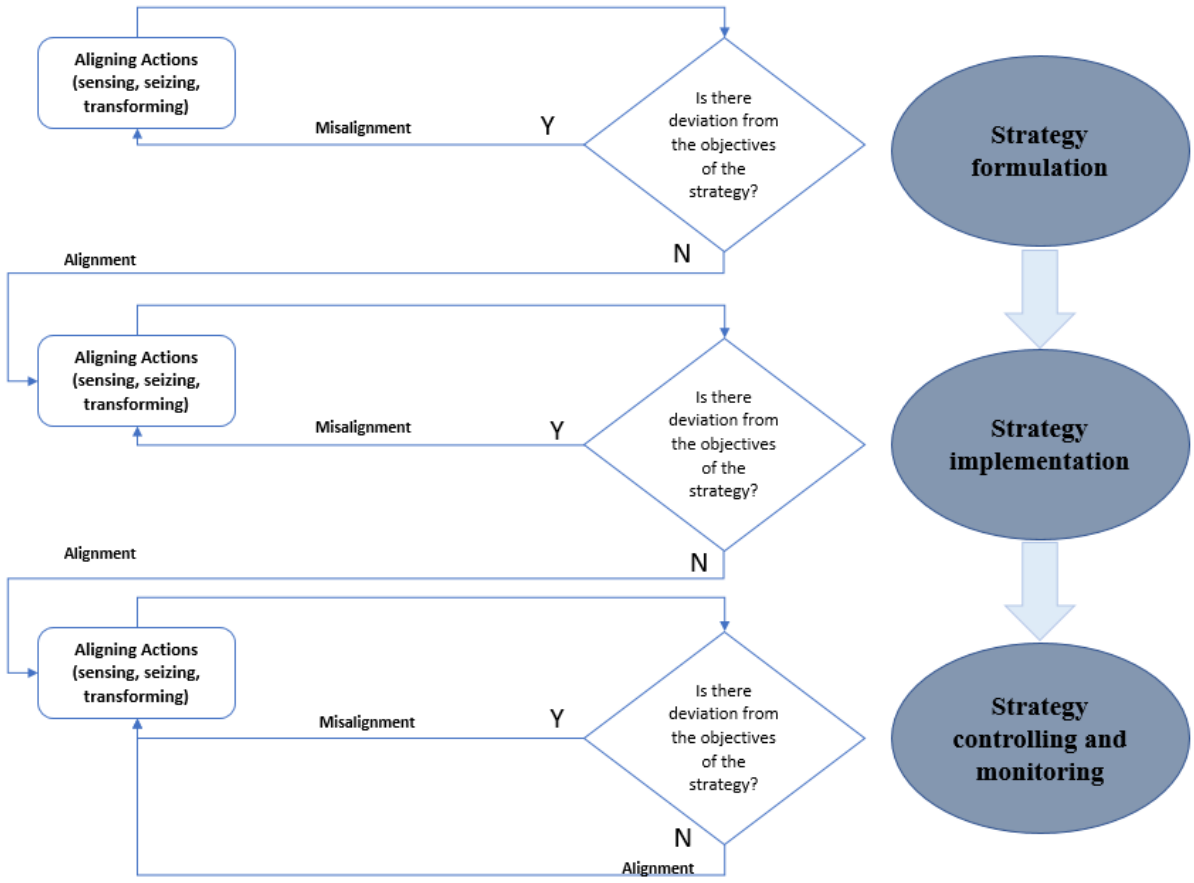

Figure 25: Digital strategic alignment process flow diagram (developed by thesis authors)

In the strategy formulation stage, the alignment process begin when the digital leaders along with business executives take actions for seizing the opportunities identified and tackled the threats the new strategy faced. Some preliminary measures enable identifying the resources required to begin introducing change. The strategy implementation stage will also initiate with alignment actions. However, the purpose here is to develop new resources which supports the strategy after reallocating current resources and recognizing where there are gaps from the previous stage. Finally, the monitoring and controlling stage the alignment actions focus on further leveraging and enhancing the capabilities developed in the previous stage. The final cycle of alignment action keeps active as long as the stage of monitoring and controlling is going to ensure the achievement of alignment at any point over time.

6. Conclusion

This chapter aims to answer the three research questions based on the analysis and discussion. It also introduces limitations to the research by mentioning directions for further research.

6.1 Findings to research questions

RQ1: What are the enablers and inhibitors for digital strategic alignment?

The most emphasized enablers or inhibitors (if they are lacking) from the frame of reference, primary data, and secondary data used in this thesis are:

1. Digital capability.

Digital capability is a mix of technical and managerial competences which gives the ability to adapt the situation and provide correction actions without deviating from the end objective. Digital transformation as well as digital strategic alignment is not possible without developing the right digital capability that meets the need of digital strategy and business strategy.

There are six core activities associated with the development of digital capabilities. First, research and innovation activity. Research and innovation are critical to have a responsive mindset to digital changes by modeling and solving problems through innovative approaches. Second, communication. Communication is important for knowledge sharing and people engagement. Third, learning, teaching, and assessment. These are vital to building digital education throughout the organization. Forth, Content and information. These are about delivering connections and feedback within the organization. Fifth, ICT infrastructure which refers to the technical knowledge of the digital technologies and infrastructure in light of strategic priorities. Sixth, the development of a digital culture that is conforming to the digital and business strategies.

To enable digital capabilities, top management must appoint digital leaders responsible for developing digital strategy and aligning it to business strategy. The role of top management in this case is visionary to provide direction towards company purpose. Digital leaders' role is to adapt to the changing business environment by utilizing their digital capabilities for the purpose of alignment.

2. Digital leadership.

Digital leadership shows the use of digital technologies in line with the business priorities to deliver competitive advantage. Digital leadership is not only possible for digital leaders that lead digital strategy and digital investments and initiative, digital leadership must be acquired by all personnel from different organizational levels. Developing digital culture is a great enabler for digital leadership.

Digital leadership demands for several skills to make the use of digital technologies in line with business priorities. First, digital leaders must be innovative in their way of working. The key is to stay updated on emerging innovations and ensure that workers are accepted into a working environment that embraces creativity and takes chances in testing new technologies. Second, digital leaders must have the ability to adapt to different working environment situations.

Adaptability provides actions and feedbacks from the working environment which helps in aligning deviations. Third, digital leaders must have the courage to take risks. In other words, risk-taking skill empowers digital leaders and engages people with the business objectives. Lastly, digital leaders must have the ability to stand out from the rest by understanding the business and facilitating the process of understanding the digital strategy by the business.

RQ2: What are the challenges manufacturing companies are facing in the digital strategic alignment?

The leading challenges for digital transformation fall into the categories of culture, digital talent, speed, evolving targets and cross-functionality.

The main challenges for the manufacturing industry identified by the expert panel are:

- Building resources and competences
- Leadership skills
- Lean principles
- Sharing views, not only within management
- Feeling overwhelmed and having old ways of thinking
- Having good knowledge of your processes and purpose of the digitalisation
- Cross-functional teams communication gaps
- Understanding shift in roles and power

Three areas of focus were suggested for companies to tackle these challenges:

- **Digital culture:** Before immersing into digitalisation, the right mind-set needs to be in place. Having the right company culture will provide transparency, enhance collaboration, extend digital training to all levels of the company, become a place people aspire to be a part of and become more comfortable with taking risks in an uncertain environment such as those involving new digital technologies.
- **Digital maturity models:** This model will provide an assessment of the current skills and capabilities, and what would be needed to reach the desired state. It will identify where companies are leading and where they are falling behind. It provides guidelines to which capabilities to develop and how to allocate resources to achieve goals.
- **Change management:** Managing change is key for securing success. Then it comes to digital transformation, companies need to from an integrated attitude towards change from the conceptualisation stage, increase flexibility to the process to learn fast and adapt to moving targets, and provide the regular change management framework leaning towards the requirements of the specific digital technologies selected.

RQ3: How can digital strategic alignment be achieved in manufacturing companies?

Digital strategic alignment cannot be consistently accomplished as the market environment is constantly evolving, thereby generating new information with the company and causing improvement in the business strategy as well as digital strategy. Therefore, digital strategic alignment is a process of alignment actions that are running over time in parallel to the strategy creation process to achieve alignment between digital strategy and business strategy at any

point over time. In this context, the dynamic capabilities framework developed by Teece (2007) is well applicable to provide alignment over time.

Dynamic capabilities (alignment actions) are sensing, seizing, and transforming. Sensing is the act of searching for possibilities by identifying, developing and evaluation of technological prospects relative to customer needs. Sensing consists of three stages, namely, scanning, learning, and calibrating. The second dynamic capability is seizing. The role of seizing is to enable companies to act on opportunities identified and encourage them to introduce the necessary changes to reach their targets. Seizing consists of three stages, namely, designing, selecting, and committing. The final digital capability is transforming which involves reconfiguring administrative resources to find a fit with the target of the new strategy. Transforming dynamic capability consists of four stages, namely, leveraging, creating, accessing, and releasing.

For manufacturing companies to achieve digital strategic alignment at any point over time, dynamic capabilities (alignment actions) must be presented at every stage of the strategy creation process. Alignment actions act as a cycle in each stage such that realignment actions will realign any forces that arose during the process of strategy creation. An example of forces is the resistance to change by people. In other words, if there are deviations from the objectives or conflicts arose, there will be a misalignment which need to be addressed with more alignment actions. Once the forces of each stage are sorted, the alignment actions for the next stage can begin. For clarification, see figure 25 in the previous section that shows the process of digital strategic alignment in a process flow diagram such that manufacturing companies can use to achieve alignment between their digital strategy and business strategy.

6.2 Directions for further research

Many research opportunities can be derived from the results of this thesis. The results of this thesis are theoretical, and a suggestion for further qualitative and/or quantitative research is to test these results through case studies with manufacturing companies to figure out their applicability as well as their feasibility. This can be helpful in providing detailed action plans to develop enablers and eliminate inhibitors for digital strategic alignment and how to overcome digital strategic alignment challenges.

Another interesting suggestion for further research is to test the process of digital strategic alignment provided in this thesis and provide more details on how companies can decide to move from one alignment action cycle to another within the process of strategy creation. Also, quantitative studies that measure the use of dynamic capabilities within the process of digital strategy creation would be interesting.

References

Ali, A. and Yusof, H. (2011) Quality in qualitative studies: the case of validity, reliability and generalizability', Issues in Social and Environmental Accounting, Vol. 5, pp. 1 – 2.

Akdil, K. Y., Ustundag, A., & Cevikcan, E. (2018). Maturity and readiness model for industry 4.0 strategy. In Industry 4.0: Managing the digital transformation (pp. 61-94). Springer, Cham.

Alaceva, C., & Rusu, L. (2015). Barriers in achieving business/IT alignment in a large Swedish company: What we have learned? Computers in human behaviour, 51, 715-728.

Avison, D., Jones, J., Powell, P., & Wilson, D. (2004). Using and validating the strategic alignment model. The Journal of Strategic Information Systems, 13(3), 223-246.

Banker, R. D., Bardhan, I. R., Chang, H., and Lin, S. (2006) Plant information systems, manufacturing capabilities and plant performance, MIS Quarterly, (30:2), pp. 315 – 337.

Barnett, M. (2017). The importance of real time data and five reasons why we need it, Fourth Source, August 1st, 2017.

Becker, J., Niehaves, B., Pöppelbuß, J. and Simons, A. (2010) Maturity models in IS research, In Proceedings of the European Conference on Information Systems (ECIS), Pretoria.

Beckhard, R., and Harris, R. T. (1987) Organizational transitions: managing complex change 2nd Edition, Reading, MA: Addison-Wesley.

Benbasat, I., Dexter, A. S., Drury, D. H. and Goldstein, R. C. (1984) A critique of the stage hypothesis: theory and empirical evidence, Communications of the ACM, 27 (5), pp. 476 – 485.

Berghaus S. and Back A., (2016) Stages in digital business transformation: results of an empirical maturity study, MCIS 2016 Proceedings, 22, available at: http://aisel.aisnet.org/mcis2016/22

Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. (2013) Digital business strategy: toward a next generation of insights, MIS Quarterly, 37(2), pp. 471 – 482.

Bonnet, D., Ferraris, P., Westerman, G. and McAfee, A. (2012) Talking about a Revolution, Digital Transformation Review (2:1), January 2012, pp. 17 – 33.

Bracker, J. (1980). The historical development of the strategic management concept, Academy of Management Review, Vol. 5, Issue. 1, pp. 219 – 224.

Bricknall, R., Darrell, G., Nilsson, H., & Pessi, K. (2007, January). Aligning IT Strategy with Business Strategy through the Balanced Scorecard in a multinational pharmaceutical company. In 2007 40th Annual Hawaii International Conference on System Sciences (HICSS'07) (pp. 235b-235b). IEEE.

Broadbent, M., Weill, P., O'Brien, T. and Neo, B.S. (1996) Firm context and patterns of IT infrastructure capability, In: 17th International Conference on Information Systems, December 16th – 18th, Cleveland, OH, pp. 174 – 194.

Brown, S. L., & Eisenhardt, K. M. (1997). The art of continuous change: Linking complexity theory and time-paced chanevolution in relentlessly shifting organizations. Administrative science quarterly, 1-34.

Burn, J.M. (1997) A professional balancing act – walking the tightrope of strategic alignment, In C. Sauer and P.W. Yetton (eds.) Steps to the Future: Fresh Thinking on the Management of IT-Based Organisational Transformation, San Francisco, CA: Jossey-Bass Publishers.

Capgemini & MIT (2011) Digital transformation: a roadmap for billion-dollar organizations, MIT Sloan Management, MIT Center for Digital Business.

Capgemini (2012). The Digital Advantage: How digital leaders outperform their peers in every industry. MITSloan Management and Capgemini Consulting, MA, 2, 2-23.

Carr, N.G. (2003) IT doesn't matter, Harvard Business Review, Volume 81, pp. 41 – 49.

CGI (2017) Digital transformation in the manufacturing industry, available at: https://www.cgi.com/en/cgi-insights

Chan, Y. E., & Huff, S. L. (1993, December). Investigating information systems strategic alignment. In ICIS (pp. 345-363).

Chan, Y. E., & Reich, B. H. (2007). IT alignment: what have we learned? Journal of Information technology, 22(4), 297-315.

Chanias, S., Myers, M. D., and Hess, T. (2019) Digital transformation strategy making in pre-digital organizations: the case of a financial services provider, The Journal of Strategic Information Systems, 28(1), pp. 17 – 33.

Coleman, P., & Papp, R. (2006, March). Strategic alignment: analysis of perspectives. In Proceedings of the 2006 southern association for information systems conference (pp. 242-250).

Coltman, T., Tallon, P., Sharma, R., & Queiroz, M. (2015). Strategic IT alignment: twenty-five years on.

Davis, E.B., Kee, J. & Newcomer, K. (2010) Strategic transformation process: toward purpose, people, process and power, Organization Management Journal, 7(1), pp.66 – 80.

De Bruin, T., Rosemann, M., Freeze, R. and Kulkarni, U. (2005) Understanding the main phases of developing a maturity assessment model, In Proceedings of the Australasian Conference on Information Systems (ACIS), Sydney.

Deloitte (2015) Strategy, not technology, drives digital transformation, MIT Sloan Management Review, available at: https://www2.deloitte.com/cn/en/pages/technology-media-and-telecommunications/articles/strategy-not-technology-drives-digital-transformation.html

Deloitte (2018) Distinctive traits of digital frontrunners in manufacturing: embracing the 4th industrial revolution, available at: https://www2.deloitte.com/us/en/insights/focus/industry-4-0/digital-leaders-in-manufacturing-fourth-industrial-revolution.html

Demirkan, H., Spohrer, J.C. and Welser, J.J. (2016) Digital innovation and strategic transformation, IT Prof. 18 (6), pp. 14 – 18.

DMI (2019) How to create and cultivate a digital culture in your organization, Digital Marketing Institute, available at: https://digitalmarketinginstitute.com/en-eu/blog/how-to-create-and-cultivate-a-digital-culture-in-your-organization

Downes, L. and Nunes, P. F. (2013) Big bang disruption, Harvard Business Review (91:3), March 2013, pp. 44 – 56.

Elvington, S. (2017) Evolving leadership for the digital age, Leadership Management, Oracle blogs, available at: https://blogs.oracle.com/sandye/evolving-leadership-for-the-digital-age

Eriksson, L.T. and Wiedersheim, P. F. (2001) Att utreda, forska och rapportera, Liber AB, Stockholm.

EY (2011). The digitization of everything: how organisations must adapt to changing customer behaviour, available at: http://www.ey.com/Publication/vwLUAssets/The_digitisation_of_everything__How_organisations_must_adapt_to_changing_consumer_behaviour/$FILE/EY_Digitisati on_of_everything.pdf

EY (2018). Four ways companies can align their people strategy to their growth strategy, available at: https://www.ey.com/en_gl/growth/four-ways-companies-can-align-their-people-strategy-to-their-gro

Galliers, R.D. (2011). Further developments in information systems strategizing. The oxford handbook of Management Information Systems: Critical perspectives and new directions, Oxford University Press, Oxford, pp. 329 – 345.

Gartner (2014) Top 10 strategic predictions for 2015 and beyond, available at: https://www.gartner.com/en/documents/2864817

Gottschalk, P. (2009) Maturity levels for interoperability in digital government, Government Quaterly, 26 (1), pp. 75 – 81.

Grant, R.M, (2016) Contemporary strategy analysis – text and cases edition, 9th Edition, Chichester: John Wiley & Sons Ltd.

Guest, G., Namey, E., Taylor, J., Eley, N. and McKenna, K. (2017) Comparing focus groups and individual interviews: findings from a randomized study, International Journal of Social Research Methodology, November 2017, Vol. 20 Issue 6.

Henderson, J. C., and Venkatraman, N. (1989) Strategic alignment: a framework for strategic information technology management, CISR, 190.

Henderson, J. C., and Venkatraman, N. (1993) Strategic alignment: leveraging information technology for transforming organizations, IBM systems journal, 32(1), pp. 4 – 16.

Hess, T., Matt, C., Benlian, A., & Wiesböck, F. (2016) Options for formulating a digital transformation strategy, MIS Quarterly Executive, 15(2), pp. 123 – 139.

Iversen, J., Nielsen, P. A. and Norbjerg, J. (1999) Situated assessment of problems in software development, Database for advances in information systems, 30 (2), pp. 66 – 81.

Jisc. (2014). Building digital capability: building capability for new digital leadership, pedagogy and efficiency. Available at: https://www.jisc.ac.uk/rd/projects/building-digital-capability

Johnson, G., Whittington, R., Scholes, K., Angwin, D. and Regnér, P. (2014) Exploring Strategy, 10th edition, Harlow: Pearson Education Limited.

Kane, G. C., Palmer, D., Phillips, A. N., Kiron, D., & Buckley, N. (2015). Strategy, not technology, drives digital transformation. MIT Sloan Management Review and Deloitte University Press, 14(1-25).

Kazanjian, R. K. and Drazin, R. (1989). An empirical test of a stage of growth progression model, Management Science, 35 (12), pp. 1489 – 1503.

King, J. L. and Kraemer, K. L. (1984) Evolution and organizational information systems: an assessment of Nolan's stage model, Communications of the ACM, 27 (5), pp. 466 – 475.

Kohli, R., and Grover, V. (2008) Business value of IT: an essay on expanding research directions to keep up with the times, Journal of the Association for Information Systems, (9:1), pp. 23 – 39.

Kusiak, A. (2018) Smart manufacturing, International Journal of Production Research, 56:1-2, 508-517, DOI: 10.1080/00207543.2017.13

Kvale, S. (2008). Doing interviews. Sage.51644

Lee, S. M., Kim, K., Paulson, P., & Park, H. (2008). Developing a socio-technical framework for business-IT alignment. Industrial Management & Data Systems.

Lee, O.K., Sambamurthy, V., Lim, K. H. and Wei, K. K. (2015) how does IT ambidexterity impact organizational agility? Information Systems Research (26:2), pp. 398 – 417.

Lekvall, P. and Wahlbin, C. (2001) Information för marknadsföringsbeslut, IHM Publishing, Göteborg.

Lichtblau, K., Stich, V., Bertenrath, R., Blum, M., Bleider, M., Millack, A., Schmitt, K., Schmitz, E. and Schröter, M., "IMPULS - Industrie 4.0-Readiness", Impuls-Stiftung des VDMA, Aachen-Köln, 2015.

Luftman, J., & Brier, T. (1999). Achieving and sustaining business-IT alignment. California management review, 42(1), 109-122.

Malterud, K., Dirk Siersma, V. and Dorrit Guassora, A. (2016) Sample size in qualitative interview studies: guided by information power, Qualitative Health Research, Vol. 26 Issue 13, pp. 1753 – 1760.

McCormack, K., Willems, J., van den Bergh, J., Deschoolmeester, D., Willaert, P., Stemberger, M. I., Skrinjar, R., Trkman, P., Ladeira, M. B., Valadares de Oliveira, M. P., Vuksic, V. B. and Vlahovic, N. (2009) A global investigation of key turning points in business process maturity, Business Process Management Journal, 15 (5), pp. 792 – 815.

McDonald, M. P. (2012) Digital strategy does not equal IT strategy, HBR Blog Network, November 2012, available at: https://hbr.org/2012/11/digital-strategy-does-not-equa.

McKinsey (2017) Culture for a digital age, McKinsey Quarterly, July 20th, 2017, available at: https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/culture-for-a-digital-age#

Mckinsey & Company (2014). The aligned organization, available at: https://www.mckinsey.com/business-functions/operations/our-insights/the-aligned-organization

Merriam, S.B. (1994) Fallstudien som forskningsmetod, Lund: Studentlitteratur.

Mintzberg, H. and Quinn, J. (1991). The strategy process: concepts, contexts and cases, 2nd edition. Englewood Cliffs/New Jersey: Prentice-Hall.

Morrar, R., and Arman, H. (2017). The fourth industrial revolution (industry 4.0): a social innovation perspective, Technology Innovation Management Review, 7(11), pp. 12 – 20, available at: https://doi.org/10.22215/timreview/1117

Nadler, D. A., & Tushman, M. L. (1980). A model for diagnosing organizational behavior. Organizational Dynamics, 9(2), 35-51.

Nadler, D. and Tushman, M. (1997). Competing by design: the power of organizational architecture, Oxford University Press, USA, 10th July 1997.

Nickols, F. (2008) Strategy, strategic management, strategic planning and strategic thinking, Distant Consulting LLC, Research Gate, Article January 2008.

Orlikowski, W. (2009). The socio-materiality of organisational life: considering technology in management research, Cambridge Journal of Economics, (34), pp. 125 – 141.

Patel, B. and Cespedes, F. (2016) Introduction to business strategy, Journal of the American College of Radiology, Volume 13, Issue 6, pp.747 – 749.

Pavlou, P., and El Sawy, O. (2010). The third hand: IT-enabled competitive advantage in turbulence through improvisational capabilities, Information Systems Research, (21:3), pp. 443 – 471.

Poeppelbuss, J. and Roeglinger, M. (2011). What makes a useful maturity model? A framework of general design principles for maturity models and its demonstration in business process management, Conference Paper, Research Gate, June 2011.

Porter, M. (1996). What is strategy, Harvard Business Review, November – December.

Porth, S. (2002) Strategic management: a cross functional approach, New Jersey: Prentice Hall.

Rai, A., Pavlou, P. A., Im, G., and Du, S. (2012) Interfirm IT capability profiles and communications for co-creating relational value: evidence from the logistics industry, MIS Quarterly, (36:1), pp. 233 – 262.

Reich, B. H., & Benbasat, I. (2000). Factors that influence the social dimension of alignment between business and information technology objectives. MIS quarterly, 81-113.

Ross, J.W., Sebastian, I.M. and Beath, C.M. (2017) How to develop a great digital strategy, MIT Sloan Management Review Vol. 58, No. 2, available at: http://mitsmr.com/2fAqNTk

Sabherwal, R., Hirschheim, R. and Goles, T. (2001). The dynamics of alignment: insights from a punctuated equilibrium model, In: Organization Science 12(2): pp. 179 – 197.

Sadiku, M., Tembely, M., Musa, S., and Momoh, O. (2017) Digital Culture, International Journal of Advanced Research in Computer Science and Software Engineering, Volume. 7, pp. 33 – 34.

Salkin, C., Oner, M., Ustundag, A., & Cevikcan, E. (2018). A conceptual framework for Industry 4.0. In Industry 4.0: Managing the Digital Transformation (pp. 3-23). Springer, Cham.

Saunders, M., Lewis, P., & Thornhill, A. (2009). Research methods for business students. Pearson education.

Schein, E. (1996) Organizational learning: what is new? MIT Sloan School of Management, Working paper # 3912, July 1996.

Schlosser, F., Wagner, H. T., & Coltman, T. (2012, January). Reconsidering the dimensions of business-IT alignment. In 2012 45th Hawaii International Conference on System Sciences (pp. 5053-5061). IEEE.

Schumacher, A., Erolb, S. and Sihna, W. (2016) A maturity model for assessing Industry 4.0 readiness and maturity of manufacturing enterprises, In: Proceedings of Sixth 7International Conference on Changeable, Agile, Reconfigurable and Virtual Production (CARV 2016), Bath, UK.

Shapiro, C. (1989). The theory of business strategy, The RAND Journal of Economics, Research Gate, February 1989.

Siemens (2019) successful digital transformation: how change management helps you to hold course, Siemens AG, October 2019.

Slack, N., & Lewis, M. (2017). Operations strategy. Pearson Education.

Stafford, P. (2016), Why being a small business gives you a head-start in digital transformation, the digital transformation journey: how to modernise your SME, Smart Company, available at: https://www.smartcompany.com.au/partner-content/article-series/the-digital-transformation-journey-how-to-modernise-your-sme/why-being-a-small-business-gives-you-a-head-start-in-digital-transformation/bharad

Susarla, A., Oh, J-H., and Tan, Y. (2012) Social networks and the diffusion of user-generated content: evidence from YouTube, Information Systems Research, (23:1), pp. 123 – 141.

Säfsten, K. (2015) Research methodology: material about the research process from problem to result, School of Engineering, Jönköping University, August 2015.

Tallon, P. (2008) A process- orientated perspective on the alignment of information technology and business strategy, Journal of Management Information Systems, 24 (3), pp. 227 – 268.

Teece, D.J. (2014). The foundations of enterprises performance: dynamic and ordinary capabilities in an economic theory of firms, Academic Management, 24 (4), pp. 328 – 252.

Thurow, L. C. (1991). The corporation of the 1990s: Information technology and organizational transformation (pp. 3-23). M. S. S. Morton (Ed.). New York: Oxford University Press.

Trevor, J., & Varcoe, B. (2016). A simple way to test your company's strategic alignment. Harvard Business Review Digital Articles.

Trevor, J. (2018). Is Anyone In Your Company Paying Attention to Strategic Alignment? Harvard Business Review Digital Articles, 2-5.

Wagner, H.T. (2007). A resource-based perspective on IT business alignment and firm performance: theoretical foundation and empirical evidence, Stuttgart, Germany: Ibidem-Verlag.

Waller, V., Farquharson, K. and Dempsey, D. (2016) Qualitative social research: contemporary methods for the digital age, Los Angeles: SAGE.

Waltz, T., Powell, B., Matthieu, M., Chinman, M., Smith, J., Proctor, E., Damschroder, L. and Kirchner, J. (2014) Innovative methods for using expert panels in identifying implementation strategies and obtaining recommendations for their use, From 7th Annual Conference on the Science of Dissemination and Implementation in Health North Bethesda, MD, USA. 8-9 December 2014.

Wolf, C. and Harmon, P. (2010). The state of business process management, available at: http://www.bptrends.com/surveys_landing.cfm on 2010-07-25.

Yeow, A., Soh, C., and Hansen, R. (2018). Aligning with new digital strategy: a dynamic capabilities approach, Journal of Strategic Information Systems, 27(1), pp. 43 – 58, available at: https://doi.org/10.1016/j.jsis.2017.09.001

Yoo, Y., Henfridsson, O. & Lyytinen, K. (2010). The new organizing logic of digital innovation: an agenda for information systems research, Information Systems Research, 21(4), pp.724 – 735.

Young-Hyman, T. (2017), Cooperating without co-labouring: how formal organizational power moderates cross-functional interaction in project teams, Johnson Cornell Business, Administrative Science Quarterly 2017, Vol. 62(1), pp. 179 – 214.

Zaharia, M, Grundey, D. and Stancu, A. (2008) Qualitative research methods: a comparison between focus-groups and in-depth interview, Annals of the University of Oradea, Economic Science Series, Vol. 17 Issue 4, pp. 1279 – 1283.

Åhlström, P. (2004), Lean service operations: translating lean production principles to service operations, International Journal of Services Technology and Management, Vol. 5, Nos. 5/6, pp. 545 – 564.

Öberg, P., Ahrne, G. and Svensson, P. (2011) Livshistorieintervjuer, Handbok i kvalitativa metoder, Vol. 1, Malmö, pp. 58 – 70.

Appendices

Appendix 1: Selected case studies

Results of Hess et at. (2016) research in 3 case studies of German media and communication companies

Hess et al. (2016) identified four key dimensions in every digital transformation effort:

1. Use of technologies
2. Changes in value creation
3. Structural changes
4. Financial dimension

They developed 11 questions, divided into these four dimensions, which managers should consider when defining a digital transformation strategy.

The three case study companies from their study were

- P7S1 – TV Broadcaster
- Mittelbayerische – News Publisher
- Raversburger – Boardgame and Print Publisher

Below are their answers to each of the 11 strategic questions, divided per dimension:

Strategic Question	Strategic Options	Description	P7S1	MB	RB	Impetus for the Digital Transformation Outcome
How significant is your firm's IT to achieving strategic goals?	Enabler	IT is an enabler of strategic goals	●		●	- P7S1 regards IT as a core function and understands the potential of digital technologies for business success. - Ravensburger actively follows its customers into the digital world and generates new customer experiences through the combination of analog and digital content.
	Supporter	IT is seen as a support function to reach strategic goals		●		- Mittelbayerische's core business focus remains on the production and distribution of local news. Technology is merely a means for efficient processes.
How ambitious is your firm's approach to new digital technologies?	Innovator	The firm is at the forefront of innovating new technologies				- Not applicable
	Early adopter	The firm actively looks for opportunities to implement new technologies	●		●	- Through its merger & acquisition activities, P7S1 engages with early stage technologies. - Ravensburger introduces early-stage technologies to foster the development of innovative, digitally enriched content.
	Follower	The firm relies on well-established solutions	●	●		- P7S1 and Mittelbayerische emphasize process stability and seek to minimize risks following the implementation of new technologies.

Figure 26: Strategic questions about the use of technologies. Adapted from (Hess et al. 2016)

Strategic Question	Strategic Options	Description	P7S1	MB	RB	Impetus for the Digital Transformation Outcome
How "digital" is you interface to the customer?	Electronic sales channels	Distribution of analog products over digital channels		●	●	- Both Mittelbayerische and Ravensburger have recognized the importance of ecommerce for the sales of their analog products (e.g., print newspaper or analog games).
	Cross-media	Extension of the classic product to digital channels	●	●	●	- While at P7S1 and Ravensburger, the extension to digital channels only represented a step toward even more digital business models, Mittelbayerische's intention to keep its focus on print content only demanded a limited extension into digital business models (i.e., cross-media offerings).
	Enriched-media	Digital enrichment of the classic product	●		●	- Both Ravensburger and P7S1 have understood the opportunities of digital technologies to create new business areas through complementary products based on the enrichment of their classic products (TV and board games, and print, respectively).
	Content platforms	New content based offerings	●			- P7S1 has decided to benefit from its knowhow in content creation, aggregation and distribution and to engage in the management of content platforms.
	Extended business	New offerings without direct relation to content (analog/digital)	●			- Given the opportunities provided by digital technologies, P7S1 has decided to further leverage its competencies and enter adjacent markets.
How will you create revenue from future business operations?	Paid content	Revenues from the user for access to or the use of content	●	●	●	- All three companies have decided to keep their existing (i.e., pre-digital transformation) revenue streams through paid content.
	Freemium	Revenues from add-ons based on a free basic product	●			- Through its merger & acquisition activities, P7S1 engages in the management of content platforms.
	Advertising	Selling of attention	●	●		- P7S1 and Mittelbayerische have decided to sustain existing (i.e., pre-digital transformation) revenue streams through advertising.
	Selling complementary products	Revenues from products complementary to the core business	●		●	- P7S1 selectively uses complementary digital products to increase the attractiveness of its core business (sales of merchandise complementing TV shows). - Ravensburger has decided to introduce digital products that are complementary to the core business to meet customer demand for digital products and, simultaneously, strengthen analog products.
What will your future business scope be?	Content creation	Creation of content (analog or digital)	●	●	●	- All three companies have decided to continue to create, aggregate and distribute content (i.e., continue their predigital-transformation activities).
	Content aggregation	Aggregation of content (analog or digital)	●	●	●	- All three companies have decided to continue to create, aggregate and distribute content (i.e., continue their predigital-transformation activities).
	Content distribution	Distribution of content (analog or digital)	●	●	●	- All three companies have decided to continue to create, aggregate and distribute content (i.e., continue their predigital-transformation activities).
	Content platforms	Management of content platforms	●			- P7S1's management has decided to leverage the firm's core competency (the management of content) and engage in the emerging market for content platforms.
	Other	Other business models	●			- P7S1 engages in strategic merger & acquisitions (both as financial investments and to obtain access to new technologies/competencies).

Figure 27: Strategic questions about changes in value creation. Adapted from (Hess et al. 2016)

Strategic Question	Strategic Options	Description	P7S 1	MB	RB	Impetus for the Digital Transformation Outcome
Who is in charge of your digital transformation endeavour?	Group CEO	The group's Chief Executive Officer	●	●	●	- All three companies have recognized the complexity of digital transformation and made it a top strategic priority of the Group CEO.
	CEO of business unit	The CEO of the business unit that tackles the digital transformation endeavour	●		●	- Once a firm's size moves beyond a certain threshold, it is important to involve senior managers other than the group CEO in the digital transformation program. This applies for P7S1 and Ravensburger.
	Group CDO	The group's chief digital officer				- Not applicable
	Group CIO	The group's chief information officer				- Not applicable
Do you plan to integrate new operations into existing structures or create separate entities?	Integrated	The firm is at the forefront of innovating new technologies		●	●	- Mittelbayerische wants the digital transformation to happen in close quarters with the traditional business. - Ravensburger's digital focus is on products complementary to its traditional products
	Separated	The firm actively looks for opportunities to implement new technologies	●		●	- P7S1 does not want digital initiatives to be influenced by the existing business. - Ravensburger separates its activities that go beyond mere complementary products (e.g., online games).
What types of operational changes do you expect?	Products and services	Changed products and services	●	●	●	- All three companies have decided to use digital technologies to generate new customer experiences through digital products and services (e.g., P7S1's maxedome video-on-demand platform or Ravensburger's tiptoi pen).
	Business processes	Improvement of business processes	●	●	●	- All three companies have decided to use digital technologies to optimize their business processes (e.g., big data support in TV program planning).
	Skills	A new set of skills based on digital technologies	●		●	- Through its merger & acquisition activities, P7S1 automatically acquires new skill sets. - Ravensburger wants to attract and develop a new set of skills to make its separate digital business unit a success.
Do you need to acquire new competencies? If so, how do you plan to acquire them?	Internally	Rely on the resources that already exist	●	●	●	All three companies believe that they need to develop their current workforce in new, digital technologies.
	Partnerships	Foster Partnerships				- Not applicable
	Takeovers	Accumulate knowhow via takeovers	●			- Merger & acquisition activities give P7S1 an alternative channel to accumulate digital competencies.
	External sourcing	Source additional know-how from outside		●		- Mittelbayerische has realized that it needs to attract "digital natives" for a successful digital transformation.

Figure 28: Strategic questions about structural changes. Adopted from (Hess et al. 2016)

Strategic Question	Strategic Options	Description	P7S1	MB	RB	Impetus for the Digital Transformation Outcome
How strong is the financial pressure on your current core business?	Low	Margins in the core business remain mostly unaffected by digital technologies	●		●	- At P7S1 (TV) and Ravensburger (board games and books), margins from the core business remain strong.
	Medium	Digital technologies affect core business margins, but the core business remains profitable		●		- Mittelbayerische's print publishing market suffers from market share loses to digital substitutes.
	High	Digital technologies erode margins				- Not applicable
How will you finance the digital transformation endeavour?	Internal	Finance digital transformation through internal funds	●	●	●	- At all three companies, cash flow is sufficient to finance the digital transformation program.
	External	External financing necessary to finance digital transformation				- Not applicable

Figure 29: Strategic questions about the financial dimension. Adapted from (Hess et al. 2016)

Appendix 2: Interview guide

Introduction

a) Short presentation about the research students, the thesis research questions and interview formalities (anonymity granted).

b) Is it okay for us to record the interview?

1. Strategy and Organization

a) Can you tell us briefly about your role?

b) Could you tell us about the industries you normally work in?

c) From what you have observed, who is usually responsible for the company's business strategy?

2. Digitization / Digital Strategy

a) What does digitalisation mean to you?

b) What are the advantages, opportunities and potential for companies with increased digitalisation?

c) What are the disadvantages, difficulties and risks for companies with increased digitalisation?

d) Which broader business changes need to be considered when digitalisation increases? (For instance, impact on business model, competitive situation, market positioning, or profitability and growth).

e) What sources are being used for defining the requirements of the digital strategy? In other words, what formulates the digital strategy? What are the strategic principles that are important for the digital strategy?

3. Strategic Alignment

a) From your experience, is it important to align the digital strategy with the corporate strategy? How and why? Exemplify.

b) How can organisation (Capabilities, resources, management systems) support the achievement of digital strategy?

c) What are the main challenges for developing an adequate digital strategy that supports the main business strategy?

d) What are the enablers and inhibitors of the digital strategic alignment?

3.1. Infrastructure and Technology

a) Could you mention for us the digital technologies you have come across for the following functions within an organization?

i. Communication and internal administration (mail clients or cloud services)

ii. Finance (accounting and invoicing)

iii. Management of suppliers, logistics and distribution

iv. Warehousing and order handling

v. Production (automation and robots)

vi. Management of customer information (CRM systems)

vii. Marketing, branding and customer contact (social media)

viii. Other

3.2. Skills and Personnel

a) Do you consider that employees usually have sufficient technical skills to use the systems they are asked to work with?

b) From what you have observed, how is staff training regarding new/updated systems provided?

c) How are staff with specific technical/digital skills retained by companies?

3.3. Communication

a) How well and often do you consider is the subject of digital technology and digitalisation informed within a company?

b) How do you think companies should communicate their digital work to external partners?

c) From what you might have noticed from your own works perspective, what are the collaborations with external partners regarding digitalisation and which party takes the initiative for cooperation? For example, have you integrated any function up or down in the value chain?

3.4. Partnerships

a) From your perspective, how do companies usually view digital technologies within their company?

b) What do you see as advantages and disadvantages of integrating certain functions digitally with external partners?

3.5. Systems for Measurement, Evaluation and Follow-up

a) How have you noticed companies measure and evaluate how digital technologies affect their companies in terms of performance and profitability?

b) Are you aware of specific metrics and measurement methods for digital technologies or is this the same as for other projects and investments?

3.6. Governance and Management

a) At what level within companies do you observe decisions taken with regards to business strategy and digital issues respectively?

b) What does the process seem to be when deciding which business areas and technologies should be prioritized for digitization?

c) What are the reasons you think companies choose to invest in digital technologies?

d) From your experience, what is the organizational structure that enhance the digital strategic alignment and why?

Interview Conclusion

a) Is there anything you would like to add?

b) Do you have any questions for us?

c) Can we contact you for any follow-up questions?

Appendix 3: IMPULS Digital Maturity Model

A maturity model should provide a set of basic information, along with criteria of applicability (Becker et al. 2009, de Bruin et al. 2005). Target groups for applying a specific model can documented in order to allow comparison between them (Becker et al. 2009). The design of the maturity model must be documented and communicated to the target users in a clear and understandable way, using a language which is adequate and familiar to that industry. It should be simple to discriminate among the different levels (Poeppelbuss and Roeglinger, 2011). Additionally, a model should convey to what extend it has been subject to empirical validation. This can be achieved for instance through case studies, interviews with experts in the field, focus groups, or questionnaires to illustrate the link between corporate performance and the usage of the model (Benbasat et al. 1984, Solli-Sæther and Gottschalk 2010).

There are three common purposes of use for maturity models: descriptive, prescriptive and comparative dimensions (Poeppelbuss and Roeglinger, 2011). The descriptive aspect refers to including a detailed explanation for each maturity level and sublevels. This enables the user to understand what is being measured, and to understand what each level describes. For instance, in a competency framework, a user could be asked about their level when it comes to data auditing. They must choose a level between awareness, practioner, senior or lead. Yet, without a description of what it means to be either of those alternatives, the user might incorrectly allocate themselves at a level above or below their actual skills. Hence, it is vital to provide a clear description of what each category of a model means, yet also what each level/sublevel translates into and requires. On the other hand, the prescriptive dimension will support in identifying the needs in each maturity level in order to allow improvement, along with good or best practices in each dimension of study. Finally, the comparative aspect of a maturity model will work for benchmarking (Poeppelbuss and Roeglinger, 2011).

The IMPULS assessment covers six dimension which include 18 sub-categories to allocate a level of achievement from 0 – 5. These items are shows in Figure 30 below:

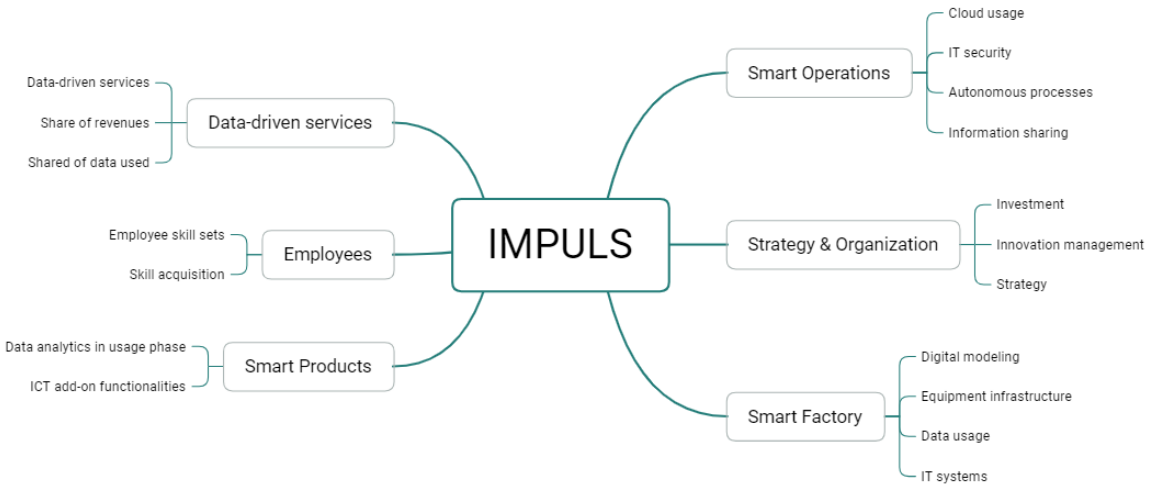

Figure 30: Dimensions and linked fields for Industrie 4.0. Adapted from (Lichtblau et al. 2015)

The test can be accessed online (available at: www.industrie40-readiness.de), and user get their final evaluation along with definition of the obstacles for advancing to the next level and recommendations on how to overcome them. Both the structure and the outcomes of the model are presented in a clear manner, making it an appealing choice for users looking to complete this assessment (Schumacher et al. 2016). A brief description for each of the six dimensions of the IMPULS model are described below (Lichtblau et. al, 2016).

1. Strategy and Organization: Opportunity to review and create completely new business models through the use of digital technologies.
2. Smart Factory: Processes are organised and completed without the need of human intervention. Production and logistics systems are carried out through an IT structure, relying on cyber-physical systems. Real-time data is analysed and integrated into decision making tools with the goal of achieving greater automation.
3. Smart Operations: Integration between the virtual and physical world by combining all elements, processes and systems within a plant. A horizontal integration across the value chain connects internal and external stakeholders. A vertical integration refers to englobing elements within a company, from production of the product or service, to sales, marketing, R&D and finance. High levels of integrations and automation could increase quality, flexibility and productivity of the offerings.
4. Smart Products: Though automation, flexibility and efficient production, physical products are equipped with sensors for data collection of their status and atmosphere. This data is communicated to high-level processes which have an impact over production levels and are reacting to changes in real-time.
5. Data-driven Services: The purpose is to coordinate upcoming business models while boosting customer satisfaction. After sales services will improve by focusing on the evaluation and analysis of data collected regarding customer feedback.
6. Employees: Lastly, the people most affected by digitalisation within a company are their employees. It will rely on their hands how this transformation towards a more digital strategy is achieved. Their working settings are directly affected and changed, demanding from them to develop new skills sets and, in some cases, even credentials. It is fundamental that the company manages to engage their personnel by using support material and promptly training. Even if all other dimensions are perfectly executed, a digital strategy can fail if there is not enough employee engagement, understanding and commitment.

When developing the IMPULS model, Lichtblau et al (2016) completed the assessment in 234 companies of the German mechanical engineering industry for companies with more than 20 employees. The results of this are shown in Figure 31 below:

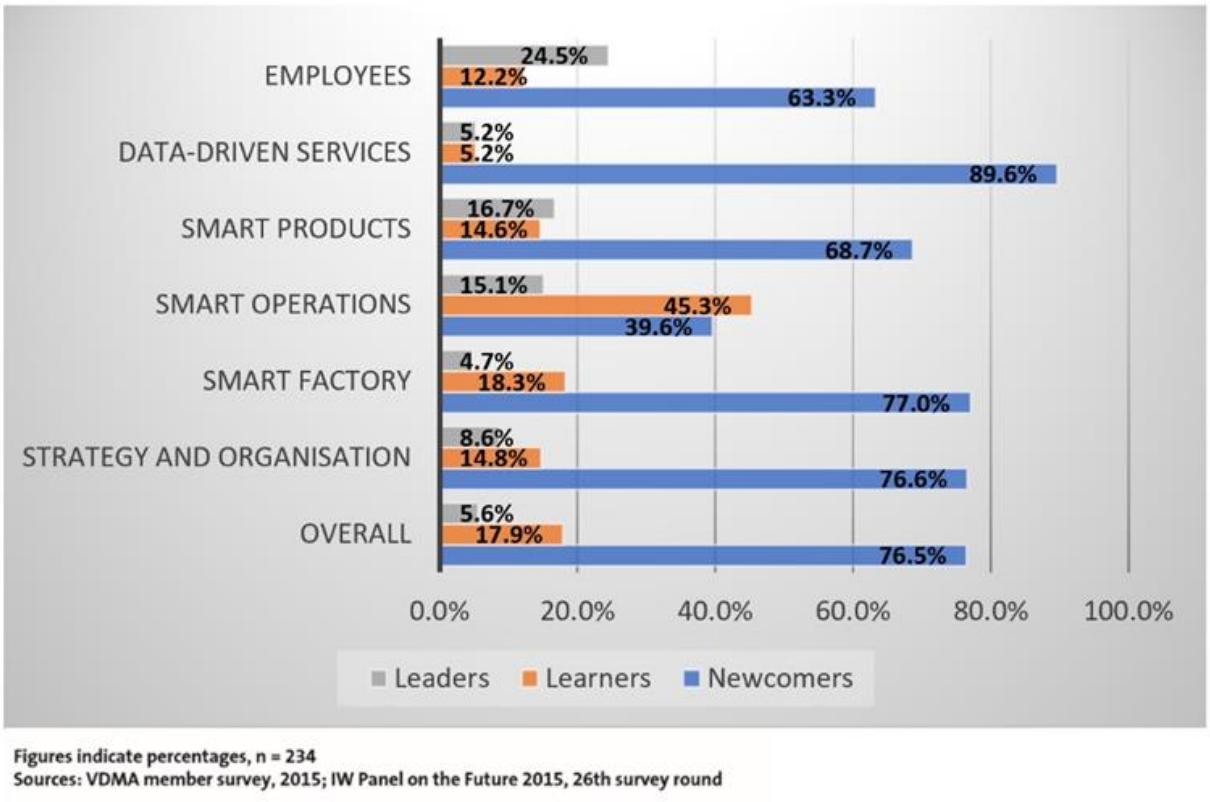

Figure 31: Breakdown by company type and dimension. Adapted from (Lichtblau et al. 2015)

From the results in Figure 30 it can be observed that 76.5% of the total sample were classified as newcomers, 17.9% as learners and only 5.6% as leaders. The challenges for reaching a higher level of digitalisation will depend on the type of company and how they scored in each of the individual dimensions. The percentages discussed above only reflect the overall scoring of the company (Lichtblau et. al, 2016).

The authors (Lichtblau et. al, 2016) concluded by saying that have a more proactive approach towards adopting and developing new technologies instead of this laid-back tendency, which can be supported by the high percentage of companies in the newcomer's category. Additionally, the results of the IMPULS model provide the user with a review of the economic benefits and the market requirements of this new era of industrialisation. Finally, they finish by saying this is a complex topic where there is not a one-size-fits-all alternative. Hence, it is important to identify best practices and to complete an assessment which will provide guidance over the recommended actions for one company, according to their skills, resources, and goals.

DEPARTMENT OF TECHNOLOGY MANAGEMENT AND ECONOMICS
DIVISON OF SUPPLY AND OPERATIONS MANAGEMENT
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2020
www.chalmers.se

CHALMERS
UNIVERSITY OF TECHNOLOGY