BARRIERS TO DIGITAL TRANSFORMATION

A CASE STUDY OF A B2B CHEMICAL MANUFACTURER

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A Case Study of German B2B Chemical Manufacturer

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Executive Summary

Digital transformation is taking place all around and there is hardly anything has not been affected (Reddy & Reinartz, 2017). It is reshaping a wide range of activities, influences the way we work, our communication and our consumer behaviors (Piccinini, Hanelt, R.W., & L.M., 2015). Benefits are less visible in certain situations, but a lot of administrative processes can be automated or digitized and manual labour can be reduced (Salo, 2006).

In a business context, digital tools are widely adopted as ERP, CRM and e-business solutions, however some, like e-business exhibit a significant gap between adoption and widespread adoption use (Zhu, Dong, Xu, & Kraem, 2006). Various theories predict the adoption of technologies such as innovation diffusion, TAM and TOE Framework, but there is a gap in digital transformation literature that depicts the barriers to digital transformation, particularly taking into consideration its nature as a discontinuous change process that holistically transforms its people, organization, structure, in the pursuit of value creation (Henriette, Feki, & Boughzala, 2016).

Furthermore, the chemical B2B industry has garnered a reputation for being a latecomer industry (Koehn, 2018). New startups have begun to enter the market where they leverage platform e-commerce services to lower prices and retain cost advantages, where large incumbent companies hesitate to try digital channels.

Therefore, the research aim of this thesis is to understand why the chemical industry is a latecomer industry and what barriers they face.

In this regard, the main research question is formed:

"What are the barriers to digital transformation faced by a B2B company in the chemical industry?"

Three sub-research questions are formed to help answer this main question. First with the help of a literature review (Chapter 3), the scope and definition of digital transformation is established. In this research the scope largely centers around digital business. The literature review also helps to determine the key factors required for a successful digital transformation. With this a conceptual framework to identify barriers is defined (Chapter 4). This contributes to the research objective of this thesis by contributing to digital transformation literature by combining prevailing theories on transformation, innovation and technology adoption.

In the second part of the thesis, one business line in a leading chemical manufacturer provides a case environment in which 15 interviews are conducted to understand various experts' motivation for digital transformation and establish drivers to digital transformation. The findings showed that respondents were unclear about terminologies like digital transformation and often had their own definition for digitalization. Thus, the definition of digitalization was revised so as to accurately portray the definition according to the respondents. It was also found that the definition of digitalization was often related to the drivers and motivations for digitalization and hence the drivers (Figure 9) were clustered into four key themes: **data-driven decision-making,**

improved customer experience, increased efficiency and digital business model innovation.

The interviews also discuss in detail the possible barriers that could impede the pace of transformation. A total of 25 categories of barriers were identified (Figure 10) and these barriers were compared with the conceptual framework that was previously derived. They were then clustered into 6 themes: **resources/capabilities, strategy, culture, value proposition, customer interaction and stakeholder engagement.** The identified barriers were then used to revise the framework.

Aside from the identification of themes of barriers, the interviews also indicate patterns of relationships between the most frequently emphasized barriers. This relationship is summarized as the Vicious cycle (Figure 11) since the relationships between these barriers are hard to break free from. It describes the significant **difficulty of defining a business case for digital business** and its perceived effect on **prioritizing digital transformation** strategically. Since digital transformation is not prioritized in the business line's strategy there is no project structure or **specific resources** allocated to it. The findings emphasize that without resources assigned to digitalization topics, there is no effort made to define a **digital business strategy**. Without a defined digital business strategy, there is an **observed resistance to change** to more digital ways of working, which then leads back to a lack of business case for digital business that can convince people to change.

The findings are evaluated by discussions held with different stakeholders within the business line representing different functions within customer relations, as well as discussions in panel presentations

with other business lines to understand the generalizability of the findings. It was confirmed that a finding similar to the barriers and the vicious cycle was observed in another business line as well. The B2B context was highlighted as a central actor in this regard as digital transformation across a value chain was invariable more complex than within an individual company. This strengthened the finding that there is a need for network-wide digital strategy discussions to garner more value.

Methods to overcome the barriers were also discussed and center largely across fostering a spirit of collaboration across stakeholders. Initiatives within the organization are already targeting more cooperation across silos and company has introduced new corporate values that also echo this sentiment. Recommendations are provided (Chapter 8.2):

1. Improving digital competency was a key barrier cited by respondents, this drove a fear for their job security as well as served as a barrier for initiating digital business ideas. In order to overcome this barrier, digital learning can be integrated into personal learning and development goals, by providing digital learning in methods tailored to the individual.
2. It would be beneficial to place the topic of digital services on the agenda for discussion with customers to encourage co-development and bring more value to all parties.
3. Assigning the responsibility of digitalization topics to a specific person could immensely improve focus on digital transformation and effort could thus be made to develop a convincing business case.
4. Partaking in cross-departmental discussions regarding digital transformation is highly informative and helps to spread

awareness and can foster collaboration with other business lines thereby reducing the effort required by an individual unit.

Finally, the framework is revised to include the drivers as found from the interviews and reflect certain changes to the initial propositions (Figure 12).

Digital transformation is a process that encompasses many challenges. This thesis aims to uncover the causes behind certain challenges by proving a framework that can help B2B companies to analyze and prepare for their transformative endeavours. Explicitly uncovering the barriers is the first step in recognizing the challenging hurdles that need to be overcome and to help define strategies to successfully combat them. This thesis highlights the gap in current research focus on the difficulties firms face in defining a business case for digital transformation. This is especially felt in B2B industries that are positioned further away from the end user and struggle to estimate the benefits of customer experience and digital service offerings. It attempts to contribute to this gap by shining light on the difficulties faced by firms in this regard and attributing causes for further research to be based upon. It also serves as a guide for other B2B chemical companies to better prepare for digital transformation by understanding the hurdles and developing strategies to overcome them.

Contents

Table of Figures

Abbreviations

ERP	Enterprise Resource Planning
CRM	Customer relationship Management
OA	Oil Additives
BL	Business Line
IT	Information Technology
B2B	Business to Business
EDI	Electronic Direct Interchange
AI	Artificial Intelligence
R&D	Research & Development

1

Introduction

1.1. Problem Statement

The business world is abuzz with talk of digitalization, digital technologies, and the desire to go ‘digital’. The impact on economies could be huge, with studies (Windhagen, et al., 2017) estimating that a committed increase in adoption of digital technology could add about 10 trillion euro to the combined European GDP by the year 2025. Many industries have been disrupted by start-ups with digital business models, who quickly manage to steal market share from incumbent market leaders with more traditional business models (Hess, Matt, Benlian, & Wiesbock, 2016). Thus, businesses are presented with extraordinary opportunities and new challenges (Schreckling & Steiger, 2017) and since digital technology is becoming increasingly important in order to achieve business goals, managers are extensively interested in knowing how to handle digital innovation (Nylen & Holmström, 2015).

According to the Digital Business Global Executive Study which surveyed more than 4800 respondents of varying managerial influence on their view of digitalization within their company, 60% of the respondents believed that digitalization would fundamentally transform

the way their organization worked, and 76% believed that digital technologies would disrupt their industry greatly or moderately in the future (Parviainen, Tihinen, Kääriäinen, & Teppola, 2017). Business are therefore driving digitalization in hopes of realizing its benefits, which can broadly be classified into categories such as: customer benefit, business model benefits, business process benefit, application system and services benefit, and infrastructure benefit. (Neumeier, Wolf, & Oesterle, 2017). Furthermore, Neumeier, Wolf and Oesterle (2017) emphasize that a digital business strategy makes explicit the advantages of digital technologies in competitive advantage and strategic differentiation, along with offering the flexibility to create novel market offerings, where improved customer experiences and customer relationships are centric to the value of digital transformation (Fitzgerald, Kruschwitz, Bonnet, & Welch, 2013). Organizational operations are also seeing improvements in terms of automating operations, and internal communications, powered by social media and intra/inter-net based platforms have also helped to transform the organization's innovation culture.

Reddy & Reinartz (2017) highlight that along with the benefits also come risks, costs and challenges for different stakeholders. These include substantial initial costs and investments, risk of privacy, disruption and loss of existing value chains, threat of new competition and a possible replacement of human workforce by technology. Their summary of risks and benefits are mentioned in the Fig. 1.

TABLE 1:
Overview of potential digitalization benefits and risks

	BENEFITS OF DIGITALIZATION	RISKS, COST AND CHALLENGES OF DIGITALIZATION
CUSTOMERS	NEW PRODUCTS AND SERVICES, GREATER CONVENIENCE, MORE CHOICE, NEW EXPERIENCES, LOWER PRICES	COST OF LEARNING, COST FOR INFORMATION SEARCH, ACTIVITY OVERLOAD, LOSS OF PRIVACY, PERFORMANCE UNCERTAINTY
COMPANIES	GREATER EFFICIENCY AND EFFECTIVENESS, OPPORTUNITIES TO CREATE NEW VALUE AND ENTER NEW MARKETS	LOSS OF EXISTING VALUE CHAIN CONFIGURATIONS, NEW COMPETITORS, FASTER INNOVATION CYCLES, NEW TECHNOLOGIES
INDIVIDUALS	MORE FLEXIBLE WORK MODELS, GREATER WORK PARTICIPATION, MORE FLEXIBLE LIFESTYLES, OPPORTUNITIES FOR CROWDSOURCING AND CROWDWORKING, EASIER SHARING AND RENTING	AUTOMATION TAKES OVER REPETITIVE AND EVEN SKILLFUL TASKS AND REPLACES THE HUMAN WORKFORCE
SOCIETY	MORE EFFICIENT AND EFFECTIVE PUBLIC ADMINISTRATION, BETTER PUBLIC SERVICES	PRIVACY AND DATA PROTECTION, OLIGOPOLISTIC OR MONOPOLISTIC MARKET STRUCTURES, CHALLENGES FOR TAXATION AND REGULATION

FIGURE 1: OVERVIEW OF RISKS AND BENEFITS (REDDY & REINARTZ, 2017, PAGE 2)

1.1.1. Latecomer Industries: The Chemical Sector

While there are few sources of literature on the impact of digitalization specific to each industry, a report by McKinsey (Manyika, et al., 2015) attempted to categorise different industry sectors based on their level of digitization. Of these, ICT and media firms appear to be most digitized whereas more traditional sectors like manufacturing, chemicals and pharmaceuticals, healthcare and agriculture were ranked lower. They further suggest that B2B businesses amongst these so-called 'non-digital' sectors have immense potential to digitally engage and interact with their customers, by providing omni-channel support and increased visibility of their business. On the other hand, the chemical industry, particularly in Europe is facing risk of digital disruption. Digital disruption in other industries has seen incumbents face a significant decrease in regular business and market share. Figures in Asia report a 78.5% share in B2B ecommerce gross merchandise volume in 2017, compared to

Europe's 3.6%, despite Europe being the second biggest market in terms of its Gross Domestic Product (GDP). While on a global scale the presence of marketplaces and web shops appear to be in abundance, Europe hosts only a few (Koehn, 2018) and there is much reluctance to use them. The overlap in natures of businesses being part of the chemical industry and the B2B environment, leave chemical companies at a larger risk of lagging behind when compared to other industries.

But the talk of digital transformation is not new. Financial services underwent digital transformation in the 1990s, followed by the retail and entertainment industries. Other industries such as oil and gas, on the other hand, have been slow to adopt digital technologies, and are hence called latecomer industries. These include firms with specialized, complex industrial assets which involve large capital investments, which could act as barriers to entry for other firms, thereby resulting in organizational inertia when it comes to transformational change (Kohli & Johnson, 2011).

The B2B chemical sector itself can be classified as a latecomer industry, which is a notion supported by Koehn (2018), especially in the context of sales. While fields of research, production and processing have already started to see the benefits of digital technologies, digital solutions for sales seem to develop much slower. This is believed to be due to the nature of sales transactions, i.e., the largely person-to-person basis on which business is still conducted. Coming to an agreement often involves a copious amount of phone calls and meetings, sometimes even in person, which do not always come cheap. But in comparison to the extensive effort the numbers of quotes buyers may end up with, and the number of contracts that sales persons achieve, it remains quite limited (Koehn, 2018). Koehn (2018) further suggests that it is difficult to adopt

new technologies because of listening to the best customers, deeply embedded routines and processes and fear of cannibalization.

Furthermore, such non-digital companies face various issues that curb productivity. Some of them include manual data entry, and process bottlenecks due to a lack of parallel processes. It is widely accepted that digitalization is capable of eliminating many such bottlenecks by introducing automated workflows to replace legacy processes (Parida & Wincent, 2019), yet there is still resistance towards adopting such digital measures.

1.2. Managerial Relevance and Scientific Contribution

Despite the above literature, the benefits of digitalization remain vague for many businesses. Traditionalists argue that digitalization is hardly a one-size fits all solution and may not even be relevant for every industry, and the 'transformation' appears to be much slower than anticipated. Studies show that the share of German enterprises in the Production Sector currently involved in digitization activities is as low as 14% for SMEs and 21% for Large Organizations respectively. They regard digital transformation activities of minor importance and often assess their ICT and enterprise system use ineffectively (Bley, Leyh, & Schäffer, 2016). For companies that are far removed in the value chain from the final consumer or end user, like typical B2B chemical suppliers, the advantages of going digital are less obvious. Investments can be large and the benefits uncertain, particularly if the rest of the value chain still operates in a traditional manner. This poses a problem because the longer a firm takes to build a digital strategy the more revenue share they are likely to lose to a 'digital' competitor (Bughin & van Zeebroeck, 2017). Ultimately, since there is a lack of understanding of the value

digitalization can deliver for an organization, it becomes difficult to determine the gains digital initiatives can deliver. Therefore, integrating and exploiting the full potential value that digital technologies have to offer is one of the biggest challenges faced by companies today (Hess, Matt, Benlian & Wiesboeck, 2016).

Research offers many theories behind the adoption and use of new technologies such as the widely known Rogers' Diffusion of Innovation Theory (Rogers, 1983), Technology-Organization-Environment Framework which aims to consider different contextual factors (Tornatzky & Fleischer, 1990), and the Technology Acceptance Model (Venkatesh & Davis, 2000). Most of these theories have been used to explain the usage of IT systems in business and have also tried to explain it from the perspective of the individual's intention to use IT systems. However, while digital transformation can refer to the use of IT systems for more efficiency and economic value creation, it has a broader connotation. It encompasses the changes the new technology has on our operations, interactions and configurations, and how wealth and value is created within the entire system (Reddy & Reinartz, 2017). It thus concerns the changes digital technologies can bring even to the company's business model, which can result in changed products and organizational structures (Hess et al., 2017). There is thus a lack of integrated studies that feature a holistic transformative perspective towards the adoption of digital technologies. Therefore, by combining the existing theory surrounding the adoption of IT systems, can not only strengthen it, but the addition of contextual factors and the holistic transformative view of digital technologies can expand and enrich the possible applications of theory.

1.3. Research Objective

This thesis aims to investigate the problem of why digital transformation initiatives, despite being highly talked about, are so slow to catch on specifically in the chemical industry, and the barriers involved in adopting such strategies.

The objective is two-fold: 1) to do this by contributing to the existing literature on adoption of digital technologies by expanding perspectives to include contextual factors and transformative implications, and stakeholder perspectives and 2) to develop a framework which will help identify barriers to digital transformation by taking into consideration these multiple factors.

Company Objective

As this research is conducted jointly with Evonik OA, the objective of thesis will be to identify the barriers to transforming digitally for the business line. By identifying and highlighting barriers to digital business in the perspective of various decision-makers, the aim to is develop a better understanding of what the business needs. By providing a scientifically investigated list of pain points, the aim is to facilitate more dialogue and encourage the adoption of digital measures that are specifically suited to OA.

1.4. Research Motivation

Apart from integrating pre-existing theory to better understand drivers for digital transformation, there is a need to specifically understand inhibitors or barriers, that prevents certain industries or companies from adopting digital technologies and undergoing a transformation, like their

counterparts in other industries.

There is thus, an evident gap in the level of digitalization amongst industries which is hardly explained. The aim is to improve the understanding of why the chemical B2B industry lags behind other industries when it comes to digital transformation, by uncovering the factors that contribute to this lag. Keeping this motivation in mind, this research will aim to answer the following central research question.

"What are the barriers to digital transformation faced by B2B companies in the chemical industry?"

In order to answer this research question, four sub-research questions are formulated as mentioned in chapter 2. The research process has been clustered into two main steps. First, a comprehensive literature study is performed to dive deep into the factors that influence the adoption of IT systems. The literature study is then expanded by delving into contextual factors surrounding the adoption of digital technologies and the importance of responsibly considering each stakeholder's interests and intentions for a successful transformation. Based on this research, a conceptual framework is constructed that encompasses the key factors that influence the possibility of a digital transformation.

In the second step, this framework is used to design an interview protocol, which is then used to explore the views of key stakeholders regarding digital transformation. The interviews not only serve as a tool to evaluate the conceptualized framework but also shed light on other possible barriers that exist within the practical context of a chemical B2B supplier.

1.5. Thesis Outline

In a bid to enunciate this research as simply and clearly as possible, this thesis will follow a clear structure. After the introduction above, the next section will introduce the research questions and approach. It will further shed light on the two-step approach mentioned above and highlight the specific research methodology followed. The tools that aid the research, like interviews and qualitative data analysis, will also be highlighted.

Chapter 3 contains the section on the literature review, which examines the crucial pre-existing theory that forms the basis for this research. The key terms used in this research, followed by the central theories and models that influence the subject of IT systems, digital technologies and transformation will be examined. Chapter 4 then details how a framework is conceptualized which rounds out the first step of this research. This framework will remain the basis for the remaining research.

Chapter 5 introduces the case that is central to this research. In order to answer the research question, this thesis follows the case of Evonik Oil Additives, a business line under Evonik Resource Efficiency GmbH, a company which is a B2B supplier in the chemical industry.

Chapter 6 then details the results of the interviews that have been conducted. Key findings will be emphasized that will enable reflection on the conceptual framework developed at the end of chapter 3. By extrapolating the findings from the data, possible implications will be discussed.

This will be followed by Chapter 7 will then deliver the conclusions and recommendations, which also includes limitations of the study and possible areas for future research.

2

Research Methodology

2.1. Research Questions and Sub-Questions

As mentioned in the Introduction, the central question that guides this research is the following:

"What are the barriers to digital transformation faced by a B2B company in the chemical industry?"

2.2.1. Research Scope

The scope of this research - although briefly mentioned in the research question – includes businesses that classify themselves as B2B businesses in the chemical industry. Additionally, digital transformation is a broad and sometimes over-used term, but in this research the scope of its investigation centres around 'digital business' or the usage of digital technologies to transform the way business is conducted. It naturally follows that digital business is dependent on supporting business processes and ways of working and that is also included within the scope of this research.

In order to further define a clear scope, the unit of analysis is limited to a

specific business line within the entire organization. The business line Oil Additives has been chosen and its specific context and background is introduced in Chapter 4.

2.2.2. Sub-Research Questions

Keeping this scope in mind, the main research question will be answered by answering the following sub-research questions:

1. What is meant by a digital transformation?
2. What are the key elements for a successful digital transformation?
3. What are the drivers for OA to digitalize?
4. What are the barriers faced by OA?

2.2. Research Approach

In order to answer the various sub questions, multiple methods have been employed. The entire research approach can be classified into two steps.

Step 1: Building a Conceptual Framework

Step 1 is largely theoretical and strives to answer sub question 1 and 2. While trying to establish drivers and barriers of digital transformation, it is first essential to clarify what is meant by digital transformation and enunciate the various terms used in conjunction with it. This also serves to delineate the scope of transformation in this body of research. Then a detailed literature review is performed to delve deep into existing theory. Because digital transformation is a recent term and literature surrounding the holistic transformation is scarce, prevailing theories surrounding innovation diffusion and the adoption of IT systems serves as the starting point for this research. Since the aim of this research is to contribute to the existing body of literature, the prevailing theory will be integrated with

the research on digital transformation to develop a conceptual framework detailing the key factors that enable a digital transformation.

Step 2: The Empirical Case Study

After laying the conceptual groundwork in step 1, step 2 involves an empirical application of this framework to the case at hand.

The research question that is central to this thesis and the sub-questions, consist largely of “what” and “how” questions. The questions of “what” and “how” in this case, are exploratory in nature, and favour the use of qualitative case studies. In this case, the research will take the form of an embedded, single-case study. Yin (2002) describes the case study as a research approach commonly used in the conduct of theses in social sciences such as business administration and management science, as it contributes uniquely to our knowledge of individual, organizational, social and political phenomena while retaining the meaningful characteristics of real-life events and organizational and managerial processes. It is especially important when the boundaries between phenomenon and context are not clearly evident.

While there is a risk of lack of rigor that accompanies case studies, the investigators have done their best to ensure that no bias influences the findings. For this, a continuous sense of scepticism is to be maintained at all times, during field observations and during interviews. The data is also triangulated by referring not only to interview data, but field notes, intranet articles and discussions for the purpose of evaluation. Another limitation of the case study is the sensitivity and skill of the researcher (Stake, 2005). In order to circumvent this, the best possible use of all training materials related to case study will be made.

Generalizability of the findings is also limited since the case study pertains to a single company and therefore lacks external validity, However the aim is to contribute to the current lack of empirical data regarding digitalization in the chemical sector, and for that the case study is an apt approach.

Once the framework was developed, it was presented to multiple stakeholders to evaluate it and gather feedback. The evaluation is also discussed in this report.

2.3. Research Methods and Tools

Step 1: Literature Review

In order to answer the sub questions 1 and 2, a structured literature review was performed. While choosing literature certain criteria were kept in mind such as choosing peer-reviewed research that adhered to relevant keywords. At first, Scopus was the database used to find literature but since some keywords such as 'digital transformation' threw up fewer sources, Google Scholar provided a more exhaustive list of sources including research articles. Some articles which can be considered white papers, published by credible sources, preferably in collaboration with research institutions such as MIT were also referred since they approached relevant subject matter and described recent research.

The idea was to limit the sources to a ten-year window, considering the time-dynamic nature of the topic of digital transformation, but due to the limited number of resources it was expanded to the early 2000s, which had a breadth of literature considering the use and adoption of

specific technologies. In some cases, even when the topic of literature did not seem specifically relevant to the discussion in this thesis, the introduction and theory sections proved useful sources for cross-referencing and discovering further relevant literature. While referring to popularly used theories that substantiate the framework described above, the literature sources are even older, although they are still widely referred to even today.

Step 2: Case building using Desk Research, Interviews and Qualitative Data Analysis

Case Construction

Sub questions 3, 4 and 5 are answered by weighing heavily into the context of the case. As mentioned previously a single business line of the company will be the basis for the construction of the case in Chapter 4. In order to do this, desk research helped to determine and establish the relevant background information. The company's intranet hosts a wealth of internal communication articles that lay out key information regarding the company's market and strategy. This helps to understand the company's strategic positioning.

Data Collection

Interviews were the primary data collection method employed in this research. They are also sparsely supported by field notes taken during conversations with key decision-makers outside of the interview setting, that was deemed relevant to this research.

The type of interviews conducted were semi-structured. Since the investigator is not an expert with knowledge on the B2B chemical

industry, the objective will be first to gain a primary grounding from people with more experience. Hence the interviews will follow Kvale's (1996) approach. Interview participants are like "meaning makers" and help in the purpose of deriving interpretations. The interviewer was flexible and attentive to the variety of meanings that may emerge in the interview. Because this puts pressure on the interviewer to pay attention to every major and minor detail, the interviews were requested to be recorded. But due to confidentiality and privacy reasons, the transcripts are not available in this thesis.

The interviewer in this setting was thus more of an information collector and the interviews were characterized by a more reactive way of asking questions, looking to allow room more room for the interviewee's expertise to be collected and then asking questions to build on this. The drawback here is involved with the selection of 'experts'. They were chosen by trying to account for as much variation as possible, but it is possible that since they belong to the same organization, there may be traces of groupthink.

Since the interview was semi-structured, a loose interview protocol was defined with the conceptual framework (Chapter 3), as a foundation. This was especially helpful in cases where the interviewee was not self-elaborative and needed more structure in the interview. In most cases the open nature of the questions was useful to dive deep into certain aspects, while relying on the interview protocol to ensure no key dimension of the interview was missed out.

Sampling

Due to the size of the population and the need for qualitative data analysis

in this study, the sampling size of the study was restricted to 15 employees of the company. Purposive sampling was used in order to determine the information required from specific target groups (Sekaran & Bougie, 2009), but it can also be considered convenient, since not all candidates who would have been ideal to interview could be interviewed. Furthermore, the design is a judgement sampling design, since there was a limited category of people who are involved in decisions and activities related to the theme of research. While this may impact the generalizability of the findings, it is the best way to extract information from the required target elements (Sekaran & Bougie, 2009).

These target groups were classified into Strategic decision-makers, sales, customer service, and business process executives. The rationale for this choice is made evident in Chapter 3 but is also briefly explained below.

Selection of Interviewees

Since the objective of this thesis is to contribute to overcoming barriers to digitalization, interviewees will be chosen whose work is likely to coincide in this direction. The Interviews were divided into 3 stages:

- **Organization-level strategy:** 3 Interviewees were chosen, preferably from the subsidiary Evonik Digital, to comment on the strategic vision of the company regarding digital transformation. The idea is to bring out the company's goals, their perception of the pace of transformation, their position with respect to the market, their perception of individual business lines and their digital efforts, and the barriers/hurdles they have faced/are facing in this regard.
- **Business Line:** level strategy: 3 Interviewees who occupy key

strategic positions in the business line Oil Additives will be chosen. The idea is to bring out the goal of the business line with respect to digitalization, their perception of digitalization, their perception of the need and the barriers that they could face.

- **Function-level:** With the help of the conceptual framework defined in Chapter 3, interviewees will be identified who fit the functions outlined. In total, there will be 9.
  a. 3 interviewees represent process transactions, and these consist of business process managers.
  b. 3 interviewees represent the buying transactions, and these consist of 3 sales managers who represent different customer segments of business for OA.
  c. 1 interviewee represents the communication transaction, and they are the head of regional customer service.
  d. 2 Interviewees represents functional capability, one is the head of IT Product Engagement and the other is responsible for regional Supply Chain Management.

Each of these interviews will be based on understanding their perception of digitalization, the expected value, and the barriers that they face in order to digitalize.

Data Analysis

After performing all 15 interviews, they were transcribed. According to Miles and Huberman (1994), there are three main steps in qualitative data analysis.

- **Data Reduction:** Since 15 interviews of 1 hour each resulted in a large amount of data, the data first needed to be reduced. This was first done by the process of coding, where significant pieces

of text were highlighted.

In many cases the words/statements were retained as is to form the code, but when the meaning was implicit the code was rewritten suitably. Code labels were mostly chosen according to key characteristics already highlighted in theory (Chapter 3), but in cases where the code did not lie under previously identified characteristics, a new code was created inductively, as per a description deemed fit. Some codes were repeated in the same document multiple times and the number of instances were noted to also highlight the dimension of subjective emphasis. In this manner 505 codes were generated.

Patterns were then identified amongst the codes and they were clustered into categories. The patterns were identified mostly based on similar word usage. However sometimes it was necessary to find implicit meaning in the codes based on context because different individuals attributed different meanings to similar words.

- **Data display:** The data reduction was conducted with the help of the qualitative data analysis tool Atlas.Ti and the code view feature helped to display each code and cluster it into code groups, which could form categories. Using the network feature of Atlas.Ti, it was possible to obtain a visual representation of the data. An example of the network view is shown in Fig X, which demonstrates how the codes were clustered into categories based on patterns. The remaining categories and their networked codes are found in Appendix B.

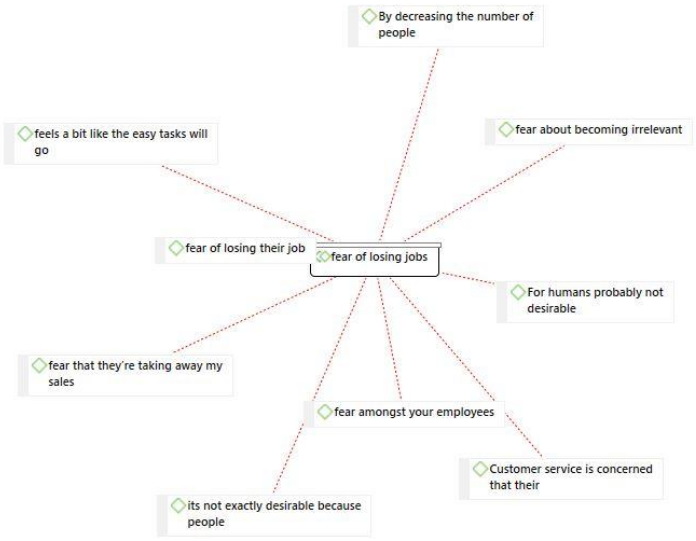


FIGURE 2. NETWORK VIEW OF CATEGORY "FEAR OF LOSING JOBS" WITH UNDERLYING CODES

- **Drawing Conclusions:** In this crucial part of the analysis, key comparisons and relationships were formed with respect to the existing theory with the help of the conceptual framework identified. The categories formed previously were further clustered into themes that aligned more closely with the conceptual framework. This was done intuitively based on the researcher's interpretation. Each interpretation is elaborated on in Chapter 6.

Data Triangulation

According to Sekaran & Bougie (2004), Data triangulation is considered as collecting data from different sources or time periods. While interviews were the primary source of data collection, field notes borne from key strategic meetings and interactions with decision makers also provided some insight and helped develop the discussion and conclusions from the data. These field notes are not disclosed in this thesis because of confidentiality reasons. However, certain quotes

barring confidential company information are included in the following chapters.

Information available from Evonik sources such as the intranet, company presentations and the external website have also been referred to develop background and contextual information that is important for this case study. This is done in Chapter 5. This has proved extremely useful in discerning if social desirability bias was prevalent in the interview answers. It also helps to maintain subjectivity while dealing with perspectives of different respondents.

3

Literature Review

This section discusses the theory that forms the basis of this research. Key concepts regarding digital transformation, innovation and prevalent theories will be elaborated upon.

The literature review is structured in a topical manner. The first section introduces the concept of digital transformation and associated terminology. After defining the required terms, the relevance of strategy is introduced. This is followed by the role of environment and relationships for digital transformation.

Section 2 introduces the term ‘innovation’ and aims to highlight its relevance to the concept of digital transformation. Since there is a sufficiently large gap of literature that investigates digital transformation as a type of innovation, this thesis also aims to contribute to closing that gap. While addressing innovation, key prevailing theories are introduced and elaborated upon. These theories include the Technology-Organization-Environment Framework, the Technology Acceptance Model, and more.

Section 3 aims to address the ever-evolving aspect of digital transformation – change. It introduces the dynamic capabilities theory.

Section 4 then addresses the stakeholder element of transformation via Responsible Innovation Theory.

3.1. The Concept of Digital Transformation

Definition

Digital transformation is an oftentimes overused and confusing word. Thus, it becomes important to first establish its meaning and that of the relevant terms.

While some studies consider '**digitization'** to be the utilisation of digital technology, digital assets and digital engagement (Manyika et al., 2015), others consider 'digitization' as the conversion of analogue data into digital form. Low costs of replicating, processing and storing data have driven firms to digitize products and services, conduct analytics, and implement business strategies that take advantage of digital economics (Grover & Kohli, 2013). This has resulted in the usage of another term, '**digitalization'**, which for the context of the rest of this research is defined as more than simply using digital technology, digitalization has come to herald a '**digital transformation'**, which signifies changes in business processes, traditional roles and business offerings. It thus follows that either one cannot exist without the other. Digital transformation has been defined in various ways; as a social phenomenon (Stolterman & Fors, 2004), a cultural evolution (Belk, 2013), and the evolution or creation of new business models due to adoption of digital technologies (Zhu, Dong, Xu, & Kraem, 2006). However, these definitions do not account the effect on organizational culture, structure, workplaces and ethics. Henriette, Feki, and Boughzala (2016) define digital transformation as "a disruptive or incremental change process." It includes the adoption and use of

digital technologies, and then evolves into an implicit holistic transformation of the organization, or an explicit pursuit of value creation.

In the rest of this thesis, digital transformation is used as a term that heralds the combinatory implication of all three terms. However, due to the varied definitions and terms in literature, the subsequent research also attempts to define these terms with respect to the context of the case.

Concept of Digital Maturity

Companies invest in technology as it promises not just to automate processes but to open new opportunities of doing business (Fitzgerald et a., 2013). In a survey conducted by MIT Sloan Management and Capgemini consulting (2013), 1559 executives and managers from a wide array of industries and positions showed the belief that technology could be transformative to business. Of this specifically, 78% believed that digital transformation would be "critical to their business." But despite sharing this belief, they are unclear on what they must do to achieve this value-laden transformation, and the high-profile examples of disruptive companies do not do much to help older and more traditional companies with inflexible legacies (Westerman & McAfee, 2012).

Fitzgerald et al., (2013) introduce the concept of digital maturity, which combines digital intensity, or the level of investment in technology-enabled initiatives and transformation management intensity – the level of investment in related leadership for a digital transformation. They developed a model that describes four different levels of digital maturity.

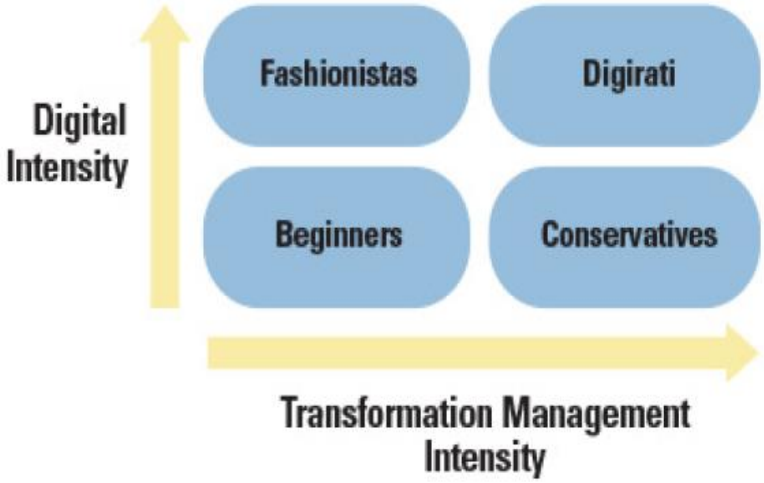


FIGURE 3: DIGITAL MATURITY MODEL, (WESTERMAN & MCAFE, 2012, PAGE 1)

1. **Digital Beginners** are those companies that may have advanced digital capabilities and may even be mature with respect to standard business processes such as ERP and e-commerce, but they do very little with their digital capabilities. More often than not this is said to be due to a lack of effective transformation management.
2. Companies can be termed **Digital Fashionistas** if they have experimented with modern applications but have not effectively generated value from all their initiatives. There is a general lack of synergy amongst the applications. They are motivated but lack a solid digital transformation strategy and knowledge to maximise benefits.
3. **Digital Conservatives** are generally sceptical of the value of new digital trends, which can be detrimental. Their cautiousness can cause them to miss valuable opportunities which could help them stay competitive.
4. **Digirati** understand how digital transformation can bring the

company value. They combine “transformative vision, careful governance and engagement with sufficient investment in new opportunities.”

According to this study the Digirati, who were most mature in both the dimension – Digital intensity and Transformation Management Intensity – had the highest financial performance in the entire sample. Digital intensity was able to help companies gain more with less capacity, with a substantial difference over companies that scored low on digital intensity.

Reddy & Reinartz (2017) state that traditionally, digital transformation refers to the use of information technology in order to create economic value. But to look at it broadly, it encompasses the change that technology has on the whole business, and how, we interact and operate with it. They also discuss the concept of digital disruption which portends that digital progress will arrive whether a company is ready for it or not. This view is also shared by Neumeier et al., (2017) who believes that digitalization “is rewriting the rules of competition” and that companies who don’t adapt will be left behind.

These views tend to portray the phenomenon of digital transformation in a technologically deterministic fashion, where the technology appears to be a force that autonomously develops following science (Pesch & Werker, 2017). However, technology is merely an outcome of a sequence of choices made by different actors in the business, which ultimately implies that it is actively shaped by the business. Therefore, to successfully face the digital transformation challenge, decision-makers must formulate and execute strategies that leverage digitalization drive better operational performance (Hess et al., 2016).

Digital Transformation is a complex issue that affects multiple stakeholders within the company. Firms' resources must be simultaneously exploited and explored to achieve "organizational agility", which is a necessary condition for businesses to thrive.

3.1.3 Key Dimensions of Digital Transformation

Fundamentally, businesses often lack clarity about the different options for digital transformation and the elements involved. Thus, Hess, Matt, Benlian, and Wiesbock (2016) have outlined a framework which describes the four key dimensions of every digital transformation endeavour:

1. The use of technologies – which reflects a firm's approach and capability to explore and exploit new digital technologies.
2. Changes in value creation – reflects how digital transformation impacts a firm's value creation.
3. Structural changes – modifications in organizational structures, processes and skill sets needed to support the use of new technologies.
4. Financial Aspect – This relates to the firm's need for action and its ability to finance a digital transformation and its related activities.

3.1.4. The Importance of Digital Business Strategy

From the key dimensions listed above, it is clear that technologies play a central role in the digital transformation. With the increasing digitization of business activities, the focus of companies is changing from developing an IT strategy towards developing a more integrated and

holistic “digital business strategy” (Neumeier et al., 2017) or DBS, for short. DBS have become crucial in determining how IT can support the firm in order to allow differentiation from competitors (Mithas, Ali, & Mitchell, 2013).

According to Sebastian et al., (2017), SMACIT or Social, Mobile, Analytics, Cloud and the Internet of Things are the key digital technologies that can pose threats to large incumbent companies. They emphasize “three essential elements for a successful digital transformation:

1. A digital strategy that defines an SMACIT value proposition,
2. An operational backbone that facilities operational excellence,
3. A digital services platform that enables rapid innovation and responsiveness to new market opportunities.”

This is depicted in the figure below.

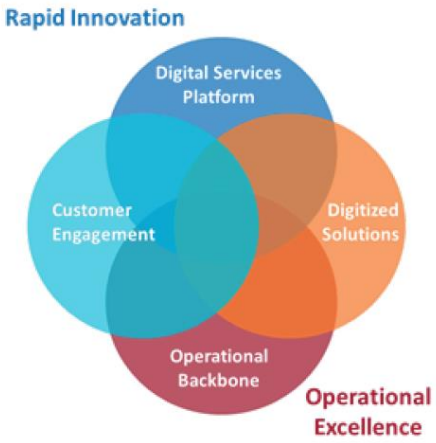


FIGURE 4: THE ESSENTIAL ELEMENTS OF DIGITAL TRANSFORMATION, (SEBASTIAN ET AL., 2017, PAGE 207)

Thus, as emphasized, a digital business strategy that is inspired by the capabilities of SMACIT, intent on delivering integrated capabilities, and which is simultaneously responsive to constantly changing market

conditions, is vital for embracing the opportunities of a digital economy. Of these, they describe two options: Customer engagement strategy or digitized solutions strategy. Under the customer engagement strategy, the customer experience is placed at their centre, by aiming to create a seamless, omni-channel experience which is easy to access and interact with. It facilitates communications between a company and its customers and it relies on analytics to capture customer data. A digitized solutions strategy seeks to guide R&D and Innovation to anticipate what customers would want rather than respond to customer needs and uses digital technologies to combine product, data and services.

While both strategies have their own advantages, research has shown that it pays off to commit to one, which emphasizes the need for strategic focus.

Neither of these strategies can be executed without the crucial presence of an operational backbone and a digital services platform. These combine the essential qualities of reliability and consistency with the speed and flexibility that begets modern digital innovation. An operational backbone ensures the “efficiency, scalability, reliability, quality and predictability of core operations,” and these can take many years to build. Without this it is difficult guarantee seamless operations and reliability which can allow the business to focus more on strategic issues rather than “fighting fires.” Operational backbones have helped increase a firm’s competitiveness, generate profits and improve customer satisfaction, while simultaneously providing a foundation for new digital services. On the other hand, the digital services platform must facilitate experimentation and digital services such as data collection, analytics, and connections to the operational backbone data. Not having a digital services platform puts a business at a severe risk of falling behind

competitors in the digital space. The practices required to develop these two capabilities are described in Fig. 4.

	Operational Backbone	Digital Services Platform
Management Objective	Business efficiency and technology reliability	Business agility and rapid innovation
Architecture Principles	Standardized end-to-end business processes; transparency into systems; data access	Plug-and-play business and technology components
Data	Single source of truth for transactional data	Massive repositories of sensor/social media/ purchased data
Key Processes	Roadmaps; architecture reviews	Cross-functional development; user-centered design
Delivery Method	Fast waterfall/regular software releases/SaaS adoption	Agile and DevOps;[19] use of MVP (minimum viable product) concepts and constant enhancements
Funding	Major project/program investments	Continuous funding by business owners

FIGURE 5: MANAGEMENT PRACTICES TO DEVELOP OPERATIONAL BACKBONES AND DIGITAL SERVICES, (SEBASTIAN ET AL., (2017), PAGE 205)

However, whichever option is ultimately chosen, Sebastian et al., (2017) emphasize that the first step for digital transformation in large incumbent companies, is to define a digital strategy with a value proposition.

3.1.5. The Digital Ecosystem Concept

Normann and Ramirez (1993) present a new logic of value where products and services are combined and distinguished as activity-based offerings from which "customers create value for themselves." As the offerings get more complex in nature so do the relationships that are required to support them. Thus, as part of its strategic activities, a business must continually reconfigure and reintegrate its competencies and customers. They thus emphasize the coalition of different economic actors to bring value (Pagani, 2013). A value network can thus be defined

as a cluster of economic actors who collaborate to deliver value to the end consumer. Digital Business strategies require coordination amongst firms in the value chain, across product, process and service domains, thereby contributing to increasing complexity and dynamism of ecosystems (Adner, 2006). This brings opportunities and risks. While the appeal of ecosystems lies in the fact that they provide the opportunity to create value that no firm could create alone, a firm's innovation efforts can be largely derailed by its dependency on its customers.

Thus, in order to succeed long term (Pagani, 2013), firms within value networks must be able to adapt and reorient themselves strategically, according to changing environments.

A business ecosystem is a term used to describe an interconnected population of organizations. According to Moore (1998), a business ecosystem is "an economic community supported by a foundation of interacting organizations and individuals." It can include customers, suppliers, competitors and other stakeholders across the value chain. Korpela & Talpale (2013) describe the presence of "Keystone" companies, who have a great impact on the whole system and serve as enablers. Iansiti (2004) mentions that three critical success factors in a business ecosystem.

1. Productivity to ensure the success of a business.
2. Robustness. By this they refer to the ability to draw competitive advantage from many sources and be able to transform when the environment demands it.
3. The ability to create niches and opportunities for new firms, which is accompanied by the change of a protective mindset to a cooperative one.

A digital business ecosystem (DBE) is said to improve the traditional, thoroughly defined collaborative environments, resulting in a self-organized software environment that encompasses a unified view of the stakeholder business entities. Gossain and Kandiah (1998) compare this to an eBusiness ecosystem where the value chain is integrated. The key difference between the two is the close symbiotic nature of relationships that is emphasized in a business ecosystem.

The automation of order-to-cash processes is often considered the first necessary step in integrating B2B processes. B2Bi (B2B integration) is basically electronic and automated information management involving multiple stakeholders. The next, most influential step on a firm's competitiveness is the integration of their strategic supply chain. Ultimately, the maximum value of B2Bi is only extracted when all the stakeholders are using it. Thus, Korpela & Talpale (2013) defines a DBE integration framework, which helps estimate the maturity of a business ecosystem in order to improve the adoption by stakeholders.

By using this evaluation framework, gaps in different levels can be identified, which serve as obstacles to integration. These gaps will need to be filled in order to have a seamless, integrated DBE (Korpela & Talpale,2013).

DBE integration model	Customer Value	Data Model	Process Model	Network Collaboration	People Capabilities	Network Value Competitiveness
Strategy Executives	Our B2B integration plan will support the company's strategic goals and enable the emergence of new strategies	Our executives have real-time information of our business units and supply chain to support decision making	Our executives have defined what standards are used for the integration of business process information	Our executive have defined and prioritized the business units where integration is implemented	Our executives are aware of the potential that B2B integration will enable and actively participate in development	Our executives are aware of B2Bi benefits and are therefore committed to using common standards across the value network
Business Model Managers	Our B2B integration plan supports business units in achieving their objectives and goals	Managers are collecting and sharing real-time business information to increase efficiency and cut non-value work	Management has prioritized business processes where integration has been sped up with the use of standards	Management has prioritized customers and suppliers where integration will be executed	Management have actively participated in B2B integration planning and they have nominated the process owner to all major processes	Management measures supply chain performance against the company's performance measures such as delivery accuracy, error-free
Information Model IT Experts	We have a compact graphical drawing of the IT structure of our enterprise to help discussions and development	The IT structure tells where the information is located, where it is collected and where it is distributed	The IT structure tells in which business locations the process integrations will be implemented	The IT structure describes the core user groups internally and within the network	The IT structure includes the key responsible persons for each module	Our company's IT budget can be presented according to the IT structure
Process Standards St. Experts	The usage of standards has made rapid integration and scalability possible	The usage of standard documents has improved information by being real-time, error-free and reliable	The usage of industry standards has made it possible to integrate the supply chain	The usage of industry standards has made it possible to integrate supply chain	We have utilized experts who know how to use standards	We have agreed to usage of standards in our integrations and we have reached our target benefits faster
Integration Channel Intermediates	Interoperable systems support real time B2B collaboration in the business network	Information is exchanged as standardized electronic documents between IT systems	Shared, standard processes allow IT systems to process and exchange business documents at a desired level of automation	Guidelines and supporting services aid in B2Bi process implementation in the network	The roles and responsibilities of the B2Bi experts in organizations are clearly defined and communicated to partners	Organizations are able to carry out the targeted B2Bi and at the intended level of automation by dispensing the manual processes
Service Portfolio Users	We know which services of our customers and suppliers are ready for integration	We have test methods available for information integration	We have test methods available for process integration	We have an information repository available to our B2Bi in the business ecosystem	We have experts available for implementing	Open information sharing has sped up integrations and brought us the targeted benefits

FIGURE 6: QUESTIONNAIRE FOR THE DBE INTEGRATION MODEL (KORPELA AND TALPALE., 2013, PAGE 8)

3.2. Digital transformation as Innovation

In The words digital and innovation are often seen together, and Yoo et al., (2010) define digital innovation as “the carrying out of new combinations of digital and physical components (in a layered modular architecture) to produce novel products.” However, digitalization heralds a different type of innovation according to Autio et al., (2018), who state that digitalization is likely to have a “transformative effect upon the organization of economic activity by supporting radical business innovation.”

Thus, considering the nature of digital transformation and it's potential to change and disrupt existing processes and business models, it can be considered disruptive innovation. In the case of disruptive innovation, Yu & Hang (2010) explain that it is often enabled by 1) Human resources 2) Organizational Culture 3) Resource Allocation 4) Organizational Structure 5) Context and environment and 6) Customer-orientation under disruptive changes.

3.2.1 Technology-Organization-Environment Theory

The TOE framework was first formulated by Tornatzky and Fleischer (1990), and it aims to take into consideration, technological, organizational and environmental contextual factors. The TOE framework represents how context influences the adoption and implementation of innovation (Baker, 2011).

The Technological Context

This context includes all the technologies that the firm uses as well as the technology in the marketplace. A firm's existing technologies form an important base that limits the scope and pace of technological change possible. Outside of the firm there are three types of technological innovations -incremental, synthetic or discontinuous. Depending on which type of innovation it is, the technology can make enhance or destroy competence (Tushman & Anderson, 1986), and the ones that are competence-destructive are capable of "rendering existing technologies obsolete." (Baker, 2011) Therefore, the type of innovation can have a considerable impact on the organization and may require changes once it is adopted.

Adoption of Digital Business Technology: the example of E-Commerce

Of the various aspects of Digital Business Transformation, E-commerce is one of them. Sila (2013) defines B2B e-commerce as "all Internet-enabled b2B technologies that allow supply chain partners to buy and sell products and share information." This therefore encompasses many internet-based systems involving transactions between firms such as internet-based interorganizational systems, e-business, e-commerce, etc. While their research does not cover a holistic digital "transformation" it dives deep into the adoption of digital technologies for business applications in the B2B context and is thus useful for determining influential factors in digital transformation. Furthermore, it likens B2B Ecommerce to innovation and examines the applicability of useful theoretical frameworks like the TOE framework and innovation diffusion theory.

Innovation Diffusion Theory

According to the research conducted by Sila (2013), online sales in the B2B sector in North America, accounted for nearly 91% of all online transactions. Of this, Electronic Data Interchange systems seemed to play a crucial role. The Innovation Diffusion Theory by Rogers has been widely used to understand the adoption of IT systems in business. It states that "Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system."

The theory provides that the following characteristics may affect innovation adoption (Premkumar, Ramamurthy, & Nilakanta, 1994): 1) Relative Advantage 2) Complexity 3) Compatibility 4) Observability 5) Trialability.

Technology Acceptance Model and its extension

TAM has been widely used to study the adoption of IT systems. It's founded on the theory that an individual's intention to use a system Is determined by "1) perceived usefulness, defined as the extent to which a person believes that using the system will enhance their job performance and 2)perceived ease of use, defined as the extent to which a person believes that using the system will be free of effort" (Venkatesh & Davis, 2000).

Regardless, low adoption and use of IT by employees is said to be a major barrier to successful IT implementations in firms (Venkatesh & Bala, 2008). IT systems within organizations are increasing in size and complexity and are playing a more central role in organizational excellence, like supply chain planning, ERP, Customer relationship Management etc. Thus, if IT implementations are unsuccessful, a firm stands to suffer a massive negative impact.

According to Venkatesh (2006), interventions had a significant potential to improve implementation success. By interventions, he refers to managerial initiatives that can foster adoption of new technologies within firms. So far research has been mostly technology-driven and focused less on the interventions. Venkatesh (2006) proposes three areas which are crucial in understanding IT adoption and relate to inter and intra-firm coordination and interaction with customers – Business Process Change and Process Standards, Supply-Chain Technologies, and Services.

Whilst considering a supply chain, Venkatesh (2006) draws

attention to the importance of considering the context of the system. He stresses the need to deepen our understanding multi-user and multi-stakeholder supply chain and the phenomenon of technology-enabled supply chain collaboration. This research will help to understand the reactions of the different stakeholders and examine strategies for adoption by different partners and reconciliation, that could foster successful adoption.

Chwelos et al., (2001) also feel that it is insufficient to simply consider the technological factors while understanding adoption and it is also important to consider the organizational. There is thus significant research that points towards understanding the adoption of technology from a contextual perspective.

Organizational Context

This encompasses characteristics, resources, linking structures between employees, intra-firm communication processes, firm size, and the amount of slack resources. Furthermore, cross-functional teams, product champions, boundary spanners, and gatekeepers influence the adoption of innovation. Organic and decentralized structures may facilitate the adoption process and emphasize teams and "fluidity in responsibilities for employees". This is not dissimilar to the concepts of agile and scrum where an "adaptive management approach is employed to measure and adjust the process" till the desired objective is achieved (Svalznay, 2004).

Digital Transformation as Technological Process Innovation

Damanpour at al., (2009) define technological process innovation as 'new elements introduced into an organization's production system or service

operation for producing its products or rendering its services to clients.' In this view, digital transformation can be seen as a way to transform existing sales processes. Technological process innovation can ultimately result in a more efficient use of resources and thereby enhance resource productivity and improve firm competitiveness. But in order to successfully drive technological process innovation, a firm must balance the pressures of exploration and exploitation during innovation. Managers often prefer to experiment with incremental innovation, leading to short-term results which focus on optimization of processes. Thus, long-term process innovation is deemed problematic. Another worry is that key resources will have to focus on innovation endeavours and will be unable to work on their regular tasks and targets, which results in insufficient priority being given to process innovation. Sometimes there is a need to bring on-board additional resources to drive this innovation, and that adds to further expenses. Furthermore, pilot process innovation projects are seldom successfully realized because there is a lack of autonomy from the main environment. This often results in established firms 'doing things in the same way', i.e., exploitation (Hollen, van den Bosch, & Volberda, 2013).

Digital Transformation and Management Innovation

As described above, adoption of initiatives for digital transformation appears to be a big problem, especially in the latecomer industries. This is often exacerbated by the lack of clarity in the value of digitalization. Hollen et al., (2013) state that management innovation is essential to capturing the full benefits of technological innovation. They define management innovation as 'the generation and implementation of a management practice, process, structure or technique that is new to the state of the art and is intended to further organizational goals'. This is

especially important in the topic of digital transformation since studies have found that the presence of digital transformation on a company's core executive agenda increases its perception of competitiveness (Fitzgerald, Kruschwitz, Bonnet, & Welch, 2013). Birkinshaw (2010) states that in order to achieve their aims, certain management activities are essential, like setting objectives, motivating employees, and coordinating activities. Furthermore, a vastly improved customer experience is touted to be the greatest advantage of digitalization, yet quite often there is ambiguity on how it can truly add value to the existing experience (Fitzgerald et al., 2013). Oftentimes, this is due to a lack of vision, unclear business case, and independent functioning of business units. Therefore, alignment and responsiveness amongst stakeholders could substantially improve the effectiveness of digital initiatives.

The Environmental Context

This includes the industry context and the level of technology provided, and the regulatory bodies. Intense competition often pushes firms to adopt new innovations, whereas the lack of it can reduce the urgency. It is interesting, however, to note that dominant firms can influence their partners in the value chain to innovate. The industry context has an important role to play in the rate of innovation. If the industry is rapidly growing, so does the pace of innovation, whereas in mature or declining industries it isn't always as clear. In case of decline sometimes innovation can drive efficiency, or firms may avoid investment in innovation to minimize costs.

Institutional Theory

Teo et al (2003) also consider the institutional aspect of technology

adoption, since supply chains largely consist of inter-organizational linkages. Institutional theory describes the process by which norms, routines and rules become established as “authoritative guidelines for social behaviour” (Scott, 2004). Thus, organizations are often under pressure to conform to certain norms within their institutional environments. If they don’t they may be denied the social support and resources required to be competitive (Teo et al., 2003).

Zhu et al., (2006) conducted an empirical study that sought to combine the use of diffusion of innovation theory and the TOE framework. They thus found four innovation characteristics and four contextual variables that drove e-business usage. They are:

Innovation Characteristics

1. Relative advantage refers to the potential of e-business to help increase sales and reduce costs.
2. Compatibility – this dimension emphasizes the level of digitization of assets and information flow required, without which e-business adoption could heavily resisted.
3. Costs – this refers to the expenses required to set up a system for online transactions, which could be an inhibitor of technology use.
4. Security Concern is an essential feature of e-business. It refers to the degree to which the platform is secure enough to conduct online transactions.

Contextual Variables

1. Technology Competence is an umbrella term used to define the organization’s technological resources. This encompasses the firm’s IT infrastructure as well as the

employee's internet-related skills.

2. Organization Size. There is often a structural inertia associated with large firms, making them less agile and less flexible. This can make the adoption of e-business rather slow.
3. Competitive Pressure – percentage of competitors in the market who use e-business. Empirical evidence suggests that the success of e-business depends on the willingness of the partners in the trading community to adopt e-business.
4. Partner Readiness – 'Technology diffusion studies have shown that diffusion occurs unevenly across countries with different environments.' (Zhu & Kraemer, 2005) Firms may also differ in the level of IT infrastructure and could have a scarcity of technical and financial resources that would be necessary to use a new technology.

3.3 Transformation and Capabilities

Singh & Hess (2017) state that transformation, when contrasted with change, expresses the "comprehensiveness of the actions that need to be taken" for an organization to successful adopt digital technologies. Fitzgerald et al., (2016) emphasize that these technologies, and hence this transformation, would demand different mindsets and skill sets than previous transformative technologies, thus requiring substantial change in that regard. Warner and Waeger (2019), thus suggest the usefulness of the dynamic capabilities theory, which is innovation based, to shed light on the response of firms to this technological and market change. They argue that firms need to build strong dynamic capabilities to rapidly create, implement and transform business models digitally.

The dynamic capabilities theory relies heavily on the resource-based view of the firm, and is defined by (Eisenhardt & Martin, 2000) as "organizational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve and die." Warner & Waeger (2019), also emphasize that strategic renewal of a firm's business model, collaborative approach, and culture is key while defining the scope of a firm's digital transformation. They assert that genuine digital transformations involve the ongoing usage of digital technologies in everyday organizational life and refresh organizational cultures.

Dynamic capabilities can be clustered into three main areas (Teece, 2007):

1. Sensing opportunities (and threats) consist of sub-capabilities like digital scouting, scenario planning, and digital mindset crafting.
2. Seizing opportunities consist of sub-capabilities like strategic agility, rapid prototyping and balancing digital portfolios.
3. Transforming the organization's business model and wider resource base consist of sub-capabilities like navigating innovation ecosystems, redesigning internal structures, and improving digital maturity (Warner & Waeger, 2019).

Furthermore, Warner & Waeger (2019) describe various barriers that incumbent firms may face on their journey to digital transformation like barriers to business model innovation (BMI). BMI is also a dynamic process and includes learning, evolution, transformation and renewal. A key barrier to changing business models or innovating, is often managers being unwilling to experiment with new business models. Path dependencies also act as barriers since most incumbents usually use

digital technologies to terminate, extend, revise or terminate existing activities instead of disrupting them. Weil & Woerner (2015) thus argue that incumbents are unlikely to adopt digital business models thanks to legacy systems and processes, work silos and organizational politics. Lack of digitalization experience amongst senior management is also a significant barrier for transformation since it causes teams to get stuck in an 'identity trap' that keeps the team locked into the organization's values and current ways of working.

3.4 Responsible Digital Transformation

Multiple sources of prior research have confirmed the importance of various stakeholders in the successful adoption of digital technologies, such as partners across the value chain (Zhu et al, 2006; Teo et al., 2003; Korpela & Talpale, 2013) as well as internal stakeholders (Venkatesh & Davies).

Stakeholder engagement, a practice that is intended to involve stakeholders in a positive way, gives access to information, stimulates mutual understanding and promotes the development of collaboration and shared objectives among key stakeholders (Blok, Hoffmans, & E.F.M., 2015). This is an important aspect of Responsible Innovation, a process which is transparent, interactive and facilitates societal actors and innovators to become mutually responsive to each other, by prioritizing acceptability, sustainability, and social desirability of the innovation process (Von Schomberg, 2013). However, the key factors of Stakeholder engagement and Responsible Innovation which are transparency, interaction, responsiveness and co-responsibility may result in consequences such as knowledge leakage which poses the risk of a decrease in competitiveness (Blok et al, 2015).

Von Schomberg (2013) defines Responsible Research and Innovation as “A transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society).”

There are various lines of questioning on responsible innovation (Stilgoe, Owen & Macnaghten 2013) and some of them are:

1. How will the risks and benefits be distributed?
2. What other impacts can we anticipate?
3. What don’t we know and what might we never know?
4. Who is in control?
5. How do we know if we are right?
6. Who will benefit?
7. What are they going to gain?

According to Stilgoe et al. (2013), the questions can be broadly clustered into four key dimensions to Responsible innovation.

1. **Anticipation** – This involves systematic thinking aimed at increasing resilience, while revealing new opportunities for innovation. However, this is different from simply future-gazing, which is already quite prevalent. These expectations not only predict, but also work hard to shape desirable futures and organize resources towards them. This is important because it instils the “ethics of promising” to prevent the entangling of hype from future reality. Upstream Public Engagement, Constructive Technology Assessment, Scenarios and Vision assessment etc are examples of anticipatory techniques.

2. **Reflexivity** – Reflexivity implies “holding up a mirror to one’s own activities, commitments and assumptions” and being aware of the limits of knowledge and framing of issues. It demands openness of leadership within science and innovation.
3. **Inclusion** – This foretells the waning of authority and top down decision-making. This emphasizes the engagement of stakeholders and ‘mini-publics’. Blok et al., (2015) stress the criticality of stakeholder engagement and point out that it is necessary yet may come with risks and issues. Some key issues that they point out are, transparency, interaction, responsiveness and co-responsibility.
4. **Responsiveness** – RI requires a capacity to change shape or direction in response to stakeholder values and circumstances. Value-Sensitive Design can allow ethical values to be designed into technology. Techniques like stage-gate also allow responsiveness in technological innovation. Institutional cultures, institutional leadership, openness and transparency all have an important impact on responsiveness.

Ultimately, there has been much stress on the fact that stakeholders should be involved in order to incorporate relevant ethical and societal aspects into innovation practices and to achieve desirable goals. It is also believed by some that it is only possible to find the answers to challenges by involving as many stakeholders as possible (Blok et al., 2015).

The relevance of RRI to digital transformation may not be obvious in this specific case due to the specific focus on the chemical industry within a B2B business context. However, in general digital transformation has instigated discussions regarding various ethical consequences to the larger society such as privacy and personal data usage. In contrast, the

digital transformation of a B2B firm might pose relatively low ethical implications towards the outside world but it is important to consider its implications on all stakeholders. In the drive for efficiency, digital transformation poses a great risk to human job security, as confirmed by history (Balsmeier & Woerter, 2019). If digitalization is to create new jobs, then adequate opportunities for education must be ethically considered at the time of strategic execution.

In sum, a digital transformation should holistically address the opportunities and risks associated with adopting digital technologies (Singh & Hess, 2017).

4

Conceptual Framework

From the literature introduced above, we see that research proposes many key factors that could influence successful digital transformation.

Central to a digital transformation is the use of digital technologies (Hess, Matt, Benlian, & Wiesbock, 2016). Various frameworks such as the TOE framework and TAM describe characteristics of technologies that are integral to the adoption of technologies by employees in a firm. The TOE describes that not only is it important to consider the aspects of the technology, but the organizational and environmental contexts of the technology significantly impact its adoption (Tornatzky & Fleischer, 1990). According to the TAM (Venkatesh & Davis, 2000), ease of use of the technology and perceived use of the technology are the two key aspects influencing its acceptance. For the purposes of this framework however, the term “use of technologies” will encompass the aspects of usefulness and ease of use.

Human and Financial resources are also emphasized as essential to a digital transformation. In the view of digital transformation as innovation, the organizational context comprises individuals working as champions, boundary spanners or gatekeepers who can play a significant role in convincing others of adoption. It is also stressed by Yu & Hang (2010) who explain the importance of human resources and

resource allocation in terms of disruptive innovation. Financial resources are also highlighted by Hess et al., (2016) as one of the four key dimensions of every digital transformation, as the firm's ability to finance its digital activities is essential.

Therefore, in terms of resources, it is proposed that use of digital technologies, Human resources and financial resources are necessary for a digital transformation.

P1: Digital transformation will have to be supported by sufficient resources in the aspect of digital technology utilization, human resources and financial resources.

Neumeier et al., (2017) describe that digital business strategies have become crucial in determining the role of IT in a firm and the ability to leverage IT to stay competitive. Sebastian et al., (2017) reinforces digital business strategy as one of three essential elements for a digital transformation. The digital business strategy should encompass building an operational backbone of digital technologies and a digital services platform. Furthermore, digital business strategies must be coordinated across firms in the value chain which creates more value and at the same time, causes dependencies between actors in the value chain. Therefore, it is proposed that developing a digital business strategy is crucial for digital transformation.

P2: Digital transformation will have to be supported by the development of a digital business strategy, consisting of an operational backbone and digital services platform, and will have to be coordinated across actors in the value chain.

Pagani (2013) also emphasizes the importance of a firm's role within a value chain, to determine the success of doing digital business. The value chain can include customers, suppliers and competitors and other stakeholders and can be considered a digital business ecosystem. This is supported by prevalent theories on organizational context (Tornatzky & Fleischer, 2000), as well as institutional theory (Teo et al., 2003). Certain companies further cement their position as enablers within this ecosystem. Sometimes organization are also under pressure to conform to social norms in their institutional environments which could impact the adoption of technologies across supply chains (Scott, 2004). Since, such ecosystems are complex and dynamic (Adner, 2006), it not only brings opportunities but also risks. It thus follows that managing stakeholder interests is crucial.

Stakeholder engagement practices can be useful as it involves involving all stakeholders, and promotes equal access to information, mutual understanding collaboration towards achieving objectives (Blok, Hoffmans, & E.F.M., 2015). It is thus proposed that stakeholder engagement is a crucial element for digital transformation.

P3. To achieve the goal of an effective digital strategy, the stakeholders involved must be sufficiently engaged.

The organizational context of the TOE framework (Tornatzky & Fleischer, 1990) examines structures within the organization such as the nature of teams and project approaches. Organic and decentralized structures are favoured for innovation adoption, with teams that encourage fluid responsibilities in its members. Svalznay (2004), also describes an adaptive management approach that is adjustable, such as agile and

scrum. Hollen et al., (2013) also state that it is often required to implement management practices and organizational structures that will support the furthering of organizational goals. Structural changes are also a key dimension of the digital transformation framework by Hess et al., (2016) who state that sometimes modifications of organizational structures are necessary to support the adoption of new technologies. Organizational culture and structure are also an important enabler of a disruptive innovation, which is another view of digital transformation (Yu & Hang, 2010) Thus it is proposed that digital transformation will have to be supported by organizational changes in structure and culture that support digital ways of working.

P4: Digital transformation will have to be supported by organizational changes in structure and culture that support digital ways of working.

Henriette et al., (2016) include the above factors in their definition of digital transformation and state that the process "transforms people, organization, and structure in the pursuit of value creation." Hess et al., (2016) state that changes in value creation are a crucial dimension of digital transformation. This involves understanding how digital transformation brings value to a firm, which is a big challenge that firms face. Reddy & Reinartz (2017), also refer to the ability of IT systems to create efficiency and economic value. This is also highlighted when Sebastian et al., (2017) describes the need for a digital strategy that defines a value proposition brought by digital technologies. Therefore, it is proposed that digital transformation results in changes in value creation.

P5: Digital transformation results in changes in value creation.

Combining all of these propositions, it lays the foundation for a conceptual framework that aims to answer the question of what the key elements are for a successful digital transformation, which was sub-research question 2.

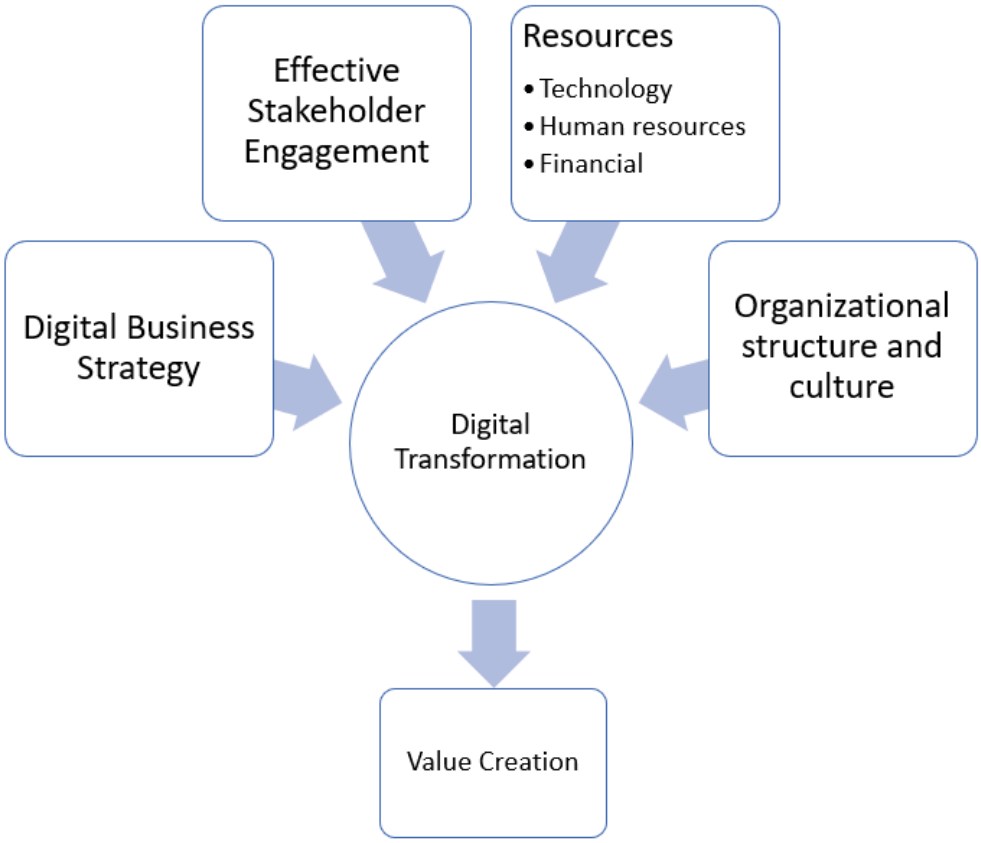


FIGURE 7: CONCEPTUAL FRAMEWORK FOR A SUCCESSFUL DIGITAL TRANSFORMATION

These themes form the basis for the design of the semi-structured

interview protocol. The selection of interviewees (previously explained in Chapter 2), was based off of the digital triumvirate model by Crittenden et al. (2019) and the DBE Integration framework by Korpela et al. (2013). As per the DBE Integration Framework, the strategy executives can be compared to Management Executives of Evonik, Business Model Managers to Sales managers, IT Experts to Evonik Digital, Process Experts to Process Managers, and Channel Intermediaries and Service Portfolio Users to the IT Managers of Evonik.

5

The Case: Company Profile

5.1. Evonik Industries AG

Evonik Industries AG is an industrial group from Germany, which is a world leader in specialty chemicals. Its activities focus on the four megatrends of health, nutrition, resource efficiency and globalization. It is active in more than 100 countries and has generated sales of around 13.5 billion euro in 2015. According to its website, it benefits specifically from “innovative prowess and integrated technology platforms.”[1]

5.2. Digitalization @ Evonik

In 2016, Evonik set up a new subsidiary, Evonik Digital GmbH in order to prepare for the digital future. The company functions as an independent unit with digital principles, in order to work fast, flexibly and with a “high degree of freedom, on the implementation of novel ideas.” They’ve created a position of Chief Digital Officer (CDO) who will coordinate digitalization activities for the Group who leads a team of 20 experts. These specialists will develop digital concepts and solutions and work to implement them Group-wide. Thus, a digitalization strategy was formed

[1] Evonik Press Release: https://corporate.evonik.com/en/media/press_releases/corporate/pages/article.aspx?articleId=106323

and built upon five pillars as shown in the Fig 6.[2]

Digital Strategists from Evonik Digital then work with different segments and business lines of Evonik to build up digital solutions based on their unique requirements. Some projects are started centrally whereas some projects are started within a business line, with the business line taking initiative. The idea is that once the pilot phase is completed and some key lessons have been learnt, the project can then be introduced to other interested business lines (or not).

The activities that Evonik Digital works on are broadly clustered into 4 themes:

1. Smart Production – Leveraging digital solutions to drive efficiency in production and supply chain.
2. Human Work – Fostering the "people-side" of digitalization.
3. Digital Business – Enhancing customer and user experience with the help of digitalization.
4. Cognitive Solutions – Exploring the application of AI for R&D and advanced technical support.

5.3. Business Line – Oil additives

Under Evonik Resource Efficiency GmbH – a *business segment* under the umbrella of Evonik Industries AG - the *business line* 'Oil Additives' produces polymer formulations to increase lubricant efficiency. It was founded in 1907 and is currently a market leader in oil additives, where they consider themselves to be "a leader in the drive towards efficiency".[3]

[2] Evonik Digital GmbH: https://digital.evonik.com/sites/digital/en/pages/article.aspx?articleId=26618
[3] Evonik, Oil additives: https://oil-additives.evonik.com/product/oil-additives/en/about/

FIGURE 8: EVONIK'S DIGITAL STRATEGY

The Business Problem

For the Oil Additives business line, much of their sales relies on having sales managers that manage their key accounts in order to sustain a close relationship with their key and midsize customers. Their smaller customers are handled by distributors. The market they operate in is characterized by limited market growth – as it mostly deals with high performance lubricants, smaller units like gears, etc. Formulations are developed over long periods of time with extensive application testing, leading to sales cycles of many years. They have, therefore, invested in a lot of effort in developing close and long-term relationships with their key customers and developing products that suit their specific needs, which ultimately leads to higher switching costs for the customer. Ultimately, the key focus for the business line is on top performance and technology, therefore the products are positioned in the top tier segment of the market.

On the other hand, as demonstrated by the establishment of Evonik Digital GmbH, the company's top management seems to have formulated a digitalization strategy, that is expected to spread to subsidiaries. But as of 2019, there has been no formulation of a specific digital strategy for OA. While digital technologies have been adopted by the production plants to improve productivity and efficiency, there has not been much effort in marketing and sales, nor is there much incentive, because of their business model that has worked successfully for them, for many years.

While there is an awareness of the 'digitalization trend', there seems to be a lack of clarity of its meaning, and in particular, its relevance and potential for the business line. Digitalization also appears to not be the number one priority and despite some discussions on probable ideas, implementation is difficult to kick off. Furthermore, there is talk of some platforms and e-business channels in the market, amongst other Evonik business lines and some competitors and customers, yet there has been no effort to use them. Therefore, there is a need to investigate what hinders the adoption of digital initiatives and overcome these barriers.

Business Organization

The current organization of the customer relation department is clustered around 3 key roles: sales, customer service and technical service.

Sales Managers are the key representatives responsible for the sales of the OA products. Customers are segmented according to their type, region, activities and business size and different sales managers assume different responsibilities accordingly. Depending on the type of account, service levels differ and hence the engagement of the sales manager differs as well.

Technical Service representatives provide consulting and advisory services to customers, in order to ensure appropriate product choice for each application and to address further technical queries and issues that may arise due to the characteristic of OA products as specialty chemicals. Since these products involve combinative formulation of various raw materials, complications may arise pertaining to their combination, depending on changes in the raw materials or other conditions. This introduces a level of complexity that is otherwise not found in supplying simple commodity chemicals such as KOH, for example, which would not require too much technical support during a sale.

Customer Service consists of a team of employees who are responsible for booking orders and generating the required commercial documentation for each order. They also serve as the first contact point for customer enquiries and complaints.

Current Status of Digitalization

Backbone technologies such as ERP, CRM, collaborative tools etc. have been introduced and rolled out company-wide. While adoption rates are high, it must be noted that utilization of the powerful possibilities of these digital tools remains limited. This is further touched upon in the results of the interviews. Historically, Evonik has had a culture of mergers, acquisitions and accompany reorganizations, that has also caused complexities in ensuring a consistent and strong IT infrastructure for the entire company. However, massive effort has been made to ensure that these backbone services are now centrally integrated for higher efficiency and lower costs. This means that ERP/CRM systems are integrated for all of Evonik, instead of existing individually for each business line.

There has been company-wide initiative to name responsible figureheads

in each business line to liaise with Evonik Digital in order to ensure concerted efforts in the area of digitalization. However, these responsible individuals carry the burden of many topics, of which digitalization is just one and is often at a lower priority, and such is the case in OA, where it is observed that digital business projects are slow to start.

Discussions have previously taken place about the possibility of e-commerce platforms being adopted, and during the course of this thesis multiple discussions and meetings have been held to discuss the suitability of potential e-commerce solutions that suit the need of the business line. OneTwoChem – a compliant platform where chemicals can be sold - was chosen as an experimental strategy to try and sell certain products that target the biodiesel market. Discussions surrounding the benefit of having a webshop integrated with the business line website and integrated centrally with the rest of the organization are also ongoing, although the benefit is unclear. During the course of this thesis, the use of an internally developed order management portal is being tested with a single Channel Partner. This supports ERP integration and came with minimal costs, and the aim is to experiment and gain some experience with digital channels for sales. However, this tool has certain limitations that prevents the business line from using this to serve Direct Customers. Furthermore, following discussions of a different centralised e-commerce strategy, the future of this tool is uncertain.

Some efforts have been made to institute e-business processes via EDI (Electronic Data Interchange) technologies, but they have been met with minimum success. The implementation of an EDI connection is perceived to be of large effort and is thus approached cautiously by the business line, opting to go one customer at a time. Key Accounts have been targeted as the first line of potential connections because of their business

size. In this regard, one such Key Account connection was worked upon for many months but ultimately could not be delivered due to technical difficulties and re-organization from the customer side which caused a large setback. This project will now have to be re-initiated.

Since the implementation of EDI is touted to be rather large, the IT department, which is rather compact, operates at a segment level and collects requests for customer connections that can transcend business lines. This way the connections can be made more efficiently and implemented for multiple business lines at once. On the flip side, this centralization of requests appears to be time-taking and feeds into the perception that working with the IT department is “time-taking” or that IT support is “slow”.

While discussing various options to serve customers digitally, the need to have real-time information comes up (further discussed in Chapter 5). Currently real-time information about shipments is not available, not just at Evonik, but it also appears to be a service that is not provided in the industry as a whole. Therefore, a central project has been started to implement live-tracking of shipments and other information that may be of interest to customers. But this project involves long-term commitments with external logistics partners, who also have a long way to go in the digital transformation journey.

6

Results

This section highlights the results of the 15 interviews that were conducted. The objective of the interviews was to answer two sub-research questions: “what are the drivers for OA to digitalize?” and “what are the barriers faced by OA to digitalize?” Thus, this chapter will be split into two main sections. Section one will focus on addressing the drivers that were described in the interviews and section two will focus on the barriers.

The method used to derive the interview questions and conduct interviews are explained in Chapter 2. The interviewees have an average of 10+ years of experience within the company. The choice of roles span Sales, Customer Service, Business Process and Digital/IT. 4 of the interviewees work almost exclusively with topics related to digital transformation not only with Oil Additives, but other business lines as well. The remaining 11 interviewees work in core business functions under the business line. The results that follow were derived from the transcriptions of the recorded interviews.

6.1. Drivers for digitalization

Defining "Digitalization"

The preliminary portion of the interview focused on the interviewee's perception of the terms, 'digitalization', and 'digital transformation'. Various terms were used while discussing the topic of "digitalization", such as "modern" or "fancy" systems, "cloud", "mobile", "e-business", "e-commerce", and "digital services." Further explanation of the above terms was vague and often pertained to the respondent's individual ideas. 14 out of the 15 respondents associated the terms with tools that can facilitate business and related processes.

The single respondent that deviated from this observation, had clear demarcations between the terms and believed that the company still had a long way to go in the journey of digital transformation, and that they were still starting out. This respondent stressed that a digital transformation would require transforming people, processes and infrastructure and that simply bringing in new tools would be insufficient.

Digital Maturity

The preliminary portion of the interview often focused around the perceived digital maturity of the company and the drivers and motivation for digitalization. The overarching self-perception of the company and the business line's digital maturity was not too optimistic. Out of the 15 respondents 12 of them rated Evonik and OA's digital maturity as a 2/5, (where 1 is bad and 5 is excellent) with 3 of them feeling that OA was even less digitally mature than other business lines within the company, and hence rating it a 1. All respondents seemed to emphasize the context of being in the chemical industry and used the industry as a reference to

rate themselves. All were in the agreement that in comparison to some other industries – usually comparisons were made to IT, retail, tourism etc, with popular examples of leading tech companies like Amazon, Booking.com, Google etc – the chemical industry was definitely 'poor' in terms of digital business and that 'a lot' could be achieved through digitalization.

Basic Analysis

When asked what the motivation was for digitalization, the answers were varied. In terms of whether Digitalization would be beneficial in some way or not, all respondents believed that it would definitely add value. Fig 8. shows the different drivers and their instances. What is meant here by instances is the number of times the sources were coded into that category. This illustrates the given emphasis on certain drivers by different respondents. Furthermore, certain drivers were more likely to stem from certain groups of respondents, so the role of the respondent is also mentioned.

Function	Driver	Instances
Sales	data-driven decision making	6
Sales, Digital, Customer Service	increased business/market reach	6
Sales, Customer Service, Supply Chain, Business Process, Digital	Improved information quality/access	18
Sales, Digital, Customer Service, Marketing, Business Process	More consistent and efficient business processes	12
Sales, Digital, Customer Service	Necessary to stay competitive	6
Sales, Business Process	Improve knowledge of the customer/market	7
Sales, Marketing, Digital	Enable business model innovation	5
Sales, Customer Service, Supply Chain, Business Process, Digital	Increase efficiency	26
Marketing, Sales, Business Process	Improve customer experience/relationship	16
Sales	Enable better analysis/benchmarking compared to competition	8

FIGURE 9: LIST OF DRIVERS FOR DIGITALIZATION

The most prominent driver, that is shared by respondents of all functional groups, is the belief that **digitalization can improve efficiency**. Upon analysing the quotes belying each category of drivers, it is seen that there is a wish to make tasks simpler, reduce manual tasks, and make processes smoother and faster. It can thus be extrapolated that the driver of efficiency belies many other drivers as well such as **data-driven decision-making, improved information quality, consistent business processes, and competitiveness**. These include qualities like avoiding subjective decisions, having more accurate data to allow seamless processes, sharing data with the customer in a timely manner to avoid customer complaints and incidents and ultimately, reducing costs.

The driver of **improving customer experience** is also related to having improved information quality. Out of the respondents, 2 sales Professionals, 1 Business Process Manager, 1 Digital Strategist, and 1 Marketing Executive remarked on the ability of digital tools to share relevant knowledge about products with customers and help in educating customers more at a potentially lower cost, also facilitating more engagement with the customer and the impression of easier and more frequent communication. These motivations were largely shared by sales and marketing professionals. Respondents were also wary that by moving towards online methods of communication, 'real' communication, or face to face communication, could possibly decrease and the sentiment regarding this was dubious, since so far face-to-face communication with customers has been extremely beneficial. It was also stressed that if they were to ask their customers to use a digital solution, it was imperative that the solution provides a 'good' experience and provides some customer benefit. Otherwise, customers will be less likely to adopt such a solution. There were also reservations on the potential to save costs, with one respondent asserting that "it may not save costs" but it could improve the relationship with the customer. Similarly, digitalization could also drive **increased business and market reach** which was a view shared by 2 sales managers, 1 customer service manager and 1 digital strategist. This could be achieved by utilizing an effective e-commerce solution that could reduce order complexity and increase visibility to new potential customers.

Analysis and benchmarking with respect to the competition was mentioned as a driver for digitalization by 2 respondents – 1 sales manager and 1 executive. It was accompanied by the emphasis that "data in itself is not useful, it's knowing how your data measures against others, and what can be done with that data to improve."

Out of the 15 interviewees, only 2 sales managers, 1 marketing executive and 1 digital strategist felt that digital transformation could enable **business model innovation**. One interviewee remarked that discussions within OA “are still far away from discussing business model innovation driven by digital changes.” When asked about how digitalization could affect their business model, the answers were uncertain, with the additional remark that there is a long way to go achieve a stage where they can leverage digital technologies to experiment with new business models.

6.2. Barriers to digitalization

During the discussion of drivers, the respondents highlighted many of the possibilities that they believed could be achieved with the help of digitalization, but it was also accompanied with some scepticism. While 10 out of the 15 respondents were in total agreement that digitalization would in some way be beneficial for the business line, different drivers were emphasized by different individuals.

In the second stage of the interview, discussion mostly centred around how the digital transformation was progressing in Oil Additives. While three respondents felt that the transformation was progressing at a satisfyingly fast pace, the remaining twelve believed that a lot more could be done and should be done quicker.

The findings from the interviews are broadly clustered into six themes. The categories of barriers that were derived from the interviews were classified according to the conceptual framework in Chapter 4 and in cases where it didn't fit with literature identified barriers, a new theme was created. The identified themes are presented in Table 2.

Resources/Capabilities

When asked why digital transformation was not progressing as fast as it should, a frequent answer was **"lack of resources"** and specifically, a lack of **"resources dedicated to digital transformation activities."** This was brought up by 14 out of the 15 interviewees and emphasized in 45 instances. 9 out of 15 interviewees occupying central business functions such as sales, marketing, customer service and business

process stated that “the current team capacity is simply insufficient to take on digital transformation activities.” One stated that “Digitalization is a full-time job because it involves not only many tools, but also convincing people to use them, while keeping the needs of the BL in mind.” All of the interviewees stressed on the current environment in the company as a contributing factor to this barrier, since the company has a goal to reduce its headcount by 1000 people by 2020. However, as another respondent brought up, “the workload remains the same, regardless of the headcount reduction.” On the other hand, one sales manager mentioned that they needed “more digital thinking people than just digital tools,” and that they already have a “soup of tools.” He stressed that a change in mindset was imperative.

This is not dissimilar to the barrier **“lack of digital competency,”** which was perceived by 12 out of the 15 respondents across all functions. One respondent describes that they are a chemical company, and they “do not know much about digitalization.” The perception is that there is a knowledge gap in areas perceived as ‘digital’ such as Artificial Intelligence, Data, or Agile, and that the solution in Evonik is often to outsource the needed competency in such areas. However, this then does not allow the business to acquire such competency without external dependencies. This is found to be a large barrier while adopting tools or platforms that can provide digital services, like data analytics for example, but the business line would then need people who can analyse it.

Another barrier that came up was a perceived **“lack of IT support”** which was brought up by 9 interviewees, consisting of 2 sales managers, one customer service manager, one supply chain responsible, three business process employees and two executives within OA. All of them reported that IT support was often slow to come by and requests

often take many days to get solve. The respondents cited **"lack of budget"** and successive downsizing of the IT department as possible reasons for this lack of support. Another reason was an organizational restructuring that was consuming a large number of IT resources to support the corresponding company IT infrastructure changes, thereby making their responses to business line requests even slower.

The aforementioned categories clearly point to a specific resource that is concerned lacking or inadequate by the respondents and is hence grouped under the theme "Resources/Capabilities." While there is a generic nod towards the cost-saving atmosphere that is currently present within the organization, the context that is shared by these barriers is the general need for focused resources on digitalization.

Strategy

The second key theme of barriers is strategy. According to the findings, all 15 respondents state that there is "no digital business strategy" defined for the business line. The respondents from Evonik Digital confirm that the digital strategy of the overall company is, in itself, loosely defined, so as to "allow the business lines freedom to define a digital strategy that suits their needs." However, according to one executive, "Evonik as a company is used to setting long-term strategy and planning for long term goals." This is corroborated by the findings from the interviews which show that a **lack of vision, goals, project structure and strategy** is impeding the pace of digital transformation. Furthermore, there is agreement that **"top-down vision is needed"**, and that currently it feels like "the future direction or goal is missing." The results show a lack of clarity in what digitalization means and mentioned that he encounters the term in discussions, but the meaning and details remain

vague. This view is shared by 8 other interviewees as well, with a highlighted need to define the meaning and scope of the words, 'digitalization' or 'digital transformation,' for OA. One interviewee stated that "if you have an official project structure, it also means you have a push from the management, which does not exist at the moment." This alludes to a **"lack of commitment from the management"** to digital transformation, which is a view shared by 9 interviewees. One respondent says that "there is talk amongst the top management but there needs to be more of a middle management push."

This is further substantiated by a **"lack of prioritization"** of digital transformation. 12 out of the 15 interviewees believe that digitalization is not a priority at OA, and that it is not built into business line strategy. 3 respondents suggested that frequent organizational restructuring is often prioritized higher and thus takes away from effort that could rather be focused on digital transformation.

Whilst lack of commitment and project structure can be misconstrued as a culture of the organization, it must be noted that this is not the case with other topics that occupy a higher priority in the business line's corporate strategy. A pattern of missing strategic prioritization of digital transformation was noted, and thus these barriers are clustered under the theme "Strategy".

Culture

Under the theme of culture, the findings show that the interviewees cite both internal and external factors for why culture hinders the pace of digital transformation. The barriers mentioned below share several common patterns that are mindset and attitude related which stem from

respondents' usage of terms that imply a collective way of working and thinking. Since these patterns are not strategically forced upon employees they are considered to be the "culture" of the organization.

Internally, 11 respondents state that there is a "**conservative mindset"** and that "people need to learn to adapt to new things." A business process associate stated that it was often "difficult to convince people to work with a new tool." Furthermore, there's also an expectation that each tool is rolled out with specific trainings whereas, the expectations are changing, and self-learning is now promoted, which is a difficult change for employees. In fact, the findings show that 10 respondents feel a **"frustration with tools"** due to the sheer number of tools that have been provided that have now become "messy." One respondent refers to the chemical industry itself as being conservative and says, "in the outside world I think digital transformation moves faster." 3 respondents feel that it's also part of the German business culture and that "the US is more of a frontrunner in digitalization." Two respondents also suggest that age-demographics might have a role to play in mindset changes, with younger people having a more "open attitude towards change." There is thus a **"resistance to change"** that is supported by a sentiment that changes are "far away," "disruption in the chemical industry is unlikely" and that people do not want to change because things are working well in the status quo. Even if there is inclination to change, **"hierarchical decision-making,"** as referred to by two respondents, causes the process to slow down further.

Another barrier that came out in this study was a **"distrust in digital tools"** that was supported by 7 interviewees. The sales professionals emphasized a fear of missing out on important information if transactions and interactions would get more digital, or if they were to

take place on a digital platform. A sales executive shared that “when we meet face to face we exchange so much more information than we would ever find on the internet.” Not only is the personal connect appreciated by both supplier and customer, this information is highly valuable to the business. The other respondents showed a lack of trust in the reliability of digital systems, with one stating that he is “not a fan of relying completely on these tools” because sometimes they suffer downtime and orders may be missed, and that they “simply cannot afford to fail in front of the customer”. Thus, utilising a digital solution for an advanced operation, like supply chain planning, is something that is perceived as “risky.”

This **“risk-averse behaviour,”** is another barrier, which according to two respondents from Digital and IT respectively, hinders digital transformation. According to one digital strategist, “we are not willing to try, test and fail enough to be successful,” which is a mindset most digital successful start-ups have. He suggests that “Germany and Europe have very high standards,” and thus those standards are usually met before considering the need to be “speedy” or early to market.

Another prevalent barrier is the presence of a **“follower mindset,”** according to 7 respondents. In previous instances of picking up new technologies, there have usually been “examples from other BLs where it worked successfully,” and the business is often “second or third in line and have adapted the technology to their needs. Thus, they follow an early adopter approach. One respondent asserts that this is particularly true especially in the digital space, since “this isn’t our job” to think of new ideas, and hence the only way to get new ideas is from others.

The eighth barrier under culture is the **“lack of collaborative**

attitude," as referred to by 6 respondents. There are differences in the pace of digital transformation in different BLs and there is limited awareness of the different activities being conducted in the digital space. One respondent refers to it as "everyone is in their own space doing their own thing." Other respondents feel that there is a large distance between the business line, Evonik Digital and the IT department, and more proactiveness should be shown by Evonik Digital to involve the business lines. However, IT and Evonik Digital maintain that the push must come from the business lines.

The last barrier under culture is largely external and refers to the **"B2B/Chemical industry environment."** Six respondents refer to the industry as a whole as conservative and lagging, and state that their supporting industries like logistics providers are the same. One respondent says, "in B2B generally, its less digital," and since OA is not so close to the end user, "it is difficult to understand the value digital services and data can bring us since we provide only one part of the final product."

Value Proposition

The theme value proposition case basically consists of only one barrier: "lack of business case." This is categorized into another theme in order to relate it as close as possible to the conceptual model, while in actuality the conceptual model does not cover this exact factor. This will be discussed in more detail in the next chapter.

This barrier is cited by 8 respondents, with the overarching sentiment that the value that digitalization can bring is unclear. One respondent stated that "the value it can bring is difficult to measure and

there simply isn't enough effort being made to measure it", while another emphasises that the benefits of a digital transformation are "intangible," and that it will take time to prove the tangible benefits, and ultimately quantify it. It is therefore a large hurdle because the business is used to long-term planning, and "making a business case and asking if it's worth it or not."

Customer Interaction

This theme consists of three barriers that were initially conflicting, since the BL places high strategic importance on its high-valued customers and their relationships. A "Lack of customer centricity" was cited in the context of asking and handling feedback from customers in an agile, digital manner. This was reflected in interviews with 5 respondents, some of whom made comparisons to B2C centric services such as Amazon and their frequent use of customer feedback to provide highly tailored services to customers. Two respondents stated that "when it comes to our business service, we don't listen or ask for feedback enough to our customers" and identify pain points as much as they probably should. This was stressed in the context of business service as there is already a high strategic importance placed on the quality of material that is sold.

This points to the barrier of "lack of collaboration," in terms of digital topics as referred to by 4 respondents. There is currently no "open discussion" regarding digitalization and possible interests in digital services that the customer may have accompanied with the pervasive impression that "we already know our customers well."

Furthermore, the close relationship with customers largely centres around customers that drive high value business, and there is a lower

focus on “non-strategic buyers” and “lost customers.” These customers receive less services from the customer relations team than the key customers who drive most of the business.

These barriers share patterns of customer-related activity and focus and highlight a difference in the meaning of customer centricity in a digital context when compared to traditional customer focus, as given by the existing sales model. Thus, they are clustered under the theme of “customer interaction.”

Stakeholder Engagement

The presence of multiple actors along the value chain in a B2B transaction results in increased complexity when it comes to a digital transformation. Three respondents indicated that **“difficulty in getting multiple stakeholders to work with each other”** was a barrier to digital business transformation. One respondent pointed out that digitizing transactions and interactions require systems and resources on the side of multiple partners to function effectively, from organization and technical perspective. Interview findings show that dependencies on supporting companies also hinder the pace of transformation when the supporting companies are even less digitally mature. Another barrier is a **“lack of alignment”** amongst internal stakeholders, cited by 7 interviewees. One respondent felt that there was a lack of alignment between the business line’s activities and the central digital strategy of the company. The others highlight that they “feel very distant from corporate IT” and that it is “unclear what the interplay is between the corporate approach and business line goals.” It is also stressed by one respondent, that there are “too many projects and too many separated initiatives.”

8 respondents alluded to a **“fear of losing jobs”** as a hurdle for successful digital transformation. This barrier was not only derived from interviews but also from field notes taken from conversations and meetings with the respondents since this topic was met with slightly more reservation than the others. The customer service professional states that “despite digitalization being slow” there is fear for their jobs in the future. He says that “digitalization may not be desirable for employees” because it will allow the company to further decrease the headcount and help the business save more money, since they may not need them anymore. There is also a fear that “easy tasks will go” and uncertainty about what jobs could like in the future, and what skills they would need. Two sales professionals also pondered that if transactions and negotiations can happen over a platform, “will they even need us anymore?”

The above barriers share several common patterns. One is that there appears to be difficulties in collaborating across various dimensions. These include silos/business lines, job functions, and departments. The difficulties are of a technical and logistical nature, and also allude to the previously mentioned lack of time, which was mentioned under the theme “Resources/Capabilities.” However, there is also a shared pattern of differential engagement of the different stakeholders in the digital transformation that results in certain stakeholders being more involved and aware than others. That is why the barrier “fear of losing jobs” is classified under the theme of “Stakeholder engagement.” This is a significant topic under stakeholder engagement, because of the interests of the stakeholders’ who fear losing their jobs are not considered carefully, it may hinder the transformation in terms of adoption of new technologies.

THEMES	CATEGORIES	NUMBER OF CODES
STAKEHOLDER ENGAGEMENT	FEAR OF LOSING JOBS	12
	DIFFICULTY IN MULTIPLE STAKEHOLDERS WORKING TOGETHER	8
	LACK OF ALIGNMENT	10
STRATEGY	LACK OF COMMITMENT/PUSH FROM MANAGEMENT	24
	DIGITALIZATION IS NOT A PRIORITY	19
	LACK OF PROJECT STRUCTURE	12
	LACK OF VISION/GOALS	23
	LACK OF DIGITAL STRATEGY	19
RESOURCES/CAPABILITY	INSUFFICIENT RESOURCES	18
	LACK OF BUDGET	13
	LACK OF DEDICATED RESOURCES FOR DIGITAL TRANSFORMATION ACTIVITIES	27
	LACK OF DIGITAL COMPETENCY	27
	LACK OF IT SUPPORT	18
CULTURE	CONSERVATIVE MINDSET	21
	FRUSTRATION WITH TOOLS	23
	DISTRUST IN TOOLS	11
	LACK OF COLLABORATIVE ATTITUDE	18
	B2B ENVIRONMENT	15
	RESISTANCE TO CHANGE	22
	FOLLOWER MINDSET	9
	RISK-AVERSE BEHAVIOUR	3
	HIERARCHICAL DECISION-MAKING	2
VALUE PROPOSITION	LACK OF BUSINESS CASE	16
CUSTOMER INTERACTION	LESS COLLABORATION	6
	LACK OF CUSTOMER CENTRICITY	17

FIGURE 10: LIST OF BARRIERS TO DIGITAL TRANSFORMATION

7

Discussion

7.1. Analysis of Drivers

The results showed varying definitions of digitalization and lack of clarity with the term digital transformation. It was a deliberate research decision to begin the interviews by asking the interviewees for their perception of digitalization and digital transformation, since there were varied definitions in literature as well. In hindsight, this decision reinforced the finding from literature that digitalization can have various interpretations and significance depending on the area of application. In doing so, a singular definition and scope was not imposed on the interviewees, and they were thus at creative liberty to describe what they meant by digitalization, how it would impact them and how it would bring them value. It can thus be said that the barriers that are discussed in the next section are perceived barriers towards achieving the drivers that are outlined by the respondents, indicating a direct relationship between the two.

A total of 10 drivers were found in the interviews conducted, and they are described in Chapter 6.1. They are: data-driven decision-making, increased business/market reach, improved information quality/access, more consistent and efficient business processes, necessary to stay

competitive, improved knowledge of the customer, enabling business model innovation, increased efficiency, improved customer experience/relationship, improved analysis/benchmarking against competition. The ones highlighted were the drivers that were cited most frequently as indicated by the instances in Figure 9.

Upon further analysis, we can see that the drivers mentioned by the respondents are not entirely independent of each other. It is useful to identify the drivers separately in order to break down the individual motivations for the business line, but common patterns shared by the drivers can help cluster them together to present an overview.

The category “data-driven decision-making” referred largely to the usage of data or information to develop a better understanding of one’s own business and find opportunities for improvement. This is similar to the category of “improved analysis/benchmarking against competition,” except that the concept extends to the usage of data to understand one’s own performance in comparison to other market players. This was also emphasized by one respondent who claimed that without the element of comparison, the data lacks usefulness, and cannot improve the quality of decision-making. It follows logically, that when useful data is obtained, there must be a mechanism to be make it accessible to the required persons easily. It was also believed by respondents that these digital qualities would become “necessary to stay a competitive.” Therefore, the categories “improved analysis/benchmarking against competition,” “necessary to stay competitive” and “improved information quality/access” can be clustered under the theme of “data-driven decision-making”.

The category “increased business/market reach” was mentioned by respondents in the specific context of social media presence and e-

commerce opportunities. One respondent stated that social media and e-commerce were not necessities to do business currently but are areas that need to be strengthened because they would become essential elements in the business language of the future. Such tools would also provide the basis for “improved knowledge of the customer”, as stated by 5 respondents. Multiple channels of interaction would also allow the customer more options for communication while simultaneously smoothening the process and “improving the customer experience.” Therefore, the categories “improved knowledge of the customer” and “increased business/market reach” and “improved customer experience” are clustered under the theme of “improved customer experience.”

Efficiency was a widely cited driver by 13 out of the 15 respondents and reflects on the company’s culture and priorities. The drive for efficiency stemmed from the respondents’ beliefs that digitalization could sharply reduce manual work and speed up existing business processes. A related category was the driver of “more consistent and efficient business processes.” This was specifically cited by respondents as a desired quality of the business processes to not require repetition of work and out of sync information. While this relates to the category of “improved information quality,” this category was mentioned in the context of making processes more efficient and is thus clustered together to form the overarching theme of “increased efficiency.”

The fourth theme is “business model innovation.” This was a category listed only by 4 respondents with limited emphasis whilst confirming that digital business models are not at the top of current discussions. One respondent stated that they are “too early in the digital transformation journey to think of digital business models, but it is something that is necessary to take full advantage of digitalization.” Thus,

the ten drivers for digital transformation can be clustered into four themes: data-driven decision-making, improved customer experience, increased efficiency and (digital) business model innovation.

Therefore, taking into account the clustered drivers and the respondents' perceptions of digitalization and digital transformation, a definition in the scope of this research is attempted. This is important in order to set the context in which the barriers exist.

"Digitalization can be defined as using digital tools that can bring value in the form of increased efficiency, improved customer experience, and data-driven decision making, as well as enable business model innovation."

However, the demarcation between the terms, "digitalization" and "digital transformation" was unclear to many of the respondents and thus the data is insufficient to coin a definition within the scope of this research.

7.2. Analysis of Barriers

Following the analysis of the results, there were certain findings that stood our more than the others. From the interviews it is clear that the vast majority of the respondents associate tools with digital transformation, and holding that association, they rate themselves moderately. It has also become apparent that there is some experimentation with digital tools and services, but there is a lack of alignment and collaboration between the business lines, which hinders the businesses from maximizing value. This is highlighted by a digital strategist who works with multiple business lines as “living very close to our silos”, and that a “large innovation impact” lies between these silos. Furthermore, despite there being some awareness and motivation in achieving the benefits of digitalization, there appears to be a clear hurdle in defining the scope of digital transformation and communicating that to all the stakeholders. Thus, according to the digital maturity model by Westerman & McAfee (2012), Evonik Oil Additives can be considered a “Digital Fashionista” as they fulfil the criterion held by the definition of the term. They are aggressive in adopting modern applications but do not effectively coordinate across departments or have a solid vision for digital business Fitzgerald et al., (2013).

This model correctly reflects the situation in OA in that there is no concrete digital transformation strategy or knowledge to maximise benefits, and the findings of barriers helps to shed some light on the reason why. As the findings highlighted, digital transformation **is not considered a business priority**, although certain digital activities are being experimented with. Respondents have stated that “project structures can help” with digitalization but it must be prioritized. Since it is not prioritized, not much effort has been made in **formulating a digital business strategy** as some respondents state that “there is no long term

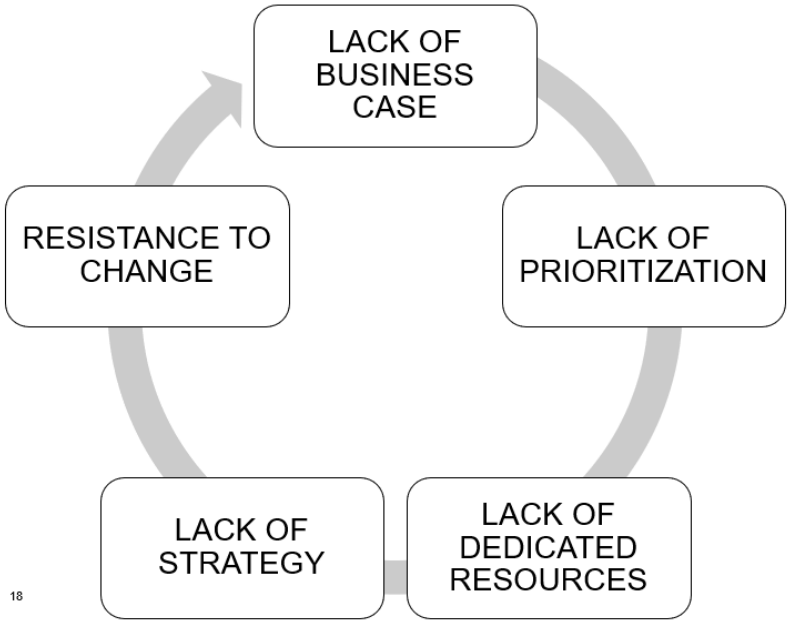
plan" and that the current approach is "to take small steps." Emphasis was then placed on the fact that **resources** have not been allocated to either formulating a strategy or to working on digital business with a project structure. When the respondents were asked why this was the case, uncertainties regarding the value of digital business were raised, and the **lack of a business case** was emphasized as the cause for it not being a priority. Ambiguity was expressed regarding resources required and the benefits received portraying a perceived "difficulty" in constructing a business case. As discussed, in the previous chapter, constructing a business case is a crucial stage whether they decide if a project is worth undertaking or not. Thus, there haven't been any established goals or vision with regard to digital business in OA. These specific terms and relationships have been raised by several respondents.

The findings from the interviews seem to suggest that this creates a feeling of confusion or uncertainty for the employees because they do not know the direction in which all these efforts are headed, or the ultimate goal of digital transformation. Without clearly establishing the vision, it thus becomes difficult for the business culture to change, hence leading to a **"resistance to change**." This in turn points to a hesitancy in spending effort in creating a business case. Therefore, the business case problem for digitalization is two-sided: not only is it difficult to create a business case, because of the "intangible" nature of digital transformation in terms of both effort and benefit, no effort has been made to create such a business case so far, and it is therefore difficult to discern whether the difficulty in creating a business case is perception that can be traced back to limited digital competency, or if the nature of digital transformation somehow causes this difficulty. This ultimately indicates a lack of prioritization, ultimately leading up to what is named "the vicious cycle" in this thesis.

The Vicious cycle largely resembles the factors in the conceptual framework described earlier on in this thesis. When there is a lack of vision, not only does it become “difficult to convince people” to change, it is also difficult to prioritize constructing a business case. It is made more difficult by the lack of dedicated resources and a lack of strategy.

This nature of this vicious cycle as described in Fig 8, in that it feeds to itself, plays a potentially large role in slowing down the digital transformation of this business line. The relationship between the elements were largely explained by the interviews as respondents pointed to each element in a sequence as described by the quotes previously.

It is interesting to note that while this relationship of factors is not touched upon in innovation or technology adoption literature, the factors are mentioned by Fitzgerald et al., (2013) in their study of survey of companies undergoing digital transformation without alluding to their relationships or cyclic nature. They briefly allude to the business case problem in their research and suggest that the ambiguity in adding value to the existing status quo is often due to lack of vision, unclear business case and independent functioning of business units, and that alignment and responsiveness could go a long way in “improving the effectiveness of digital initiatives.”



18

FIGURE 11: THE VICIOUS CYCLE

7.3. Analysis of Perceptions

Since this study is largely conducted by factoring in the perceptions of different experts, it was worth considering if certain perceptions are more prominent amongst a certain function group. Hence, where possible, function-based details of respondents were specified for each barrier in the Results section. The elements of the vicious cycle were equally predisposed amongst all business functions. However, there are certain sub-barriers that are worth mentioning here.

All members commercial functions (sales, marketing, customer service, business process), perceived a lack of digital competency and IT support. Digital and IT expressed awareness of this situation and attributed the downsizing of IT resources as possible cause for this perception. However, it was also showcased in the interview findings, that were as a lack of alignment in the expectations of these two stakeholder groups. There was a perception from the business line functions that Digital and IT needed to be more involved and proactive and drive digital strategy in a “top-down” manner, where the top was perceived as Evonik Digital in this regard. Evonik Digital however, expressed that beyond formal lines of communication – intranet, email – it is difficult to engage business lines individually, especially because they operate in different markets and industries. One respondent from Digital maintains that “there has to be a pull” from the business lines and the respondent from IT stresses that it is ultimately “the sales or marketing manager’s perspective” because they are the ones who understand the customers and the business. It was also stated that further proactiveness from the business lines could even improve the resource crunch situation as it would help IT understand the demand for their services and hence request for more resources. It was also clarified that the digital strategy of Evonik

is to give business lines freedom to choose their own digital strategy that closely aligns with their business. This approach is somewhat different from the central IT approach towards standardization of tools across business lines. Since the overwhelming association with digitalization is "tools" this results in the business line expecting the drive for digital strategy to also come from a central perspective, standardized for the entire organization. Therefore, the business line is unprepared for developing a digital strategy and undertaking digital activities centric to their business as they would require additional resources. This lack of alignment therefore causes inefficiencies and confusion when it comes to the business line's approach to developing their digital strategy.

Similarly, most individuals, who occupied non-executive positions shared the view that there needs to be more commitment and 'push' from the management for digital transformation. There was a desire for digital goals to be actively woven into responsibilities so as to develop performance goals and KPIs, and therefore assign resources. On the other hand, executives of the business line did not bring this up. It was even reflected upon by one respondent that perhaps more serious push from the management in terms of formulating a long-term strategy was not the best way to approach digital transformation, since long-terms plan may become "outdated" and that "small steps were the way to go," especially in order to convince people of the value of digital initiatives.

It is also interesting to note that no sales professionals cited barriers under customer orientation as a potential barrier. Considering that these barriers include identifying customer pain points and having an open discussion with customers about their digital business interests, they were emphasized largely by digital strategists and marketing. This sheds light on a slightly different meaning of customer centricity in the scope of the

digital transformation discussion. Sales teams traditionally work with their key customers as their main focus, with an emphasis on providing them excellent service. However, comparisons were made to leading digital services in the B2C sector such as Amazon, which challenge traditional customer focus notions by striving for frequent feedback from the customer across multiple channels in order to improve service, surveying all customers for feedback and better service regardless of the amount of business that they bring.

The emphasis on B2B environment was also constant throughout all interviews. This is backed not only by perceptions of all respondents, but also by literature (Lavassani et al., 2008; Loukis et al., 2011). The environment is such that initiating digital business does not pose any urgency, simply because there is no intense competition in terms of B2B digital business in the chemical industry. Furthermore, according to Tornatzky & Fleischer (1990) the industry context is very influential, as market size has an impact on innovation. Since the industry in which OA operates isn't growing in terms of market size, the rate of innovation is not so fast.

7.4. Reflection on Conceptual Framework and Theory

The conceptual framework was built on five main propositions that were built from scientific literature.

P1: Digital transformation will have to be supported by sufficient resources in the aspect of digital technology utilization, human resources and financial resources.

The findings of this research support this statement. However, sufficient

resources in technology utilization involves assessing the organization's digital maturity and this was done subjectively, by assessing perspectives of multiple respondents. The literature by Fitzgerald et al., (2013), that this research refers to also uses a similar approach, and it should be reflected if there could be a better way to assess this digital maturity. Perhaps it would benefit from an industry-wide standard, or a globally agreed definition of the different levels of 'digital', before the data collection was made.

Additionally, the findings show a marked distrust in digital tools by the stakeholders. While risk of failure is an amplified fear while interacting with a customer, there is a basic lack of trust that the tool may not function at any given point in time and crucial information or even business may be missed. This is not clearly captured in the conceptual framework. Furthermore, there is a fear that the tool will simply not be able to gather as much information as a human being in a face to face interaction. According to Venkatesh & Davis (2000), this could mean that the perceived usefulness of the tools is limited.

Findings additionally stress the importance of digital competency as an additional resource or a dimension of the human resources required for digital transformation. Digital competency was also stressed as more important than sheer numbers in terms of resources. Thus, the proposition is revised to reflect this finding:

Digital transformation will have to be supported by sufficient resources in the aspect of utilization of digital technologies that are reliable, human resources with specific digital competence and financial resources.

P2: Digital transformation will have to be supported by the development of a digital business strategy, consisting of an operational backbone and digital services platform, and will have to be coordinated across actors in the value chain.

This statement was derived from Sebastian et al., (2017)'s work on essential elements of digital business strategy. While analysis of the interview supports the necessity of having strong and consistent business processes as an operational backbone, the study does not irrefutably support this statement. An important part of this theory is the prior aspect of choosing a digital strategy that suits the needs of the business. As we have seen in this study, no formal digital strategy has been formulated, and thus it is difficult to back up this statement. However, this supports the notion of the Vicious cycle as highlighted above, showcasing the relationship between defining a strategy and allocating resources.

The findings from this research largely substantiate this statement. The results have shown marked emphasis on having a digital strategy for the business line, as goals and vision behave as a motivational element for stakeholders. Findings however, emphasize that strategy is not being built due to a lack of prioritization of digital transformation. Prioritizing and forming goals is a crucial step towards transforming, particularly for large companies like Evonik that have developed a culture of long-term planning, will be particularly dependent on this. On the other hand, the findings show that it is also imperative to be able to operate adaptively in the short term and develop a "risk-positive" behaviour, that will enable a strategy that can adapt quickly to change.

Thus, the proposition is revised to accommodate these findings:

Digital transformation will have to be supported by the development of an adaptable digital business strategy, consisting of an operational backbone and digital services platform, and will have to be coordinated across actors in the value chain. This requires prioritization, vision and goal-formation.

P3. To achieve an effective digital transformation, the stakeholders involved must be sufficiently engaged.

The interview findings also stress the importance of responsible stakeholder engagement to achieve digital transformation and multiple factors come to light. In accordance with the responsible innovation theory (Von Schomberg, 2013), it is necessary to consider how the risks and benefits will be distributed. For example, the risk of losing one's job is highly anticipated, and is obviously not to the benefit of employees at risk, Furthermore, their possibility of being laid off is completely beyond their control. This anticipated outcome could be a significant factor that contributes in a lack of engagement with the digital transformation and a resistance to change.

P4: Digital transformation will have to be supported by organizational changes in structure and culture that support digital ways of working.

The findings supported this proposition by highlighting the need for project structures towards the implementation of digital initiatives. It was emphasized that assigning responsibilities for digital transformation and

having a culture that supports collaborative working on digital initiatives could significantly improve the pace of transformation.

P5: Digital transformation results in changes in value creation.

This is derived from Hess et al., (2016)'s framework on the key dimensions of digital transformation. This implies that every digital transformation endeavour will result in some change in created value, whether it increases or decreases. However, the findings from this research suggest that there is a lot of uncertainty surrounding this value creation, as discussed in the problem of the business case. While the value can be measured post-initiative, and hence change can be observed according to Hess et al., (2016), this does not hold much ground if firms resist digital transformation in the first place due to unclear value. Furthermore, the conceptual framework does not take into consider this pre-phase in the process of digital transformation. In fact, the conundrum of building a business case to instigate digital transformation is rarely discussed in digital transformation literature, and this study hopes to bring attention to this gap and contribute research towards closing this.

Therefore, this statement is revised to reflect the necessity of approximating value before a digital business initiative is undertaken.

"*Undertaking digitalization initiatives will require an estimated proposition of the value created.*"

The findings also pointed to the existence of an additional element that was not considered in the conceptual framework – "Customer Interaction." While the barriers listed under this could be attributed to culture, it is specific to the nature of interaction with customers. There was an

indication of the need for a more digital or agile mindset while approaching feedback from customers and reflected the need for more open discussions on the topic of digital interests.
Therefore, an additional proposition is created:

Digital transformation requires higher transparency and collaboration with customers regarding digital services.

The Conceptual framework previously only reflected the key success factors for digital transformation. However, we see that the definitions of digital transformation (and digitalization) can differ depending on perspectives. This definition is often shaped by individual drivers or benefits of digitalization and it is thus important to include the drivers in the framework. In this way it becomes clear that these barriers to digital transformation exist in the context of the assumed drivers.
Therefore, we introduce a new proposition,

Digitalization can result in value changes in the form of data-driven decision making, improved customer experience, increased efficiency and digital business model innovation.

7.5. Post Analysis Evaluation

After arriving at these findings, the barriers and the vicious cycle depiction were shared with multiple individuals within the company, including senior digital experts, a panel constituted for digital activities within the business segment, a project manager spearheading digital learning projects for the entire organization, and a representation of the customer relations population within OA. These people were chosen based on ease of availability, functional diversity and maximum

opportunity to evaluate the results. The discussion that followed is mentioned here for purposes of information, and an attempt to strengthen the findings of this report.

The business case problem for digital transformation was easily identifiable and was attributed to be a part of Evonik's "culture", but also extendable to other incumbent chemical manufacturers, as per their interactions and knowledge. One Digital Strategist who works with platform solutions and thus has worked with different B2B companies across different industries, suggested that the vicious cycle depiction could be extended for incumbent players in various industries within a B2B setting. However, different elements could assume different weightage. This respondent emphasized that the barrier of culture and stakeholder engagement could play a higher significance than other barriers whilst providing a specific example of a bank providing B2B financial services which terminated several employees who feared losing their jobs and resisted changes brought about by digital transformation.

These findings were shared in the form of a presentation to a panel of representatives involved in digital topics across different business lines within the parent business segment with the purpose of stimulating discussion and receiving feedback as per the generalizability of these findings – the barriers and the vicious cycle – to other business lines. Feedback was received from another digital strategist that the vicious cycle was something that they had seen with other business lines as well. Interestingly, a representative from another business line mentioned that they had carried out a similar study and achieved very similar results. It is imperative to note here that this business line also functions within a B2B setting. This therefore strengthens the claim of internal validity to be extended across multiple business lines, and perhaps within the entire

organization, with a clear emphasis on the role of B2B context.

From this interaction the barrier of “lack of collaboration” is also highlighted insofar as a similar study has been conducted previously in another business line, and yet the study’s existence and its findings were unknown to people outside of the business line. However, we can see a conscious effort to overcome this hurdle by conducting monthly panel meetings across the business segment to facilitate higher transparency and collaboration. Evonik Digital has also introduced a tool titled “Digital Activity Scout” which is meant to provide greater transparency about digital projects across business lines. It is a database of projects that provides summaries of the projects along with the technologies used and the employees responsible, which makes it easier for others to reach out in case they wish to partake in a similar project and thus collaborate. Business lines are encouraged to regularly update their activities in this database.

These findings were also presented to a representative sample of the OA population (conveniently sampled), in order to test the validity of the findings and foster discussion about methods to overcome the barriers. The interactions during this meeting were noted and are described further. Some of the members in the discussion were respondents of the interviews and felt that the vicious cycle of barriers was a veritable depiction of the conflicts that they were faced with. However, people who did not participate in the interviews, also responded. One respondent wished to clarify whether there was a benchmark being used in terms of a similar company – B2B, chemical – to compare Evonik with. No such benchmark is used in this study because of its largely internal focus, but the reaction of the respondent is characteristic in that it depicts the instant thought process of comparing

oneself against peer companies.

It was also pointed out that there is “no customer demand” for digital services, a reiteration of a previously identified barrier in the interviews, and that recent undertakings such as a drive to digitize supply chain and logistics were specific requests at the behest of customers. This highlights the “follower mindset” that was also listed as a category of barriers that brings attention to current market and customer demand. This is a logical line of thought for a commercial organization to react and give importance to market demand, but it is then to be considered if OA will strategically adopt the stance of introducing digital business initiatives only when there is customer/market demand.

Being a part of the B2B value chain is a considerable cause for taking this stance as in a B2B value chain it is difficult to transform alone, when members of the value chain are at different stages in terms of digital transformation. This would further strengthen the need for collaboration across the value chain when it comes to digital transformation and indicates that the value of digital transformation is found in networks. The importance of networks and ecosystems is emphasized in literature in terms of digital business ecosystems (Korpela & Talpale, 2013; Pagani, 2013). The B2B value chain also behaves as a business ecosystem (Moore, 1998) of which OA is a part, in which there are a large number of inter-organizational linkages (Teo, Wei, & Benbasat, 2003). Thus, partner readiness plays a huge role in adoption of new technologies (Zhu, Dong, Xu, & Kraem, 2006). Such ecosystems require coordinated digital business strategies amongst the different business firms in the value chain. This is more complex to achieve than transforming individually, but it brings significantly greater value to all actors in the value chain (Adner, 2006).

Alternatively, the topic of digital transformation can be considered as an innovation area, thus posing characteristics discussed in the literature studied in Chapter 3. Innovators, as categorized by Rogers (1983), are usually the first to adopt an innovation and are comfortable with a 'high degree of complexity and uncertainty' and also have access to considerable financial resources (Schilling, 2013). Interview results show however, that financial resources appear to be a constraint in this case. Therefore, it could prevent OA from approaching digital business as an innovation topic. This difference in approach – market responsiveness vs. innovation – is reflected in the difference in perspectives between the business line and central functions such as Digital, where one respondent from Digital stated that "Digitalization is basically innovation." This conflict is similar to the pressures of exploitation and exploration as described by Hollen et al., (2013). This explains the drive to efficiently use resources for operational day-to-day activities that bring an established source of revenue vs allocating these resources for long-term innovation that could seem uncertain.

The context of the sales department was highlighted during a discussion with the People and Organizational Development Manager spearheading the digital learning journey project for sales employees in Europe – a project which aims to tailor digital knowledge offerings depending on the existing competency of the person. The sample of participants in this project consist of 209 sales managers across different business lines. They followed a method of categorization of sales managers based on digital personas based on their comfort and knowledge of digital technologies. Extensive surveys conducted by the project team attempted to classify the sales managers into the different personas. The "resistance to change" aspect of "the vicious cycle" was

highlighted in this study as well, with 63% of the salesforce being "not very active, doubtful or refuse to engage in digital activities." In order to overcome this resistance, the project aims to cultivate the digital competency of the employees by tailoring content specific to individual preferences and utilizing different mediums such as audio, visual, e-books and interactive workshops based on different learner types. The barriers highlighted in this thesis reflect possible causes for this resistance towards digital activities.

The Drivers mentioned were common across multiple business lines in Evonik and this is seen not only in discussions but also via articles on Evonik's intranet. The group has recently constituted the Evonik Data Management Council[4] under corporate and global IT to ensure data quality and unambiguity. Their aim is to develop sustainable governance infrastructures for data in order to build a solid data backbone within Evonik which can support analytics and decision-making.

This is in a similar vein to projects carried out by business lines which are developing big data and machine learning competencies to codify expertise and prevent knowledge drain. An effort is also being made to expand this application into a service for customers and experiment with digital business models. This decentralized approach to digital innovation in Evonik could result in inefficiencies with multiple business lines working parallelly on similar topics, but it promotes quicker development and fewer layers of hierarchy in decision-making. Efforts like the digital activity scout help to overcome such inefficiencies. This is in line with Evonik's new Corporate values of "Performance, Trust, Openness and Speed."[5] With this corporate value system, values such

[4] Evonik Intranet article, "Adding value with Data", Oct 14, 2019
[5] Evonik Corporate values, Folio 6, Oct 2018.

as “close cooperation,” “open dialogue,” “agility” and “decisiveness,” are emphasized.

8

Conclusions and Recommendations

This section will conclude the thesis by presenting the answers to the research questions as well as limitations of the research. This will be followed by recommendations for future research.

8.1. Summary of Research Questions

The objective of this thesis was to develop a better understanding as to why chemical B2B companies lag behind other industries when it comes to digital transformation. The scientific objective was to contribute to the literature on digital transformation by developing a framework for a successful digital transformation in order to identify barriers. The central aim was to answer the research question:

"What are the barriers to digital transformation faced by a B2B company in the chemical industry?"

This question can now be answered by answering the following sub-research questions:

1. **What is digital transformation?**

Answering this question was important to set the scope and basis for the rest of this research. This is especially important in the context of digital transformation since it is an overused and often confused term, with many related terms that are often used interchangeably. While originally a definition from literature was adopted, due to multiple definitions existing amongst literature sources as well as perceptions of individuals, the decision was made to coin a definition for that was relevant to this research. This provided the opportunity to develop a practical definition that closely reflected the motivations of stakeholders. However, many stakeholders were unclear about defining "digital transformation," and hence opted to use the term "digitalization." The definition coined from the interview findings was:

> "Digitalization can be defined as using digital tools that can bring value in the form of increased efficiency, improved customer experience, and data-driven decision making, as well as enable business model innovation."

Therefore, the definition for digital transformation was adopted from the literature review and was defined as "an implicit holistic transformation of the organization, or an explicit pursuit of value creation" (Henriette, Feki, & Boughzala, 2016), where the scope was restricted to 'digital business.'

2. **What are the key elements for a successful digital transformation?**

This question was also answered by means of a structured literature

review. The aim of this question was to build a conceptual framework detailing the elements required for a successful digital transformation. In the first stage, a detailed review of scientific publications regarding digital transformation was performed. Research surrounding digital transformation appeared to grow in number from 2011, so the number of scientific sources were scarce, and reputed professional publications were also referred to. Since digital transformation as a term was recent, cross-referencing these papers shifted the discussion to e-business technologies and the adoption of the same. This then led to the study of innovation theories and technology adoption theories that are detailed in Chapter 3.2.

The emphasis on different stakeholders in the process of technology adoption led to the concept of responsible innovation which was originally a process to involve stakeholders (mostly societal actors and innovators) to become mutually responsive to one another (Von Schomberg, 2013) . Chapter 4 describes the conceptual framework defined at the end of the literature review. However, after analyzing the data from the interviews (Chapter 6), new insights were discussed (chapter 7) and can therefore be used to revise the framework. Thus, the key building propositions of the framework are re-stated below:

P1: Digital transformation will have to be supported by sufficient resources in the aspect of utilization of digital technologies that are reliable, human resources with specific digital competence and financial resources.

This statement was originally derived from the literature presented in Chapter 3 which emphasize sufficient resources for digital transformation. Interview findings that highlighted digital competency

and the reliability of technologies were also used to revise the proposition. Following the analysis of data, it became apparent that people not only need to be supported by relevant resources and conditions, they also need to trust the tools and trust their reliability in order to be able to adopt the tools and use them.

Furthermore, developing specific digital competency is ranked especially high in the perceptions of stakeholders when it comes to managing digital transformation. This stems from a perception that the organization lacks in digital competency since it is not their core area of focus. However, it has been recognized as a necessity to develop in the future.

P2: Digital transformation will have to be supported by the development of an adaptable digital business strategy, consisting of an operational backbone and digital services platform, and will have to be coordinated across actors in the value chain. This requires prioritization, vision and goal-formation.

While originally derived from literature, findings support the need for a strong operational backbone that supports reliable and consistent business processes. However, findings highlight the necessity for digital transformation to be strategically prioritized in the corporate strategy in order to support the formation of relevant goals and develop a vision. This is necessary to mobilize the support of relevant stakeholders. Developing an agile, adaptable short-term strategy that encourages risk taking behavior is necessary in order to be equipped for a changing environment.

P3. To achieve the goal of an effective digital strategy, the stakeholders involved must be sufficiently engaged.

This importance of stakeholder involvement was derived from the literature on environmental (Tornatzky & Fleischer, 1990) and institutional contexts (Teo et al., 2003). Literature on stakeholder engagement emphasizing the need positive involvement of stakeholders to foster mutual understanding goals and interests (Bloke et al., 2015), was supported by the findings that showed concerns for future job security. It is necessary to manage stakeholder concerns of job security and low perceptions of competency which could otherwise behave as a major cultural hurdle towards digital transformation. Stakeholder management was found to be especially important in the B2B environment that this study was centred in as employees are highly aware of the dependencies on different actors in the value chain. Difficulties are found in collaborating across silos and organizational boundaries.

P4: Digital transformation will have to be supported by organizational changes in structure and culture that support digital ways of working.

Digital transformation requires specific project structures and responsibility allocations that are different from current processes. This involves cultural changes that span digital learning and competency building, collaborating across business lines, and managing the conflict between exploration of innovation and exploitation of competencies.

P5: "Undertaking digitalization initiatives will require an estimated proposition of the value created."

As the literature study pointed out, a digital transformation will impact value creation for the firm. However, in terms of digital business firms face difficulties insofar as the benefits of digitalization are sometimes ambiguous, such as customer experience, and is hence difficult to construct a business case. However, conscious effort must be made to create a business case wherever viable in order to convince stakeholders of the value that digitalization can bring. It can be seen that a business case is the starting point of the digital transformation, and that without it, it can be very difficult to move forward.

P6: ***Digital transformation requires higher transparency and collaboration with customers regarding digital services.***

This is a new addition to the conceptual framework that was added after the analysis and discussion. Based on the case studied, it is seen that digital transformation requires a more digital mindset when it comes to offering new digital services. This can be incorporated in early discussion stages, where co-development and collaboration with the customer are encourage from the stages as early as prototyping discussions. Asking for regular feedback and engaging in open discussion about the customer's digital strategy can help coordinate digital business strategies across the value chain.

3. What are the drivers for OA to digitalize?

The study showed that for the firm the key drivers were clustered into the themes of data-driven decision-making, improved customer

experience, increased efficiency and digital business model innovation. The drivers were key in developing a definition of digital transformation as the overwhelming association of digitalization was was with digital tools. Therefore, the motivation to adopt these tools largely stemmed from these four themes.

This leads to the formation of a final proposition for the conceptual framework, as these drivers establish a context in which the subsequent barriers were found.

P7. Digitalization can result in value changes in the form of data-driven decision making, improved customer experience, increased efficiency and digital business model innovation.

The drivers are thus integrated with the essential elements in sub-question 2 to form a revised framework in Figure 13.

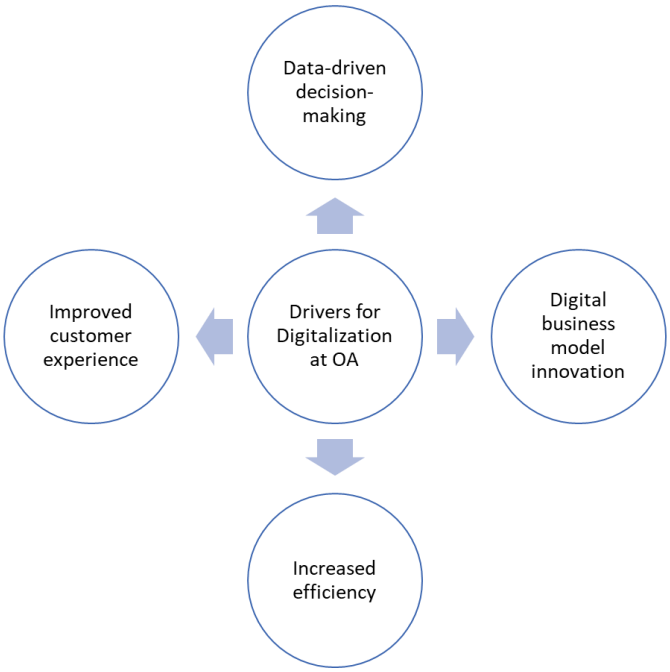


FIGURE 12. DRIVERS TO DIGITALIZATION

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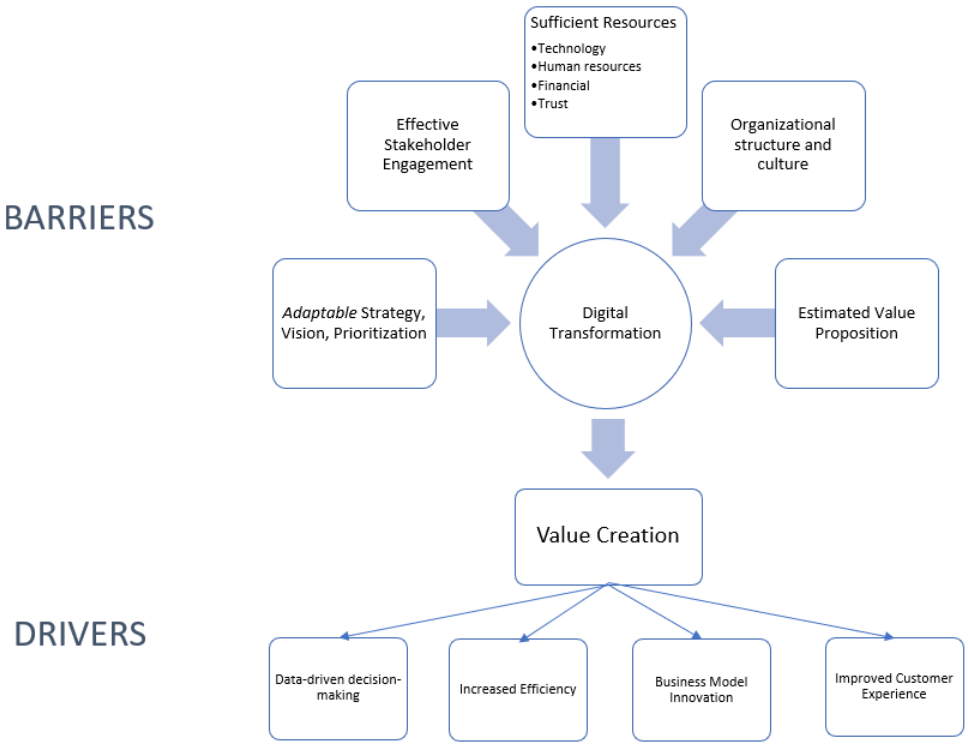

FIGURE 13. CONCEPTUAL FRAMEWORK FOR A SUCCESSFUL DIGITAL TRANSFORMATION

4. **What are the barriers faced by OA for a digital transformation?**

   By analyzing the content from interviews conducted, the barriers were obtained. The barriers faced by OA are explained in depth in Chapter 6.2, where the twenty-five different barriers that were identified were clustered into 6 major themes which were pre-identified with the help of the conceptual framework.

   In the discussion these barriers were scrutinized even further to pick out the key barriers (higher number of codes) that had inter-linkages between them. These barriers appear to form a cycle, which is difficult to break, which appears to explain the main reason why the pace of digital transformation appears to be slow in OA. This cycle is referred to as the Vicious Cycle and is represented in Figure 10.

Thus, the main research question, "*What are the barriers to digital transformation faced by a B2B company in the chemical industry?*" can now be answered. Taking Evonik as an example of a typical large chemical B2B manufacturer, the key barriers faced by a B2B chemical company can be represented by the Vicious Cycle. The remaining barriers are mentioned in chapter 6.2. Therefore, the key barriers are:

1. A lack of business case – This is a key element that precedes digital transformation. A business case often decides whether a project is worth pursuing or not in quantifiable terms, and especially in the B2B chemical sector where the benefits of digital business are less obvious, it assumes an even higher importance.
2. Lack of Prioritization – Digital transformation is a holistic process that touches many aspects of business, and to do it right it, it must be prioritized. If not, digital transformation remains a fragmented effort with benefits that are hard to achieve.
3. Lack of dedicated resources – Following a lack of business case and a lack of prioritization, it naturally follows that digital transformation would not have dedicated resources allocated to it, which in turn hinders the process even more. Digital transformation is a resource intensive process that requires quite some effort.
4. Lack of strategy – Ultimately having goals, focus and a long-term vision are key factors for a successful digital transformation. Without a strategy, the goal is unknown, and it leaves other employees uncertain or confused about the motivation for transformation.
5. Resistance to change – When goals and motivations for change are unknown, people are quite resistant to change because "things work well as they are."

It is also found that these barriers do not exist in isolation, but they

reinforce each other in a cyclical manner. Therefore, it is not sufficient to simply address a single barrier, these barriers must be considered in sum, as their relationship makes them harder to overcome. It should also be noted that the vicious cycle exists in the context of the B2B chemical environment in which the case company exists. This was a frequently cited cause for the business case problem and the lack of prioritization as there was no market pressure to transform. Other barriers like the lack of collaboration amongst stakeholders identified in the interviews, highlight the complexity of the value chain and business ecosystem within the B2B chemical industry that make it difficult for companies to transform individually. Since the value chain must transform digitally to truly benefit from digital transform, it is complex and involves breaking the cycle of barriers across all the actors in the value chain which could thus contribute to the notion that the chemical B2B industry is a latecomer industry.

8.2. Recommendations

Alignment and responsiveness across functional and departmental boundaries could prove highly useful to the business, as the meetings held during the course of this research with a wide range of stakeholders resulted in increased dialogue and awareness. Additionally, these discussions highlighted the differences in silos, and the differences in perspectives across functions. This also highlighted the need to increase awareness of activities across business lines. It is thus recommended to increase engagement in cross-departmental digital discussions that could result in new opportunities for OA, even despite the resource crunch as collaboration with different business lines could reduce OA's individual effort. While prioritization and building responsive strategy and capabilities is the key to digital transformation, even if digitalization is not a priority, activities and initiatives that involve collaboration and a clear goal are

proven to be more effective.

One example of looking outside of silos, would be to compare the customer relations approach to digitalization with that of production technology within OA. Production technology has committed to an intensive digital optimization project to improve their plant-related processes, that is run centrally at a segment level. The procedure used to address this topic was similar to that in this study insofar as it first involved the establishment of motivations and drivers and the definition of digitalization from their perspective. Following these motivations, certain goals were agreed upon by the relevant stakeholders, which involved defining a methodology to assess the current status of digitalization at each plant. The analysis was holistic and spanned the topics of people, processes and technologies. Based on the current status the plant then decides a target level of digitalization. Following this a business case analysis and roadmap is created based on the target level that must be achieved. This is an example that can be followed in terms of digital business as well. However, a business case for benefits is difficult to construct unless clearly defined goals are created.

The findings thus show that it is necessary to assign a formal priority to digital transformation activities in order to transform most effectively. If and when it is assumed to be a priority in OA, it would greatly benefit to assign a digital strategist or expert to spearhead digitalization activities. Other business lines who have incorporated digital transformation in their strategy have introduced this function in order to formally execute their digital strategy effectively. Therefore, the recommendation is to allocate targeted effort in identifying a suitable application and creating a viable business case that allows OA to strategically choose to undertake digital business activities.

The stakeholders that were interviewed not only expressed a fear for job security but also a significant perception that they lacked digital competency. It could be helpful to boost the morale of the stakeholders by incorporating digital competencies into personal learning and development goals in a manner similar to that envisioned by the digital learning journey study conducted for sales employees, where a digital learning plan was tailored to individual goals and preferences. Discussions revealed that stock training sessions or video tutorials might not always prove successful and that employees would benefit from a team-based approach where a teammate discusses the usefulness of digital tools along with ways of usage that bring value to the employee instead of contributing to the feeling that tools require more input than the value that they return (as mentioned in the interviews). A suggestion is to assign responsibilities to employees to develop certain digital competencies and spread the competency across the team.

Since the B2B value chain was a central actor in the discussion of barriers, it is recommended to bring digital services on the agenda of discussion with customers. It can be viewed as a collaborative co-development instead of a unidirectional service, since the value of digitalization is amplified across partnerships and networks. Therefore, it could benefit to start the conversation towards understanding the services that could interest them in the future, without the pressure of having a fully developed product to be “sold” to them.

However, the urgency for change is unlikely without an external threat (Warner & Waeger, 2019), and as discussed earlier, when the entire value chain doesn’t face this threat or when a threat to disrupt seems unlikely in the market. To transform digitally it is important to build scouting

capabilities for external digital activities happening in the market to consistently assess market readiness. Readiness of peers can occur unevenly across environments and firms may differ in the level of IT infrastructure and maturity (Zhu, Dong, Xu, & Kraem, 2006).

8.3. Limitations and Future Research

The approach of the literature review began with studying literature on digital transformation. As stated previously, the literature on digital transformation is relatively new and few sources exist that describe it in its holistic manner. Similarly, the sources relevant to the chemical industry and B2B were also scarce. Therefore, literature on digitization and adoption of relevant IT systems was looked into. However, most of these were not recent. Furthermore, the literature on adoption of IT systems was so vast that it was infeasible to study them all. Therefore, further review that combines the literature of adoption of IT systems, along with the latest transformation related literature could provide an incredibly detailed source of information. Literature pertaining to the measurement of value for IT systems could also prove useful considering the addition of the new factor in the framework: “lack of a business case.” Future research in the field of how to build business cases for digital transformation could be very helpful.

In regard to the interviews, purposive sampling is limited in that it does not take into account every candidate that is most ideal (Sekaran & Bougie, 2009), as there were more candidates that could have been interviewed but were unfortunately not available. The functions of the various respondents differ according to prior justified reasoning, but this difference results in non-uniform perspectives. The difference in

perspectives was desired to get a more rounded view of the organization but this also implied that different respondents had varying levels of involvement in the digital agenda. Some respondents were also not a part of the business line according to their designation, and their perceptions may not reflect the business line Oil Additives exclusively. However, these external respondents were chosen such that they had been involved with OA regarding digital activities previously and were asked to keep OA's context in mind.

Furthermore, the findings are built upon perceptions of the sample and their status as fact can be disputed. However, these perceptions provide grounds for constructive discussion. Another limitation of perceptions is that sometimes the interviews may have been coloured by social desirability bias, where a respondent could give answers to portray the situation and themselves in a more positive light (Lee & Sargeant, 2011) and in other cases been affected negatively by personal experiences. The researcher has attempted to cross-question many responses to try and understand why the response was positive or negative and such reasoning is also present in the transcripts.

Since this research is qualitative, validity has been attempted by providing counts of events and supporting anecdotes (Sekaran & Bougie, 2009). Multiple fields of data have been triangulated since some data was collected through internal websites, some through field notes in meetings, conversations and observation, as well as through direct interviews. However, a limitation of this study is that its external validity cannot be guaranteed. Therefore, it could be useful to perform a similar study in different B2B contexts to investigate the impact in difference in context for digital transformation.

8.3. Managerial and Scientific Reflection

The aim of this thesis was to contribute to digital transformation literature. As a concept that has existed in different forms over the decades, the terminology of digital transformation has become an integrated force that is perceived as desirable by most organizations – both professional and public. Yet despite existing literature, there exists a lack of awareness within industrial workforces. Theories of innovation adoption had not been integrated with digital transformation literature and that could provide opportunity not just for digital transformation scholars but also for the adoption theories to be expanded beyond a purely technological view.

This thesis refers to Westerman & McAfee's concept of digital maturity (2012) to assess the business line but however there are various other methods of classification as well, such as the classificiation of employees into digital personas used by the digital learning journey project, that impact the digital maturity of an organization as well. With the growing importance of digital transformation, it is becoming necessary to establish standard definitions and measures for digital maturity assessment. This would require further research on the models proposed along with empirical applications to determine the suitability of the model to varied applications.

The literature used to support the building of the conceptual framework can be argued to support transformations in general, aside from digital. However, the basis of assessment on digital maturity forms a solid grounding to a set a context for understanding the barriers to a digital transformation. Furthermore, there are specific barriers that this framework addresses that are characteristic of a digital transformation.

These include the specific need for digital competency focus on human resources and the adoption of digital technologies. Additionally, the nature of digital transformation is central in its difficulty in creating a business case, as the proposed benefits of drivers such as improved customer experience are hard to quantify. There is a gap in scientific literature that addresses the problem of building a business case for digital transformation. Furthermore, even if business cases can be built for certain applications within the umbrella of digital transformation, more effective methods to build business cases that cover the holistic transformation would beneficial. This study hopes to contribute by shining light on this gap and providing justifiable cause to study this further. Therefore, this framework's applicability has a high dependency on the drivers and context of transformation.

It was interesting to note that there is a wealth of B2B studies on targeted applications such as e-commerce, e-business and IT systems, yet while studying digital transformation across value chains it is interesting to note the necessity to collaboratively build digital business strategies to get maximum value (Adner, 2006). Strategic co-development of initiatives is especially relevant in the digital space because of the potential of collectively owned data in smart networks. This study's relevance to B2B companies has been emphasized in interviews, discussions and articles and thus draws attention the unique challenges faced by B2B companies in digital competition, with growing distance from the end-user. While the internal validity achieved from discussions and the magazine articles featuring additional perspectives of chemical industry experts point to the findings being specifically applicable to the chemical industry, there is indication that the barriers of stakeholder engagement and difficulties in digitalization across value chains can extend across other industries within B2B as well. However, the barriers of digital

resources, operational backbone and business case could vary from company to company.

The concept of responsible innovation is introduced very briefly here, because of its lack of involvement with larger social publics. However, the basic principles of responsible innovation promote questioning of purely business-driven practices and the way they are administered to their own employees. With this, the hope is to shed light on concerns of the employees, and to promote ethical treatment of one's own internal stakeholders. Furthermore, the values of transparency, interaction, responsiveness and co-responsibility (Blok, Hoffmans, & E.F.M., 2015) not only apply while collaborating across business lines but are crucial while attempting collaboration across the B2B value chain. Making a conscious effort to responsibly engage stakeholders could ease difficulties and concerns about working across silos and organizational boundaries.

The initial research objective was to understand why digital transformation was slow to catch on in chemical B2B companies, and the vicious cycle developed in this thesis highlights factors that reinforce each other, thereby making it difficult to break. Practically, the objective is for this thesis to provide some insight into the barriers faced by an incumbent B2B company. The idea is to serve as a framework for aiding successfulness and preparedness for digital transformation and enabling companies to spot crucial hurdles when they may be stuck in tunnel vision. This study also helps highlight the struggles faced by companies in the growing element of digital competition. Where current research provides many sources regarding digital strategies (Alos-Simo et al., 2016; Fitzgerald et al., 2013; Henriette et al., 2016) and benefits of digital transformation, by focusing this study on a specific industrial context it

sheds light on the gap in research that is useful in helping companies choose digital transformation as a strategy.

8.4. Study Reflection

This thesis is written as the final step on the way to achieving a master's degree. Exploring the impact of technological transformation on business is a core aspect of the Management of Technology master programme and has proven to be a challenging and rewarding step of the author's career.

Writing this master thesis at Evonik Oil Additives has proven to be doubly enriching, as the author witnessed first-hand the growth of the business problem and was able to contribute scientifically to unravel the causes behind it. Working with Evonik provided excellent opportunities for discussion with industry experts and provided an insight into real-word difficulties that are often glossed over by editorial pieces and scientific publications. Therefore, with this thesis the author has attempted to bridge an identified gap between academia and real-world business problems.

9

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10

Appendix A

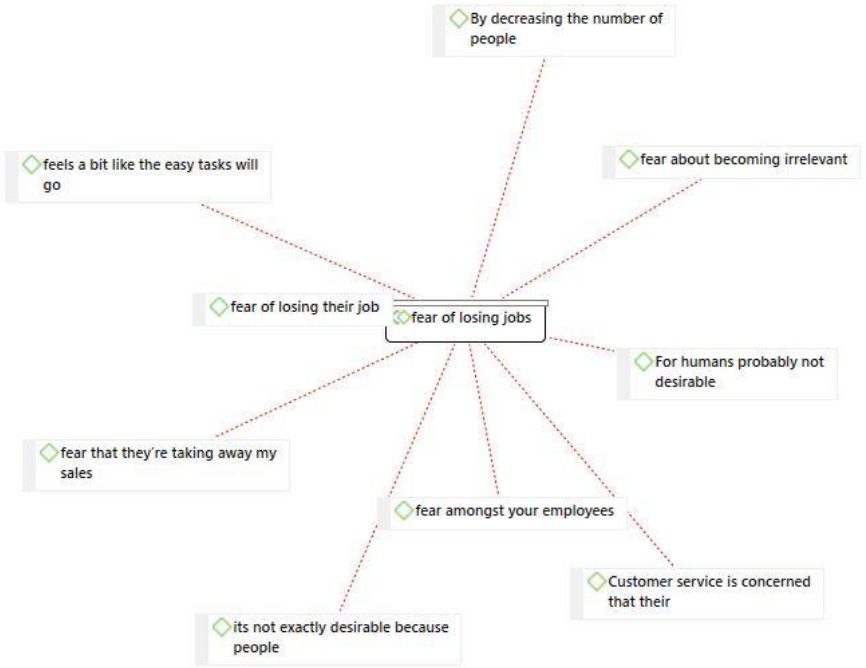
Interview Questions

1. [Introduction] Please describe your role/function
2. What does digitalization mean for you? Is it desirable/necessary?
3. How digital would you consider Evonik? What about OA in particular?
4. Do you think digitalization is a priority at OA?
5. What is the main motivation to digitalize?
6. How does digitalization affect you and your daily work? Does it improve your quality of work?
7. How do you think digitalization will impact your knowledge of the customer?
8. How do you think digitalisation is progressing in OA? Do you think there's something slowing it down?
9. Do you feel that the current organizational structure is conducive to digital transformation?
10. Do you feel that there is enough IT support for digital transformation?
11. Do you feel that the current team (and their capacities) are enough to drive digital transformation?
12. Do you feel that financial considerations often block digital possibilities?
13. What else do you think is necessary/crucial for a digital transformation? Any other specific kind of support?
14. How aware are you of BL goals/digital strategy?
15. Do you think there is a top-down push for digitalization?
16. Do you think there is enough support from the management for digitalization?

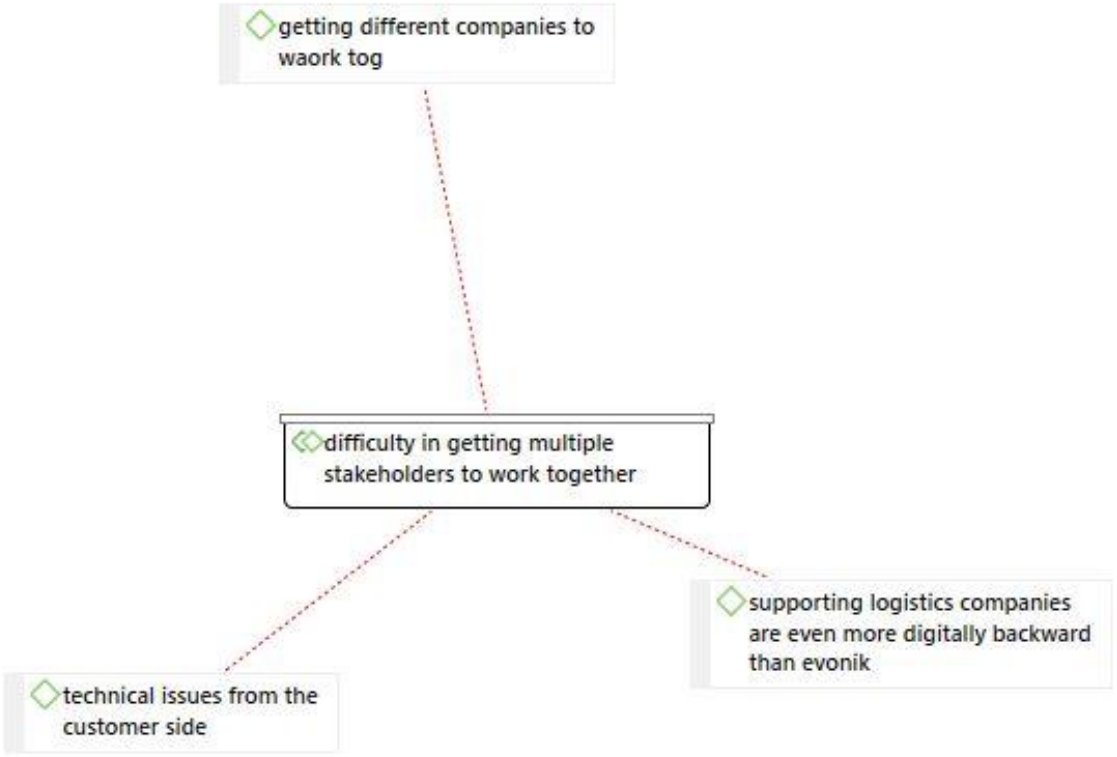
11

Appendix B – Barriers (Categories)

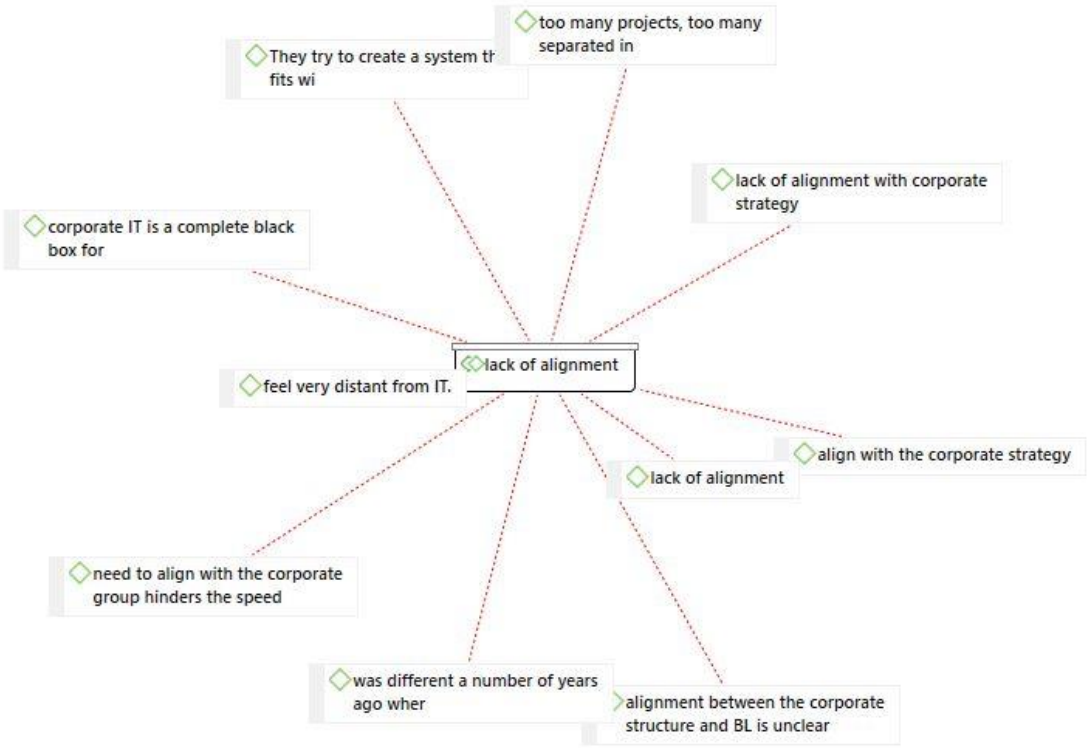
AB.1 Fear of losing jobs



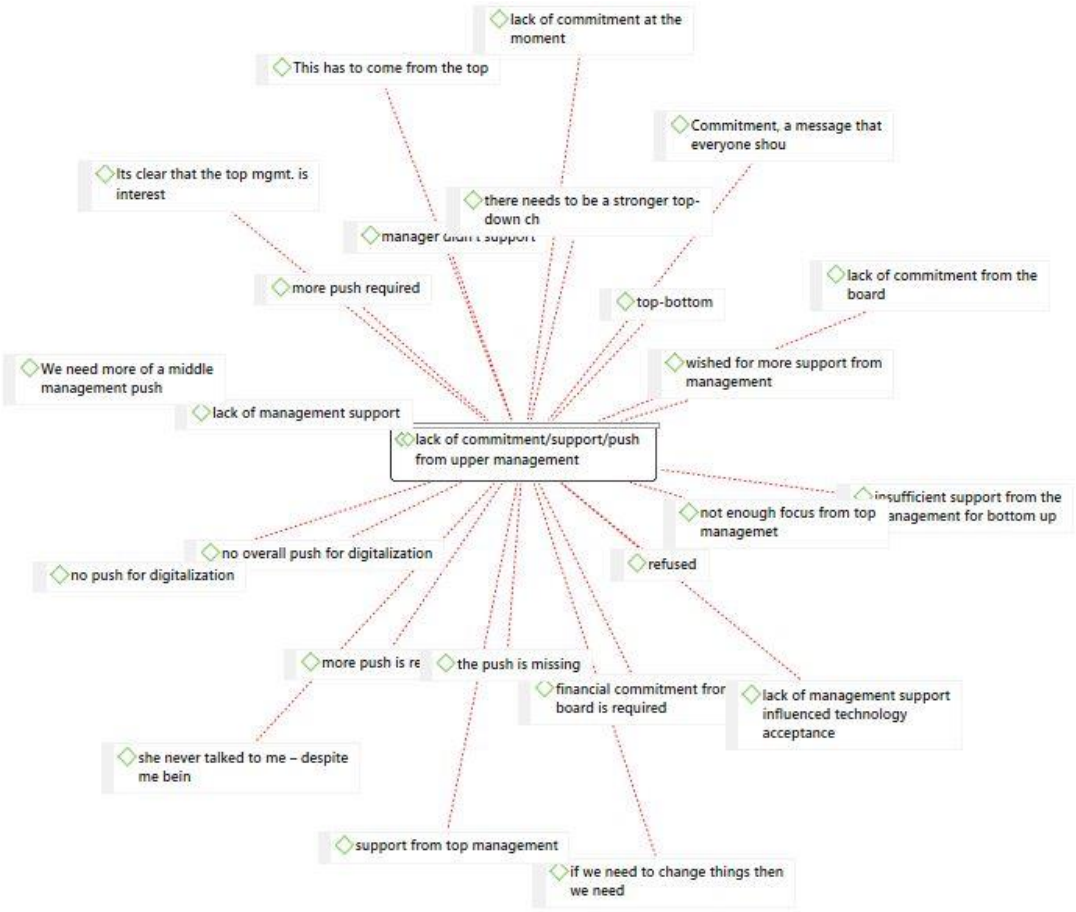
AB.2 Difficulty in getting multiple stakeholders to work together


getting different companies to waork tog
difficulty in getting multiple stakeholders to work together
supporting logistics companies are even more digitally backward than evonik
technical issues from the customer side

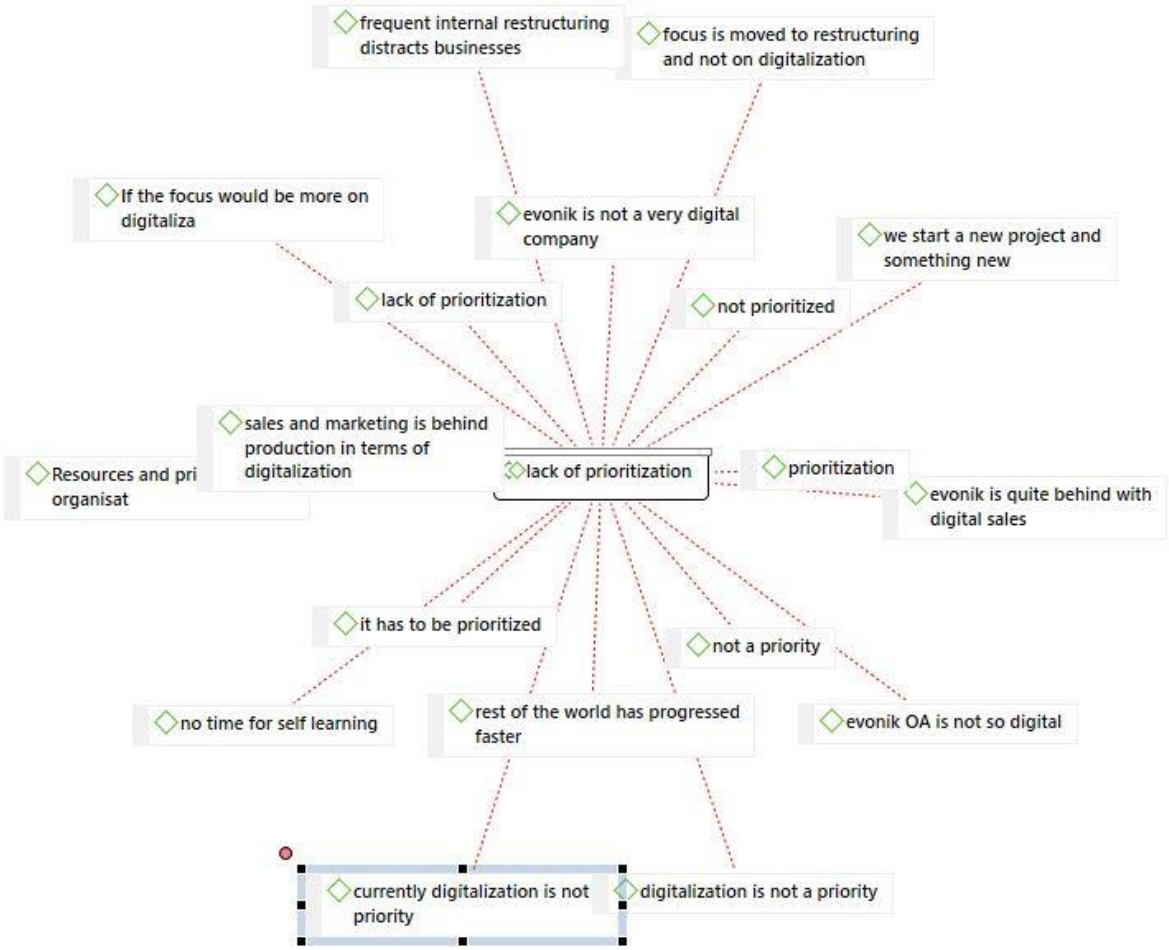
AB.3 Lack of alignment



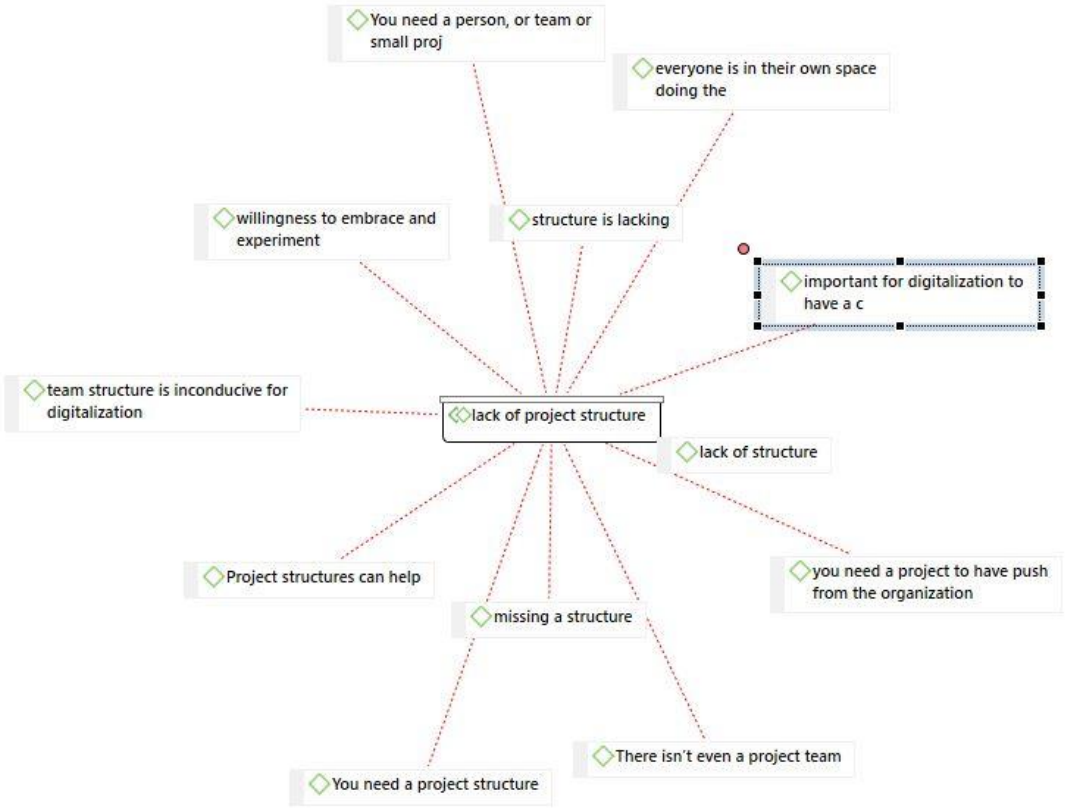
AB.4 Lack of commitment/push from management



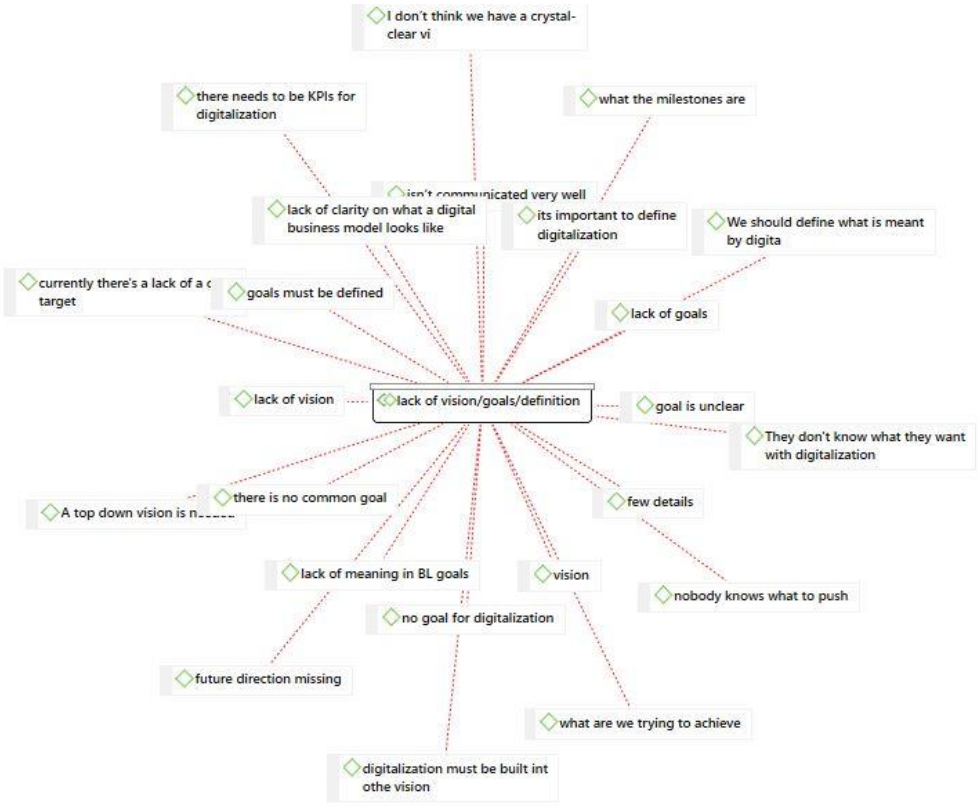
AB.5 Digitalization is not a priority



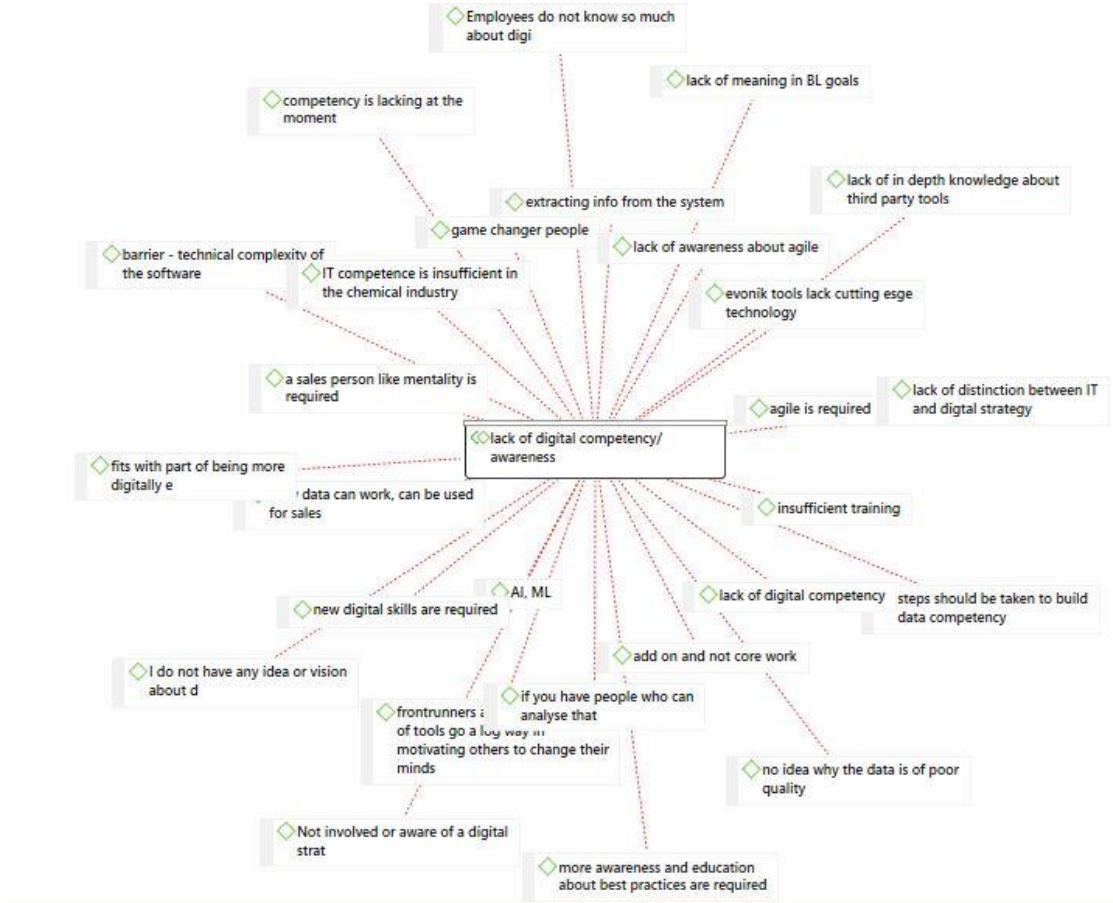
AB.6 Lack of project structure



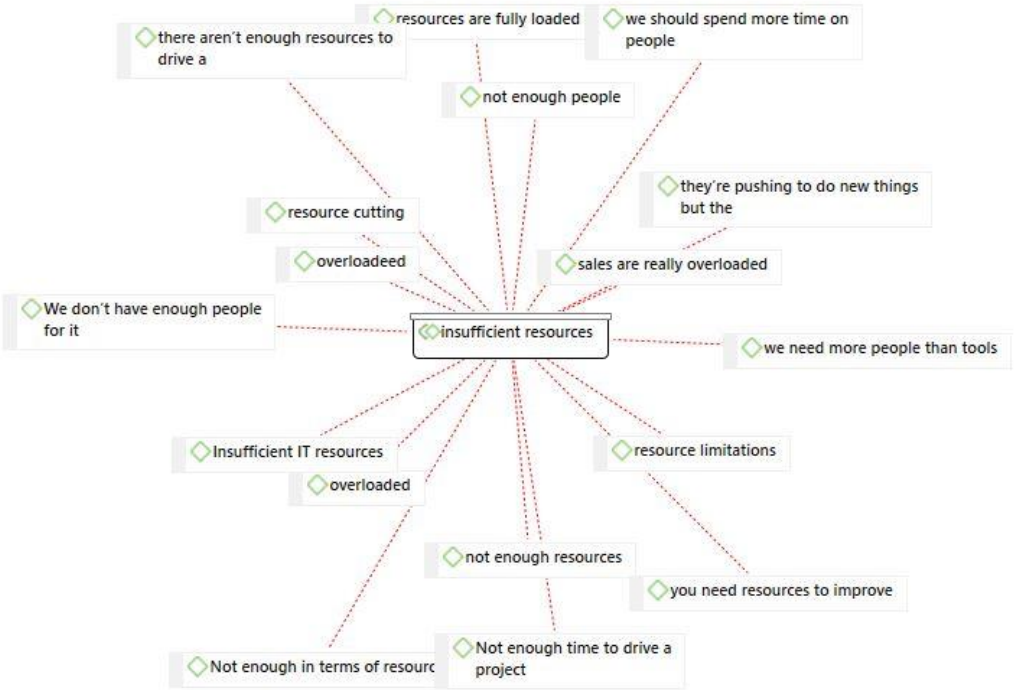
AB.7. Lack of Vision/Goals



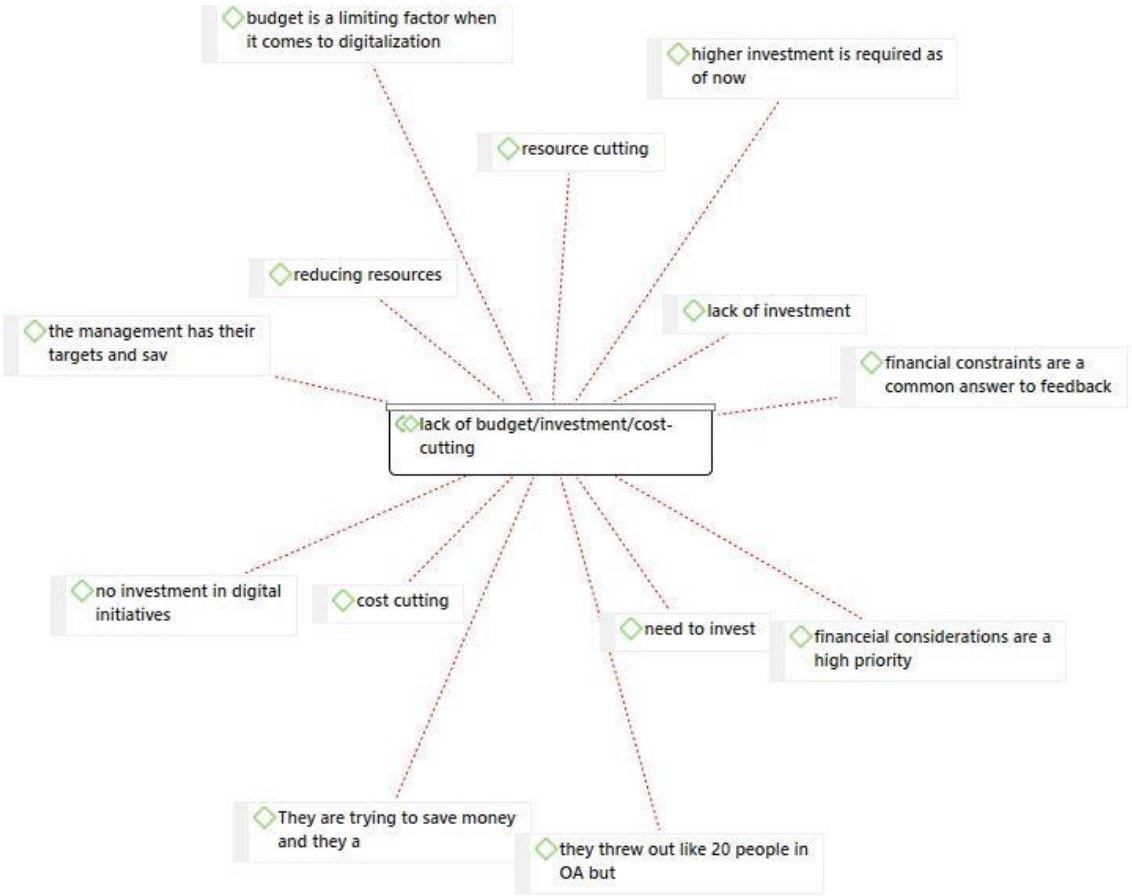
AB.8 Lack of digital strategy



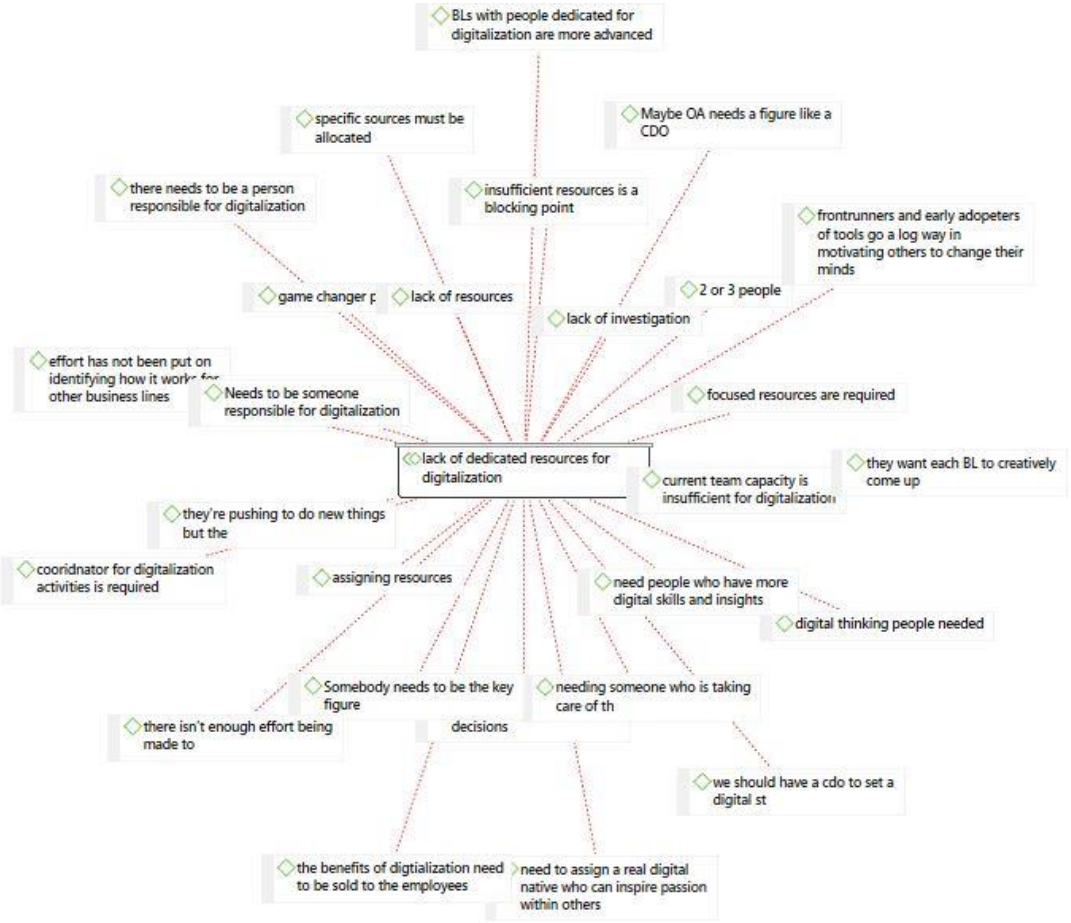
AB.9 Insufficient Resources



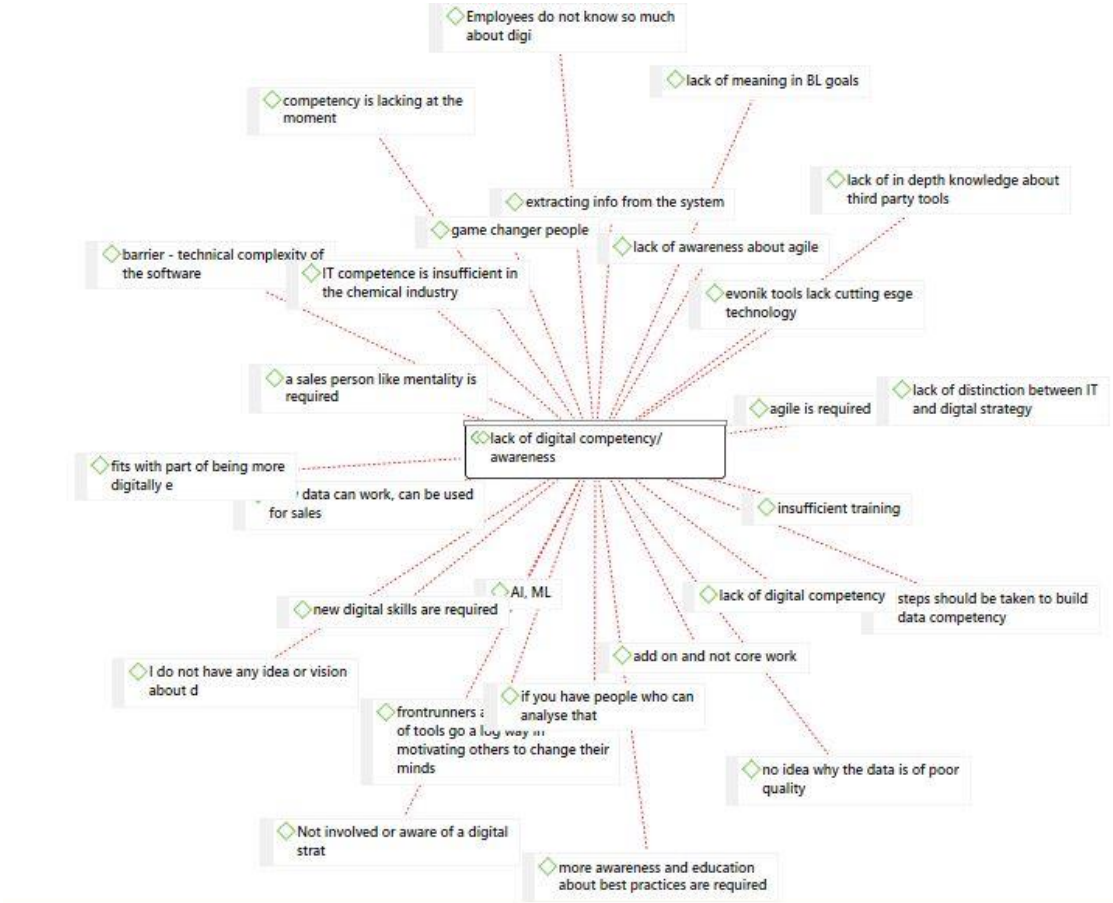
AB.10 Lack of budget



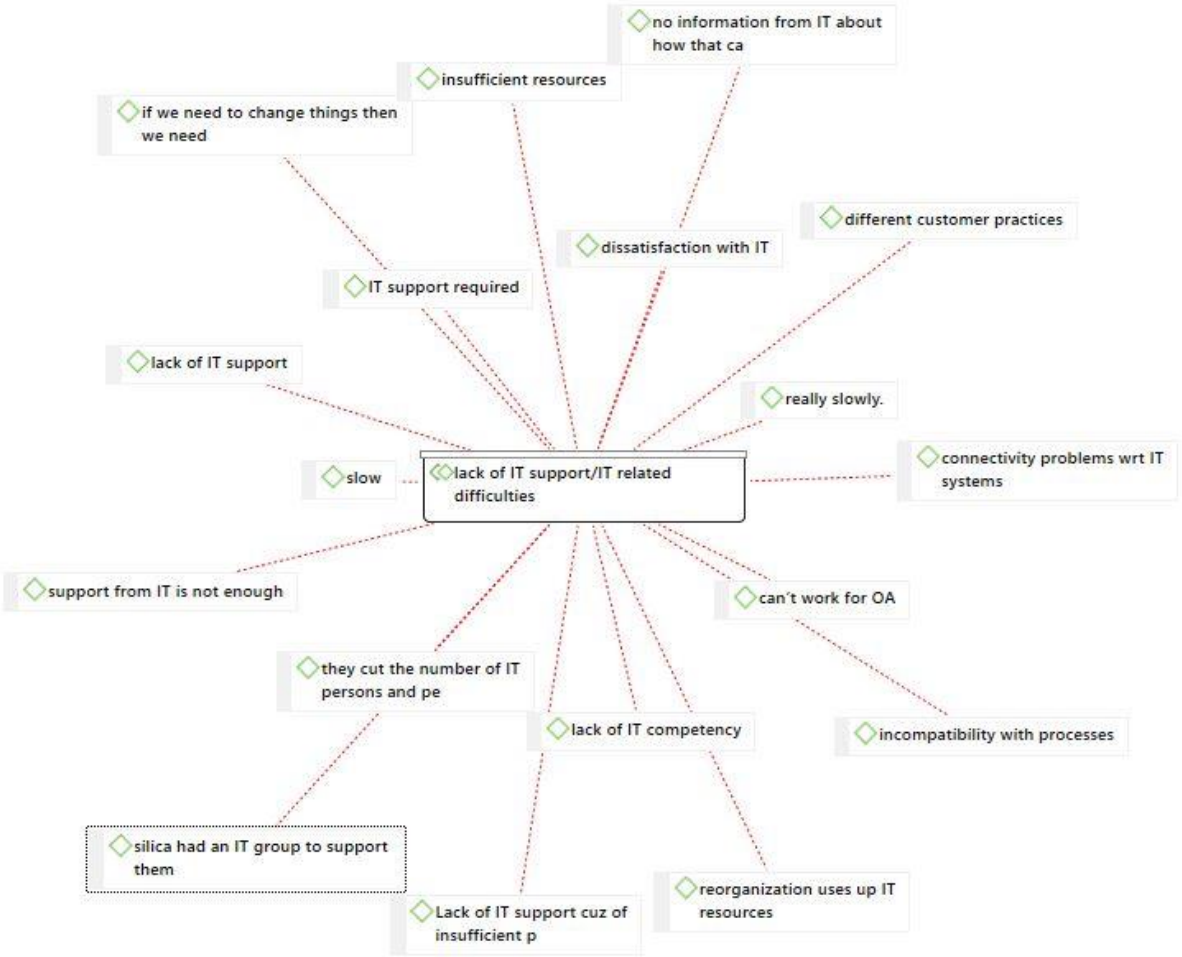
AB.11 Lack of dedicated resources for digital transformation activities



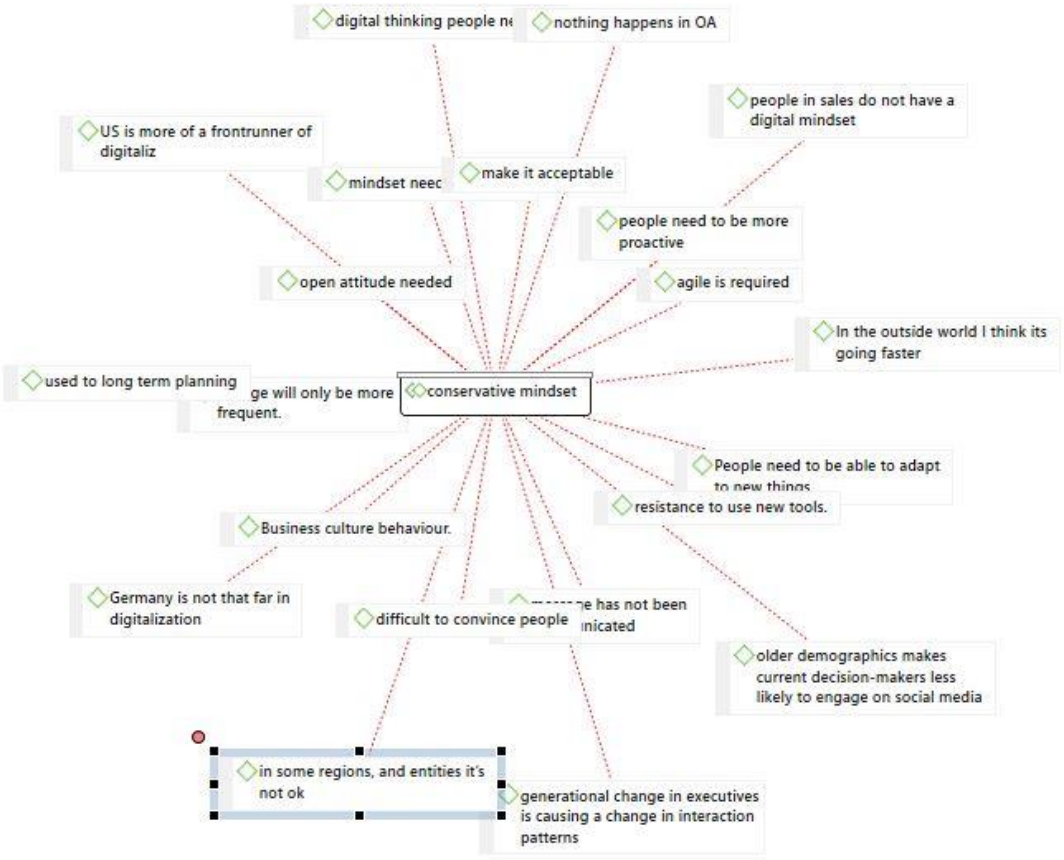
AB.12 Lack of digital competency



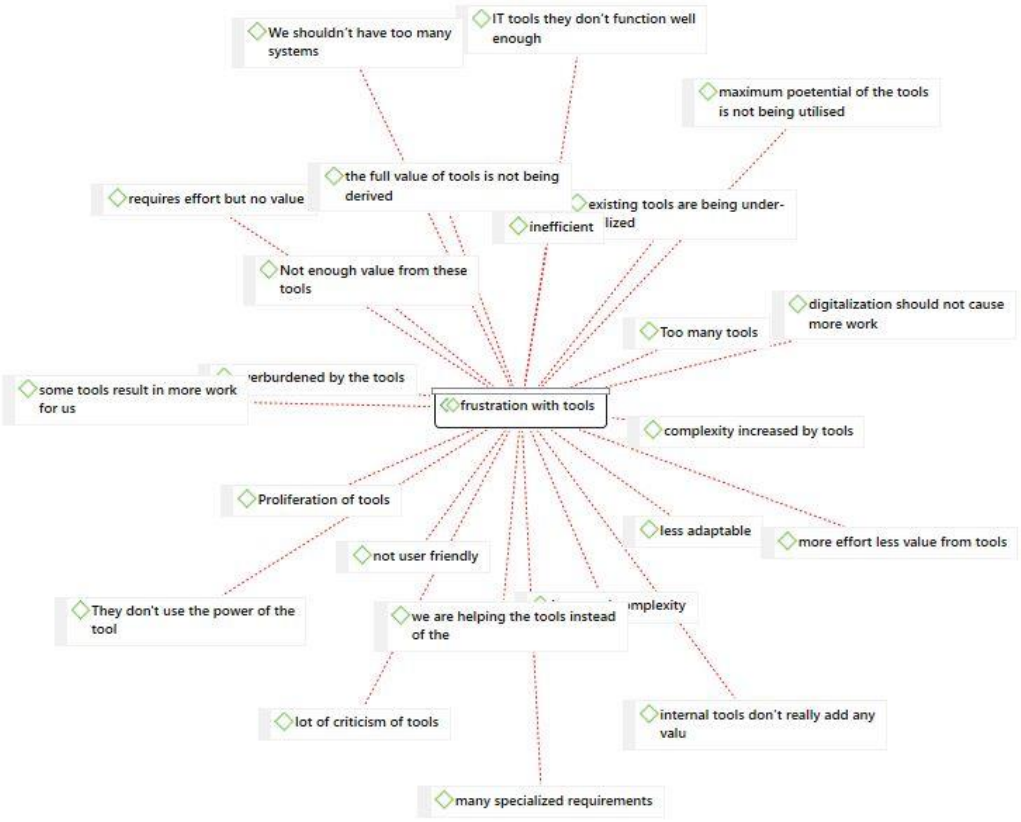
AB.13 Lack of IT support



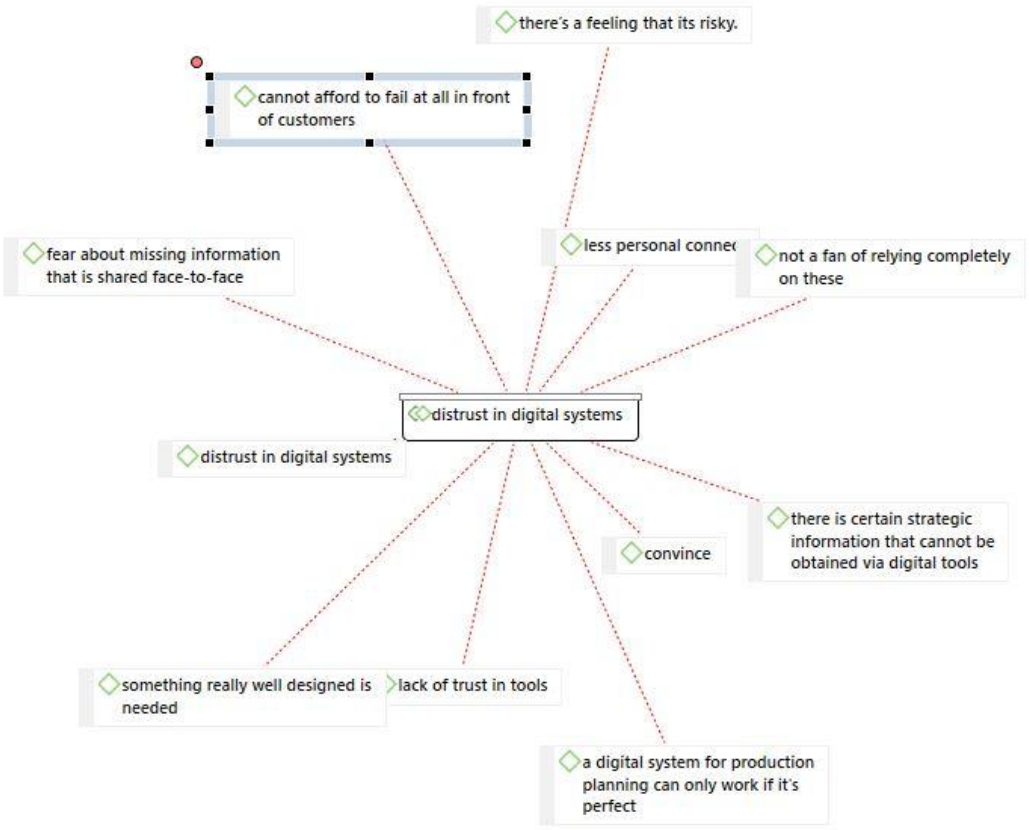
AB.14 Conservative mindset



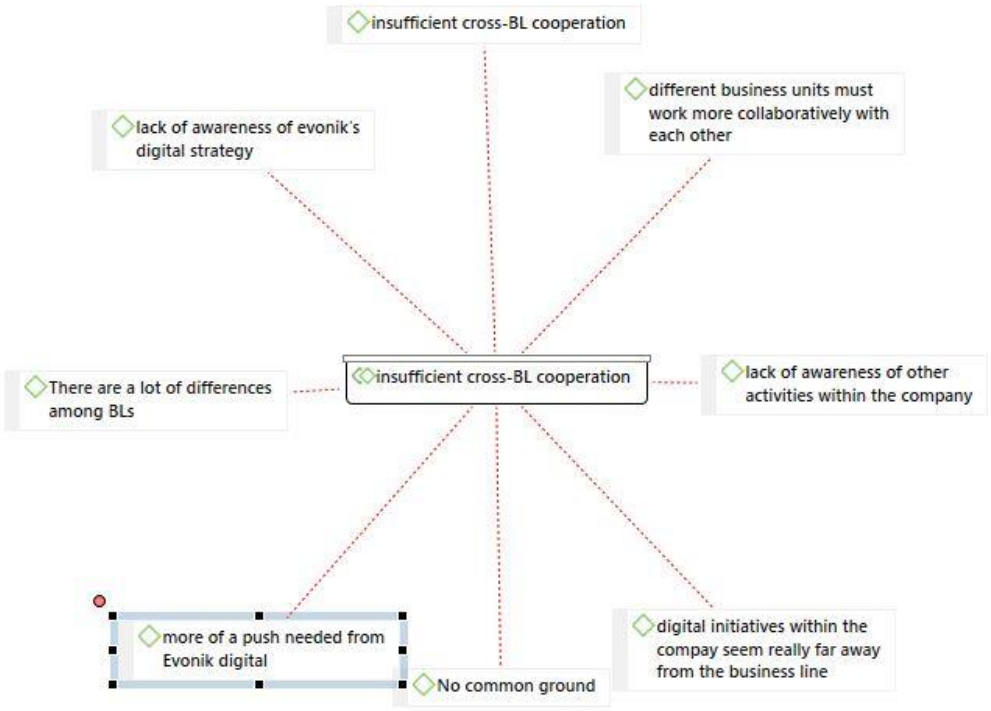
Ab.15 Frustration with tools



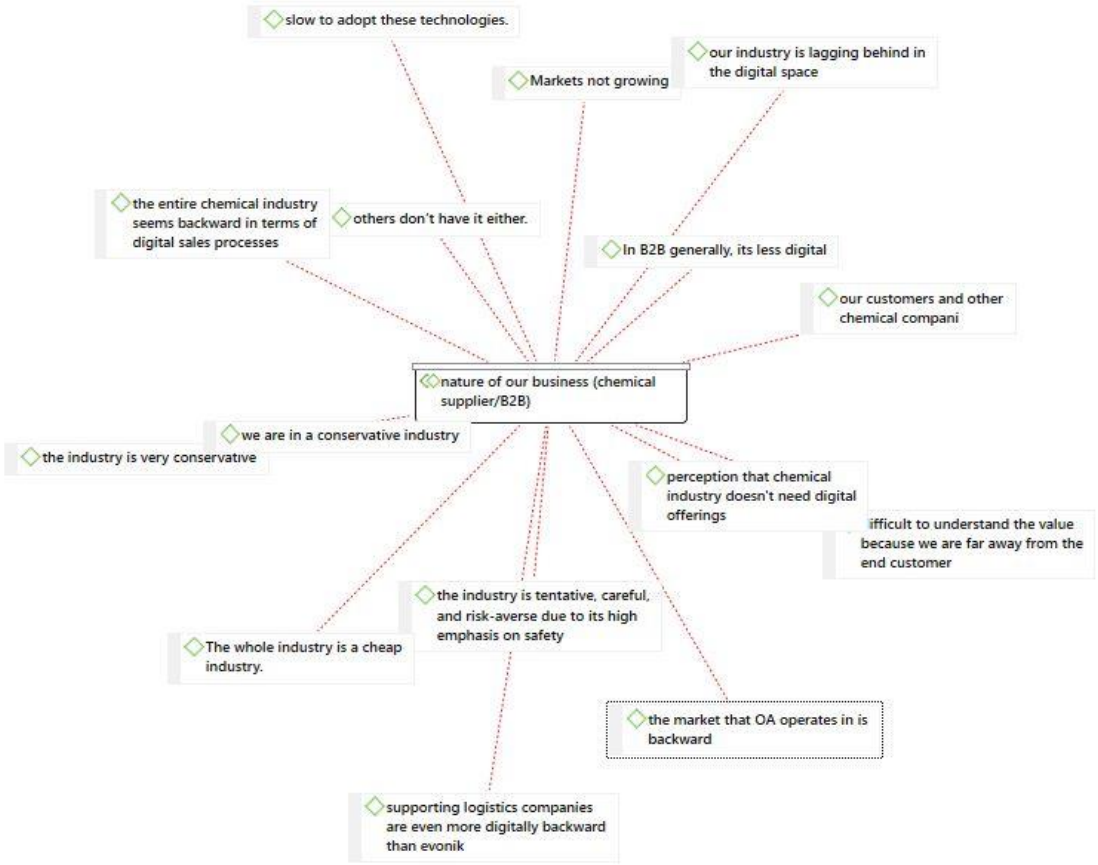
AB.16 Distrust in tools



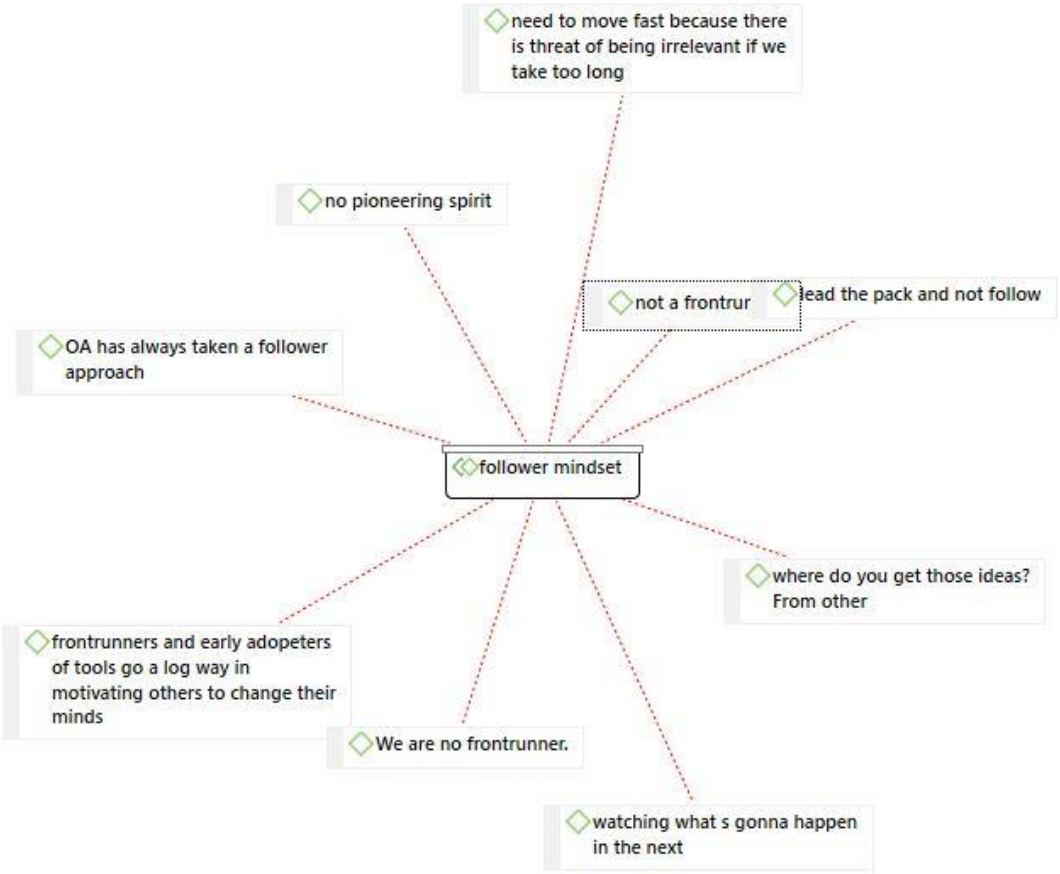
AB.17 Lack of collaborative attitude (across BLs)



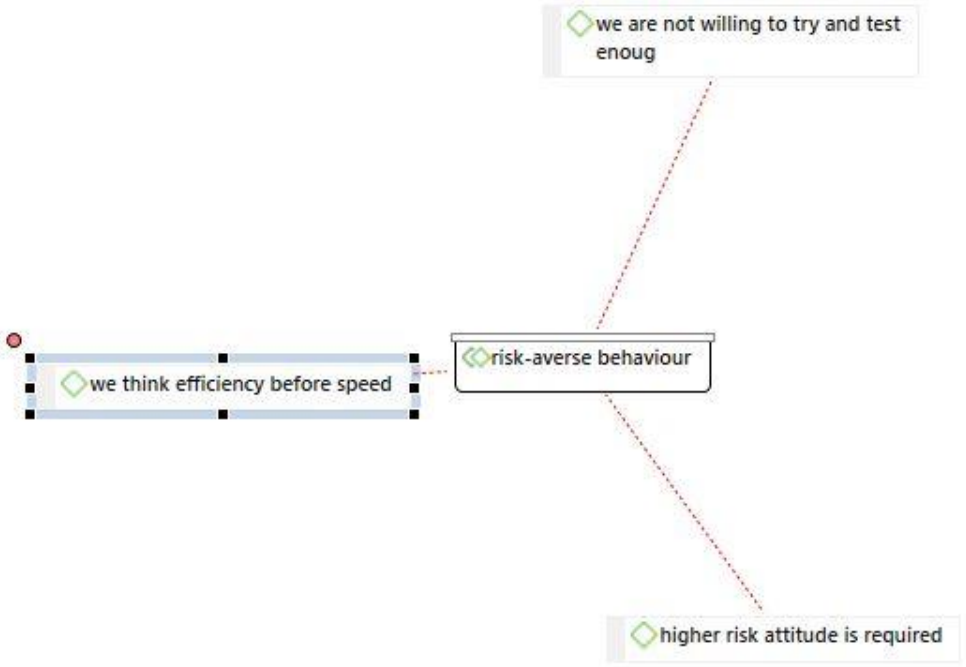
AB.18 B2B environment



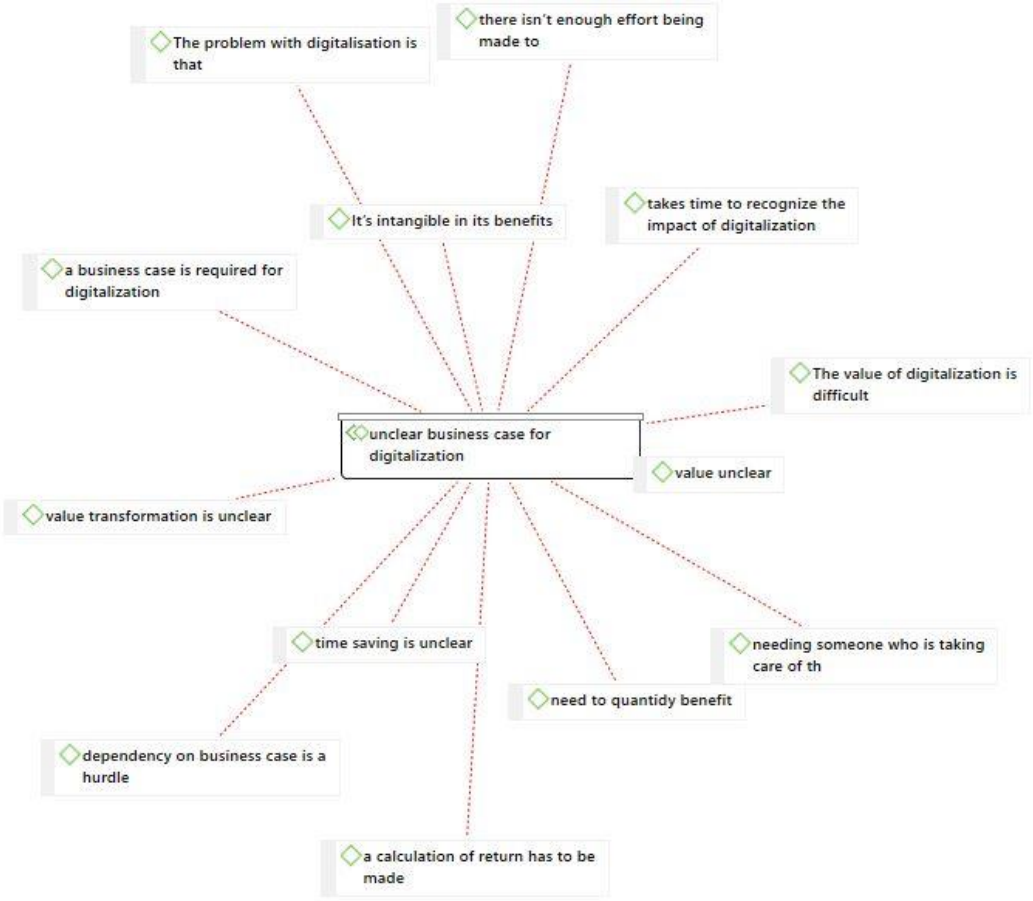
AB.19 Follower mindset



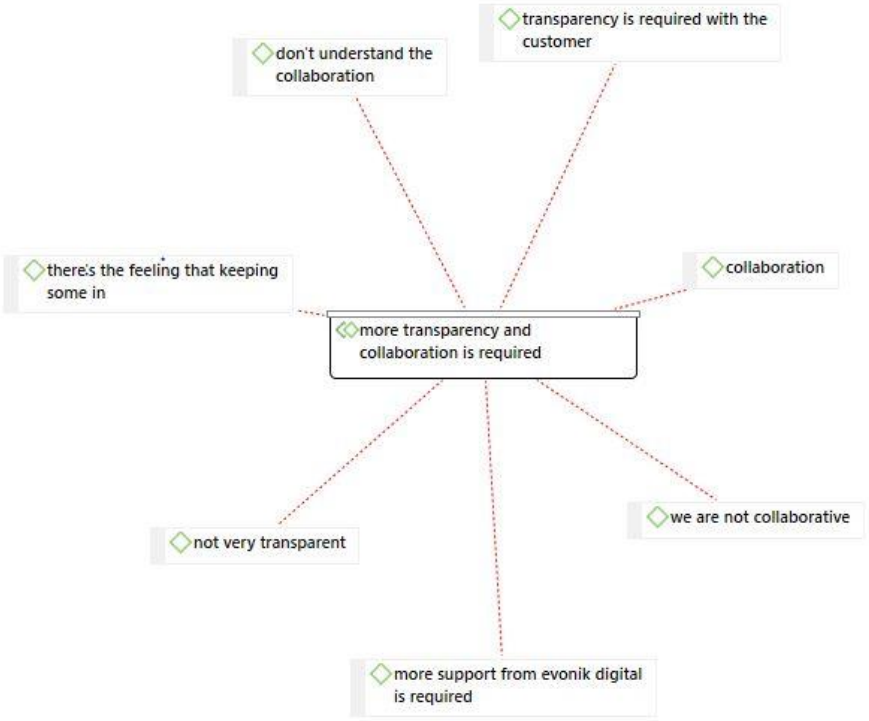
AB.20 Risk-averse behaviour



AB.21 Lack of business case



AB.22 Less transparency and collaboration (with customer)



AB.23 Less customer-centricity