



Do or Die: How large organizations can reach a higher level of digital maturity

- A multiple case study

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PREFACE

This report presents the master's thesis of Jesper Hägg and Sandy Sandhu, the last building block of our master's degree in Industrial Engineering and Management, with specialization in Innovation and Strategic Business Development, at Luleå University of Technology. The learning experience we have gained from our master's thesis is incomparable with any other course during our university studies, we have had the opportunity to contribute to research literature as well as provide guidance for our case companies. It's all thanks to the people who have guided us along the way. Firstly, we wish to express our gratitude towards Johan Frishammar, our university supervisor for this thesis. Johan has been a tough yet fair mentor during the process, and his advice has been truly invaluable.

We would also want to thank our supervisor at Propia AB, Louise Sandén. Louise has been a very sharp and valuable advisor during our cooperation, and her ability to shed light on the practical aspects of our study has really helped us achieve the results we aimed for. Lastly, we are very thankful for all the time and effort the respondents of our interviews and workshops – employees at Propia AB, Tekniska Verken, BE Group, and Ericsson – have invested in this thesis. A special thanks to the employees at Propia for their generosity, expertise and uplifting spirit, and without which we would not have attained the Digital Maturity Framework.

Stockholm, 26th May 2017

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ABSTRACT

The business landscape as we know it is being disrupted by an increasing usage of emerging digital technologies, to reap the benefits of the new technological opportunities managers need to transform their organizations. To do so, research literature proposes striving towards digital maturity. However, knowledge within the area of digital transformation and digital maturity is insufficient amongst organizational leaders. Moreover, theoretical guidance in terms of which changes that are required to increase digital maturity in an organization, is still absent in research literature.

To address the academic gap and provide guidance in practical challenges, the research objective *to create a framework to evaluate digital maturity* was constructed. To reach this objective, the following research questions were derived: *RQ1: Which levels can digital maturity be divided into and what characterizes each level? RQ2: When progressing upwards along the digital maturity scale, what are the key dimensions that allow transition from one level to the next?*

To answer the research questions and thereby meet the research objective, an abductive, multiple case study of large companies in the manufacturing and service industry was performed. 16 interviews and two workshops were conducted to provide the data which was then thematically analyzed and structured to provide answers to the research questions. Our findings were then used to construct the Digital Maturity Framework.

Our findings suggest the following three levels of digital maturity; Awareness, Experience, and Autonomy. The characteristics of each levels is expressed in six organizational dimensions, namely Processes, Leadership, Culture, Strategy, Analytics, and IT. To transit from one maturity level to the next, Leadership in terms of change management is a key dimension in all transitions. Before organizations qualify for the level Awareness, they must first lay the foundation through Process management. Experimenting and testing new digital tools and technologies is a key dimension to reach the level Experience, and Strategy is a key dimension in both the transition to Experience and the transition to Autonomy.

Our findings contribute with a more nuanced framework of digital maturity as well as guidance for managers about what they need to do to progress in digital maturity. The importance of change management is the most valuable managerial implication of our findings, because change will always trigger friction in the organization, which in turn requires strong and driven leaders to drive the change.

Keywords: *Digital maturity; Maturity models; Digital transformation*

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1. INTRODUCTION

The following chapter will serve as background to the discussion of the research gap, concerning digital maturity and present why this gap is relevant to address, it also aims to present the consequences of not addressing this gap. The objective and research questions will be presented in this chapter.

1.1 Background

“I argue that all industries must consider these issues, sooner or later you have to change”

– Respondent, Ericsson

Digital technologies are disrupting the business landscape as we know it. To stay competitive, organizations must not only know how and when to apply these new technologies to succeed (Andal-Ancion, Cartwright, & Yip, 2003), they must rethink the way they do business (Early, 2014). Organizations are struggling to transform their business to adapt to the new competitive environment. However, digital transformation is not a fair term to use for this process, and managers can find benefits from using and understanding digital maturity instead (Kane, 2017). The reason behind this is that transformation can imply that it is a change that happens overnight, whilst it is more about learning to respond to the competitive environment, which is more in line with the definition of maturity. That is why we intend to study digital maturity.

Digital transformation is defined as “adopting business processes and practices to help the organization compete effectively in an increasingly digital world” (Kane, 2017), where “digital” refers to emerging technology that uses digital signals, which is increasingly integrated in businesses today (Iansiti & Lakhani, 2014). There are many benefits following a digital transformation such as increased efficiencies, innovation, financial performance, competitiveness, productivity and new ways of interactions with one’s customers (Andriole, 2017; Matt, Hess, & Benlian, 2015; Westerman & McAfee, 2012; Westerman, 2016). Leaders in most industries should strive to transform their

organization (Westerman, 2016), and whilst some organizations disregard digital transformation and adopt a follower strategy, that kind of thinking is wrong according to Westerman & Bonnet (2015). However, there are advantages with a follower strategy as well, since it often entails a more mature market.

Although the benefits a digital transformation entail are many, there are also challenges to overcome along the way. A digital transformation is a complex procedure, and under the surface of all the hype about the concept, there is still confusion among organizational leaders (Andriole, 2017). A common misunderstanding is that profitable organizations are most likely to launch successful digital transformation projects, which is not entirely true because less profitable organizations are often more motivated to change because they really need to, according to the author. The complexity of digital transformation requires established management practices (Matt et. al, 2015) as well as thorough planning, execution and support by top management, but the absence of these is common in practice today and often the source of mistakes (Andriole, 2017).

Kane (2017) argues that managers could benefit from shifting their focus to digital maturity instead of digital transformation, where digital maturity is defined as *the ability to compete effectively in an increasingly digital competitive environment*. The author adopted this definition from the psychological perspective of the word “maturity”, which is defined as “the ability to respond to the environment in an appropriate manner”. Kane argues that organizations cannot become digitally mature overnight, it is a gradual process that takes time. Neither does organizations know what they will look like when they are digitally mature, making a planned transition to that state difficult. This is also recognized as a practical issue, organizations lack knowledge about how to become more digitally mature.

The author further argues that organizations can always become more digitally mature, meaning one is never finished. Kane, Palmer, Phillips, Kiron, and Buckley (2015a) have charted digital transformation as a path through levels of digital maturity, supporting the perspective of Kane (2017) about how the two terms are correlated, which is also the perspective we adopt in this study. Kane et al. (2015a) argue that depending on certain

characteristics of the leadership, culture, strategy, and talent development in an organization, it qualifies in one of the three maturity levels *early*, *developing* and *maturing*. The authors also include common barriers to progress further from each maturity level. Another perspective of digital maturity is the one of Westerman and McAfee (2012), who built a model to demonstrate four different types of digital maturity. Depending on the combination of investments in technology-enabled initiatives and investments in leadership capabilities, an organization can belong to one of the four types of digital maturity: beginners, fashionistas, conservatives and digiratis.

Apart from the above-mentioned models concerning digital maturity, research literature has not provided detailed contributions on the subject yet. Digital maturity has not been addressed by many scholars, even though its correlated concept, digital transformation, is not as new to research literature as digital maturity, detailed theoretical models and frameworks are relatively absent in that research area as well.

1.1 Problem Discussion

The benefits of digital maturity, such as increased financial performance, are known and discussed by scholars. Scholars have also discussed emerging digital technologies such as social media, analytics, sensors, the cloud, and how organizations are using them to compete in the emerging digital business environment (Iansiti & Lakhani, 2014; Westerman & Bonnet, 2015; Kane et. al, 2015a). However, the existing literature on digital maturity is mainly focused on brief decompositions of the term and characteristics of organizations that have become digitally mature (Kane, 2017; Kane et. al, 2015a; Westerman & McAfee, 2012), and there are two problems with this.

Firstly, there is not much nuance to their digital maturity models. For example, Kane et. al (2015a) discusses characteristics of strategy, leadership, culture, and talent management on the digital maturity levels. However, these characteristics are described at a more abstract level, such as “collaborative culture” which is an indicator for culture at the maturing level. The implication of this is that the model is not as practically valuable as it could have been, and by that we mean the possibility for other

organizations to use this model to assess themselves. The aim of this study is to develop a more practically applicable framework. Since assessing one's performance is key to facilitate any business development according to Maier, Moultrie, and Clarkson (2012), this weakness of the model that Kane et. al (2015a) developed leaves a research gap that is important to close.

Secondly, there is an absence of guidance in how to progress in digital maturity. Confusion about digital transformation is a problem that often leads to mistakes (Andriole, 2017), and executives in all industries lack guidance to help them progress in digital maturity (Westerman & McAfee, 2012). For an example, Kane et. al (2015a) do not elaborate how to reach the maturity levels that they describe other than that digital transformation needs to be led from top management. Kane, Palmer, Phillips, Kiron, and Buckley (2016) carry a more guiding discussion on the path to digital maturity, by aligning one's culture, structure, people, and tasks, organizations can reach digital maturity. However, the guidance is still at an abstract level, such as "Salesforce.com combines customized online-learning with badges that play a central role in performance evaluation and promotion". Many of their discussions plays an inspirational role for the reader, but practical guidance could be improved. Their contribution paints a picture of a desired digital maturity state but there is no guidance for how to reach it.

The path to digital maturity is a generally known challenge for executives in all industries today. The lack of knowledge about the process in combination with the hype around the concept, resulting in further confusion, often leads to organizations making mistakes in their transformations. The need for theoretically supported guidance is crucial for organizations to navigate the complex path towards digital maturity, hence the need to study digital maturity further is critical. To address the practical challenges and close the academic gap described above, the objective of this research is *to create a framework to evaluate digital maturity*. To meet this objective, the following research questions will be answered.

RQ1: Which levels can digital maturity be divided into and what characterizes each

level?

The framework will consist of several cumulative levels of digital maturity, and description of the characteristics of each level.

RQ2: When progressing upwards along the digital maturity scale, what are the key dimensions that allow transition from one level to the next?

To reach digital maturity it is crucial to not only evaluate one's organization according to the levels but also know where development is required to transit from one digital maturity level to the next. This research question intends to identify what organizational dimensions, such as leadership or culture, are key to focus on to transit to between levels.

2 LITERATURE REVIEW

To answer the research questions, existing literature on digital maturity is presented and discussed, which will contribute to general knowledge around the term as well as to an embryo of the digital maturity framework (DMF). Since several scholars use digital transformation to describe the levels of digital maturity, the chapter about digital transformation is expected to enrich the understanding of important cornerstones to become digitally mature. Other relevant maturity models are also presented and discussed, to facilitate understanding of maturity, since knowledge is still thin in the academic area.

2.1 Digital maturity

Definitions of digital maturity are still scarce in research literature, but Kane et. al (2015a) defines the state of digital maturity as “an organization where digital has transformed processes, talent engagement and business models”. This definition provides two important insights. First, being digitally mature means that some form of transformation of processes, talent engagement and business models has taken place, where digital technology is the tool. Second, the definition also indicates that being digitally mature is, according to the authors, the end state of the transformation process. Although this definition puts the term in an understandable context, it fails to clarify the outcome of reaching digital maturity, since a transformation is not necessarily successful. Another weakness of this definition is that it addresses few organizational dimensions as subjects of transformation. Surely there must be more than processes, talent engagement and business models that can be transformed, such as a compelling customer experience or digitized solutions as discussed by Ross, Sebastian, & Beath (2017).

Kane et. al (2016) argue that to reach digital maturity, organizations need to align their structure, tasks, people, and culture with the digital future. This description adds to the definition of Kane et. al. (2015a) with the argument that digital maturity is not only a state where a transformation has taken place, digitally mature organization have aligned

their whole organization to better respond to the digital business environment. This description is more like the definition of maturity in the psychological sense that Kane (2017) adopts for his study on digital maturity, which is the “ability to respond to the environment in an appropriate manner”.

According to Maier et. al (2012), there are two reference points one can consider when discussing maturity. The first is a “state of being complete, perfect, or ready”. The second reference is “to bring to maturity or full growth; to ripen”. The second reference forms a circular description of the term, which easily causes confusion. The first one, is better suited for this study since the state of being ready is similar to Kane’s definition (2017). We choose to define digital maturity as *the ability to compete effectively in an increasingly digital competitive environment*. This definition focuses on the outcome and the positive effects of progressing in digital maturity, and it also sets it in a context. This definition does not put focus on technology as a tool to transform, which is also in line with what Kane (2017) argue, that technology is not always a part of an organization’s effort to adapt to the increasingly digital business environment.

The “digital” part of the term refers to the digital technology which is increasingly used in businesses today, it is explained by Iansiti & Lakhani (2014). The authors provide details about digital technology and digital signals that facilitates the understanding of why digital technology is so much more transformational than analogue technology. Firstly, digital signals are transmitted perfectly without errors, independent of distance. Secondly, digital signals can be replicated indefinitely without degradation. Thirdly, given that the infrastructure is in place, digital information can be sent to the incremental receiver at zero marginal cost. The authors exemplify technologies that businesses are increasingly using as connectivity components, sensors, and data.

2.1.1 Digital maturity models

One thing Kane et. al (2015a) clarify with their digital maturity model is that they view digital transformation as the process of progressing between the digital maturity levels,

which is also the perspective we adopt in this study. Another important contribution with this model is that strategy, culture, talent development, and leadership are all important dimensions of digital maturity, which we will take into consideration in our study. However, the authors' findings do not provide any guidance in how to transit from one digital maturity level to the next, which we believe would add managerial value to the model.

According to the digital transformation chart of Kane et al. (2015a), the level of collaboration and innovation in the organizational culture increases with digital maturity. Along the digital maturity scale, strategies shift focus from internal efficiency towards transformation and decision making, and the digital skills needed in the organization are progressively believed to be sufficient as digital maturity increases. The commonly mentioned barrier to become more digitally mature at the early level is lack of strategy, at the developing level is too many competing priorities, and at the maturing level is data security.

The content of the digital transformation chart that Kane et. al (2015a) developed provides insight on what characteristics are common among digitally mature companies. The authors succeed in shedding light on the term, digital maturity in a practical context, but the model also has weaknesses. One is that it is not applicable in its present shape from a managerial perspective, hence the practical value of it is questionable. By practical we mean the possibility of organizations to use it as an assessment tool to evaluate their own digital maturity, but this is neither the purpose of the model nor is it nuanced enough to allow it.

Westerman and McAfee (2012) have charted digital maturity in a matrix with the two dimensions digital intensity and transformation management intensity. The authors describe digital intensity as how a company changes how it operates by investments in technology-enabled initiatives, and transformation management intensity, as leadership capabilities are necessary to drive digital transformation. The transformation management dimension is like the leadership dimension that Kane et. al (2015a) presents, and similarities can be found in other studies where leadership and strategy is

an important part of thriving in an increasingly digital business environment, and that is an important contribution to this study. However, the model developed by Westerman & McAfee (2012) is also confusing. The authors suggest that to determine an organization's maturity along the two dimensions, it is the investments in either digital technology or leadership capabilities that determine. This is problematic since the authors do not discuss how to know what a large or a small investment in either dimension is.

The idea of the model is to show that organizations can belong to either one of the four categories: beginners, conservatives, fashionistas, or digiratis, depending on the degree of the dimensions. *Beginners* have little transformational management capabilities and are doing small investment's in digital initiatives, but they have low digital intensity and transformational management intensity. *Fashionistas* have invested in digital technologies which not all contribute business value to the organization. They do not have a solid digital transformation strategy, and low transformational management intensity but high digital intensity. *Conservatives* have high transformational management intensity but low digital intensity. They have strong unifying visions and strategies and are good at securing business value with their initiatives. However, they might miss opportunities that new technologies involve. Companies with high level of digital intensity and transformational management intensity are called *digiratis*, they combine transformational management practices and unifying visions with investments in new technologies.

The digital maturity models existing today provide insights on how digital maturity can be understood as a concept, but their role in aiding organizations to become more digitally mature is questionable. Their common ground is that an organization's digital maturity can be assessed by looking for certain characteristics at different organizational dimensions – such as leadership and culture – and that digital transformation can be described as progressing in digital maturity. However, Kane (2017) argues that one can benefit from focusing on digital maturity and not digital transformation from a management perspective to better adapt to an increasingly digital competitive

environment. Kane argue that digital transformation might sow the idea that it is a one-time transformational project, whereas, it is an ongoing process that is never finished. The author argues that organizations can always do something to become more digitally mature, but fails to enlighten readers on what. Other than discussing the importance of building the knowledge and learn how to respond to the emerging digital competitive environment, no further detail is provided. This is a gap in research literature on digital maturity, which is important to address.

2.2 Digital transformation – a path to digital maturity

The literature on digital transformation is new and definitions exist but are still scarce. Iansiti and Lakhani (2014) defines digital transformation as “the digitization of previously analogue machine and service operations, organizational tasks, and managerial processes”, where digitization is defined by Oxford English Dictionary as “the conversion of analogue data (esp. in later use images, video, and text) into digital form”. This implies that Iansiti and Lakhani (2014) define digital transformation as a conversion of operations to a digital form, but this simple definition does not do justice to recent findings on digital transformation, and the practical complexity of it. Matt et. al (2015) describe digital transformation as “a continuous complex undertaking that can substantially shape a company and its operations” which does succeed to enlighten the complexity of it as several other authors have enlightened. It also enlightens the fact that it is a continuous process, which is in line with what Kane (2017) argues, that one can always become more digitally mature.

What Matt et. al (2015) fails to enlighten is what activities are included in digital transformation. However, the authors exemplify transformation of key business operations but no more details are provided. Their main contribution is their framework describing the four building blocks of digital transformation strategies – which they define as “a central concept to integrate the entire coordination, prioritization, and implementation of digital transformations within a firm” – namely changes in value creation, structural changes, use of technologies, and financial aspects.

The authors' framework implies that these four dimensions are important for management to address when planning a digital transformation of the organization, but one thing that undermines the strength of this finding is the absence of discussion about digital transformation itself. The authors do not provide any explanation of what a digital transformation is, or what steps and actions are included, which undermines findings of how to comprise a strategy for a digital transformation.

Kane (2017) defines digital transformation as “adopting business processes and practices to help the organization compete effectively in an increasingly digital world”, which is more in parallel with the description of digital maturity that the author provides. His definition of digital transformation provides a dynamic perspective to the concept and adds an incentive for undergoing digital transformation. Which is valuable when the definition is discussed in practical contexts. Even though this definition does not give much detail, it is the best one from the perspective of this study.

2.2.1 Digital transformation frameworks

Some frameworks have emerged in the literature on digital transformation, but they all lack description of activities or steps are included in a digital transformation. For example, Matt et. al (2015) provide dimensions of a digital transformation strategy, but do not provide a description of what a digital transformation is more specifically. Andal-Ancion et. al (2003) only address what mediation strategies are most sufficient to use depending on the technological drivers on the market, and he does not provide a picture of what a digital transformation is about. Early (2014) stresses the importance for organizations to undergo a digital transformation as well as the advantage of starting with clear strategic goals integrated with business objectives, but neither here is the process of digital transformation described in detail.

Iansiti & Lakhani (2014) argue about several steps necessary to take in a digital transformation. However, the authors suggest starting by applying a digital lens to all existing products or services, and there is no discussion about the role and importance of a digital strategy, which is a centerpiece in many other scholars' work (Kane et. al,

2015a; Kane et. al, 2015b; Kane et. al, 2016; Ross et. al, 2017). The authors further suggest that one should connect existing assets across companies to gain more knowledge about customers, and ultimately using software to extend boundaries of the business. The authors carry a qualitative discussion around these briefly described actions a company should take, but the context is more focused on connected products and Internet of Things technology, which does not provide full coverage for this study. Furthermore, their guidance is limited due to the lack of details in their discussion, when and how these recommendations should occur remains unanswered.

Kane et. al (2015a) provide the most detailed chart of digital transformation yet published. Although their framework is more functional for identifying indicators that determine digital maturity, it does indicate what kind of activities occur. For example, top management support and acquiring the right skills are key to progress on the digital maturity scale. In another article the authors present a digital congruence framework where alignment of the company's culture, people, tasks, and structure is argued important in a digital transformation (Kane et. al, 2016). The framework aims to suggest key dimensions that needs to be aligned in the strategy and continuously revisited in a feedback loop. This framework provides clear directions for each dimension which makes it somehow useable as guidance in digital transformation. However, their model only suggests what these dimensions should be like at "the end line", no discussion about how to get there is provided.

2.3 Maturity Models

Maier et. al (2012) presents a review of maturity models in research literature which results in the conclusion that maturity, independently of the context, is sufficiently represented with several cumulative stages. Usually, a higher number indicate more maturity, and models are either visualized with a ladder or a spider web. The labels and characteristics of each maturity level is diverse in research literature though, indicating the context-dependency of maturity assessment. This argumentation supports the fact that digital maturity levels in the framework, which this study aims to develop, are best

extracted from research literature and empirical data related to the context in focus. Hence, digital maturity literature and data collection.

The maturity model which is the most cited one in research literature is the capability maturity model (CMM) (Paulk, Curtis, & Chrissis, 1993). In the context of CMM, capabilities are defined as the collective expertise, abilities and competencies in an organization. The maturity levels are: initial, repeated, defined, controlled and optimized, where the initial level is the least mature and optimized is the most mature in the spectrum of capability maturity. As the capability maturity of an organization increases, the variations in achieving project cost, schedule, functionality and quality targets decrease, according to the authors. The result is that organizations that are more mature in their capabilities are better at predicting outcomes and thereby meeting targets.

The context discussed by Paulk et. al (1993) is the capability maturity in an organization's software development and maintenance processes, which makes it suitable to discuss in the digital maturity area because software plays a meaningful part in that context. Processes are also a common subject of digital transformation according to Kane et. al (2015a). Process maturity has not been explicitly compared to digital maturity in research literature to date, but Andriole (2017) argues that companies must first be able to map its existing processes to digitally transform them. This association is taken into consideration during this study.

2.3.1 Capabilities for smart, connected products

Porter and Heppelmann (2014) discusses capabilities of smart, connected products in four different levels, each building on the preceding one, which makes it similar to a capability maturity model such as CMM. One difference is that Porter and Heppelmann (2014) present a model that represents the capabilities that the technology has and thereby adds to the organization, placing it in a more specific context than that of CMM. This characteristic makes the model interesting to include in this study. The insights from this model will be used to examine if the capability maturity of digital

technology is correlated to the overall digital maturity of an organization.

The model of Porter and Heppelmann (2014) has four levels of capability maturity: monitor, control, optimize, and autonomy. Monitor allows comprehensive monitoring of a product's surrounding environment and condition. Control provides the capability to control functions with help from software. Optimization allows for predictive diagnosis which leads to optimization of the product's performance. Autonomy is a state where the products runs and enhances performance by itself. These levels are much alike the maturity levels of CMM, and each level is also dependent on the preceding one. The subject of interest is whether there is a connection between the capability of the technology the organization uses and the capability of the organization.

3 METHOD

This following chapter describes the research process and the methods used to reach the research objective and answer the research questions. Description of how data was collected and analyzed as well as how the collected data aims to answer the research questions is presented. Also, to ensure high-quality results, a description of quality improvement measures is presented.

3.1 Research approach and strategy

Since literature on digital maturity is scarce, an abductive approach was chosen, which allows iteration between literature and empirical observations (Dubois & Gadde, 2002). This approach allowed a flexible process that facilitated increasing our understanding of digital maturity during the process, and it is also best suited to developing existing theory. To enrich theory and the understanding of digital maturity in a certain context as well as enhancing the generalizability of our findings, a qualitative, multiple case study-strategy was chosen (Saunders, Lewis, & Thornhill, 2009). This strategy in combination with an iterative approach allowed collection of in-depth data as well as an understanding of the context which the data was collected in (Saunders et. al, 2009).

Since the objective of this study is to create a framework to evaluate digital maturity, in the context of large organizations in different industries, the unit of analysis has been digital maturity and the unit of observation was the respondents at the case study companies.

3.1.1 Case selection

Three case organizations with difference in size, industry and assumed level of digital maturity, were chosen to understand the differences and similarities between their perceptions of digital maturity. The difference in the cases was motivated by strengthening the generalizability of the framework that has been developed, for this heterogeneous data collection was necessary. The case selection was based on size, whether they had “becoming digitally mature” on their agenda, and convenience. The size was a criteria because larger organizations are assumed to be more inclined to have

a perspective of digital maturity.

The first case selection was **Tekniska Verken** in Linköping with 885 employees. They offer electricity solutions, district heating, broadband, waste disposal, and similar solutions. Tekniska Verken have created a digital strategy and six different development programs as start of a digital transformation. Top management was committed to increase their digital maturity, but lacked full understanding in what lay ahead of them, which made them a suitable case.

The second case selection was **Ericsson**, they are a global leader in communications technology with 116 000 employees worldwide, they deliver products and services to almost 180 countries around the world. Ericsson was aware of the effects of the digital business environment and what it meant to them, thus they provided a suitable case.

BE Group was chosen as the third case. BE Group is a steel service company who delivers products to seven Nordic countries, with 750 employees. The steel service industry in general can be considered to have low digital maturity and BE Group were in the process of concretizing a digital strategy to gain advantage over competitors, which made them an interesting case.

The three cases were different in terms of governance structure, both Ericsson and BE Group are listed on the stock exchange and Tekniska Verken is partly owned by Linköping Municipality. This indicated that they had different kinds of stakeholders, which in turn meant that they had different priorities in terms of digital strategies. The heterogeneity in the case selection was thought to add generalizability to the developed framework. Additionally, the organizations are active on different industries, energy; telecommunication and steel refinery. The digital maturity was deemed to be different in these industries, which was considered an advantage since it was believed to give a wide variety of perspectives on digital maturity.

3.2 Data collection

Data was collected primarily through interviews and complimented with workshops and structured over three phases: exploratory, in-depth, and confirmation. After each

phase of the data collection, academic literature was revisited to compliment and further develop the DMF as part of the abductive approach.

3.2.1 Research process

The **exploratory phase** intended to increase the understanding of issues of interest for the study. During this phase, six exploratory interviews were conducted with open-ended questions, where respondents could speak freely and were encouraged to carry the discussion. This phase was also intended to enrich our understanding of the context in which the respondents were working in. The respondents were selected based on their role and through snowball effect. A workshop was also conducted during this phase to provide understanding of digital transformation and digital maturity in practice. The objects for the workshop were selected based on previous experience within the field and current working duties. The objective of this phase was to identify dimensions of the DMF to investigate further. The dimensions were identified by use of literature and the knowledge gained in the exploratory phase, these were Processes, Analytics, Strategy, Culture, Leadership and IT.

The purpose of the **in-depth phase** was to gain a deeper understanding of the dimensions identified during the previous phase. This phase intended to provide further understanding of the indicators in each dimension for different maturity levels. Hence, the interview guide was constructed around the maturity levels constructed by Kane et al. (2015), the respondents did not have knowledge about the levels initially. After being introduced to the definitions of the levels according to Kane et al. (2015) they answered the questions with the same initial knowledge on the levels. Semi-structured interviews were conducted to maintain structure, to ensure results but not sacrifice valuable discussions around themes.

The **confirmation phase** was conducted with the purpose of validating the findings from the previous two phases. Also, short, semi-structured confirmation interviews were conducted, most of them via telephone or Skype to validate our framework. A workshop was also conducted to secure the usability of the DMF. The respondents for

this workshop were people with experience in using maturity evaluation models.

3.2.2 Interviews

All interviews were audio-recorded and transcribed quickly after each interview, adding up to 68 pages of transcriptions. The transcriptions were sent back to the respondents when they were done to confirm with the respondent that the content was correct. Both authors were present at each of the interviews, one leading the interview, one taking notes and asking complementary questions. The interview guide was revised between the phases in the research, the final version can be found in Appendix C: Interview Guide.

Table 1: Interview respondents

| Respondent | Position | Case | Date | Time | Phase |
|-------------------|--|-----------------|-------------|-------------|--------------|
| R1 | Business Development & Digital Portfolio Manager | Tekniska Verken | 2017-03-21 | 60 min | 1 |
| R2 | Manager products and purchasing | BE Group | 2017-03-21 | 35 min | 1 |
| R3 | Purchase coordinator | BE Group | 2017-03-22 | 55 min | 1 |
| R4 | Strategic Supply Manager | Ericsson | 2017-03-23 | 45 min | 1 |
| R5 | Head of channel sales operations | Ericsson | 2017-03-24 | 55 min | 1 |
| R6 | Digital transformation programme manager | Ericsson | 2017-03-27 | 60 min | 1 |
| R7 | Distribution Manager | Tekniska Verken | 2017-03-28 | 35 min | 2 |
| R8 | Sales process, responsible for customer contact | Tekniska Verken | 2017-03-28 | 35 min | 2 |
| R9 | Delivery coordinator, customer services | Tekniska Verken | 2017-03-30 | 55 min | 2 |
| R10 | Sales and customer manager | Tekniska Verken | 2017-03-30 | 50 min | 2 |
| R11 | Business developer | Tekniska Verken | 2017-03-30 | 45 min | 2 |
| R12 | Management System, Business Architecture, Process Management, Operational Development, Project and Change Management | Ericsson | 2017-04-26 | 60 min | 3 |
| R13 | Digital transformation programme manager | Ericsson | 2017-04-27 | 45 min | 3 |
| R14 | Strategic Supply Manager | Ericsson | 2017-04-28 | 45 min | 3 |
| R15 | Head of channel sales operations | Ericsson | 2017-04-28 | 60 min | 3 |

| | | | | | |
|-----|--|-----------------|------------|--------|---|
| R16 | Business Development & Digital Portfolio Manager | Tekniska Verken | 2017-04-28 | 60 min | 3 |
|-----|--|-----------------|------------|--------|---|

3.2.3 Workshops

Four workshops were held during the data collection, for which the purpose were different. The first workshop was held in the beginning of the data collection with the objective of gaining a practical view on digital maturity. This workshop had an open, exploratory structure with a few leading questions but the workshop was structured with an open discussion around the questions. This workshop had an open, exploratory structure with a few leading questions but the workshop was structured with an open discussion around the questions. The workshop resulted in insights on what dimensions digital maturity can be evaluated from. Respondents for all the workshops are displayed, and the workshop guide for workshop 2 is found in Appendix B: Workshop.

The second workshop was more structured and had the objective of gaining insight into the process of digital transformation, as viewed in practice. The workshop was divided into activities where the attendees would suggest a general process for digital transformation. The participants were asked to write down which activities they thought were included in the different stages of a digital transformation. the activities were discussed and the workshop resulted in a deeper understanding of differences and similarities between an organizational transformation and a digital transformation.

The third workshop was held as a sequel to the second workshop, with the intention to gain a deeper understanding of what the process of a digital transformation can look like. The third workshop was mainly held in order to understand the context in which the evaluation of digital maturity should be conducted.

The fourth workshop was intended to provide insight into the usage of evaluation frameworks in general, and how the emerging DMF could be structured and adapted to secure its usability. As well as which questions can be asked at the maturity levels to evaluate digital maturity. To guide the workshop, the embryo of the DMF was used.

3.3 Data analysis

Data was analyzed continuously as it was being collected to facilitate the abductive approach as well as to develop our own understanding of the area during the process and thus enhance quality of the results. Thematic analysis was chosen as method of data analysis, which is employed to identify, analyze and recognize patterns within data (Braun & Clarke, 2006). Thematic methodology is commonly used for qualitative studies as it provides an accessible and theoretically flexible approach to the analysis (Braun & Clarke, 2006). This approach is especially suitable since the objective of this study is to develop existing theory on digital maturity by iterating analysis of empirical data with literature. The result of the analysis was a thematic map which visualizes codes derived from respondents' quotes, which in turn are divided into themes.

To guide the analysis and ensure consistency, the following process for organizing and analyzing data, suggested by Braun and Clarke (2006), was employed:

0. Development of the interview guide
1. Familiarizing with data
2. Generating initial codes
3. Identifying themes
4. Reviewing themes
5. Defining and naming themes

During **step zero**, the literature studies and the embryo of the DMF, were used as input for the interview guide. Primarily to ensure that the questions asked would complement the framework and fill the knowledge gap as well as to validate the framework.

During **the first step** the interviews were carried out, recorded and transcribed quickly after. The purpose of transcribing the recordings was to familiarize with the data (Braun & Clarke, 2006), which aimed to ensure that the researchers had a mutual understanding of the content as one listened and transcribed and the other reviewed the transcription.

During **the second step**, the transcriptions were studied and initial codes were generated from respondents' citations. Codes were evaluated based on their ability to answer the research questions and explain the studied phenomenon. The initial coding was theory-driven, which implicates that the researchers approached the data with specific questions in mind which the data was coded accordingly. However, the entire data-set was analyzed equally and interesting aspects of the data were identified based on how often data was repeated.

The third step of data analysis aimed to focus the analysis on a broader level of themes instead of codes (Braun & Clarke, 2006). This entails organizing the codes into potential themes and combining all the relevant coded data extracts within the identified themes. At this point an early-stage thematic map was constructed to visualize the themes and candidate themes. Also, due to the abductive character of the study, the themes were compared to academic findings to guide the development of new themes.

The three cases were also analyzed separately and a cross-case analysis between them was conducted to enhance generalizability and transferability to other contexts. The purpose of this step was to test how applicable our findings were in other, similar settings. This was done through examining similarities and differences across cases and then pinning down specific conditions during which the findings were relevant.

The fourth step entailed reviewing and refining the themes, and by analyzing differences and similarities relevant themes were kept. Themes with too little data to support them were removed and themes which were not mutually exclusive were organized into the same main theme. Thereafter the analysis was conducted in two steps, as suggested by Braun and Clarke (2006). In the first level, coded data extracts were reviewed to ensure a pattern amongst codes in the same theme, the codes which did not follow the same pattern were reorganized.

The second level entailed a similar process but for the entire data-set, each theme was analyzed according to its validity in relation to the entire data-set. The result of the

fourth step was a satisfactory thematic map.

The fifth step involved defining and naming the themes in the thematic map, which means defining the essence of each theme and naming it thereafter. Each theme was determined from the aspect of what was most interesting with regards to the research questions. Below, an example of the thematic coding can be viewed.

Table 1: An example of thematic coding

| | |
|---------------|---|
| Quote: | “Inadequate information management is a barrier to become digital mature” |
| Code: | Information Management |
| Theme: | Processes |

3.3.1 The data analysis process

The iterations between the steps in the three different research phases, exploratory; in-depth and the confirmation phase, in the data analysis process is visualized below. The reason to why the steps were iterated was the abductive character of the study, since gaining new knowledge through interviews entailed reviewing and developing the framework embryo and then revising the interview guide. All steps were taken in each research phase, the process visualized below aims to provide an overview of the iterations between the steps during the phases.

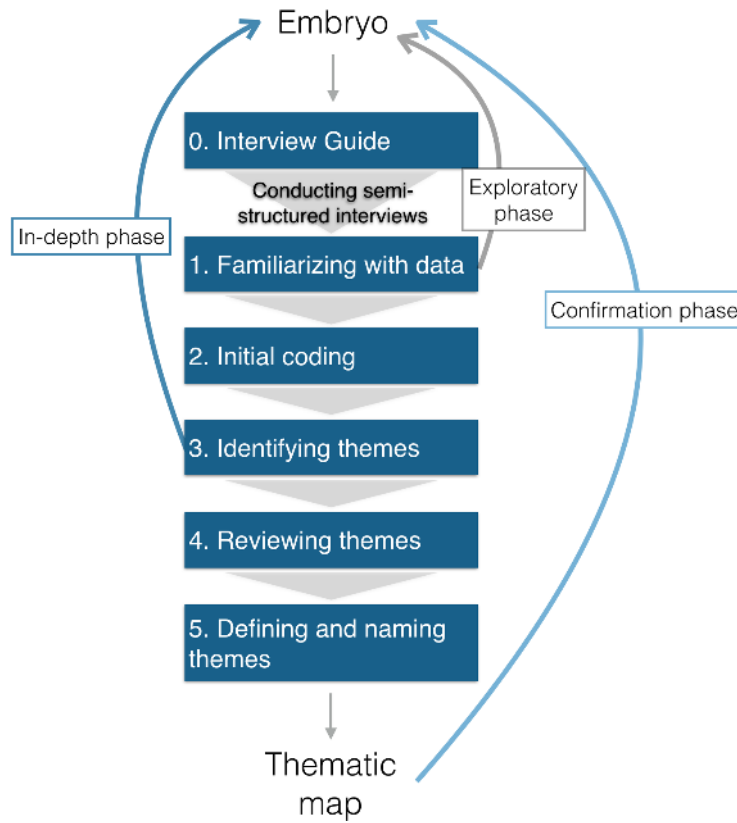


Figure 1: Visualization of the iterations in the data analysis process

3.4 Quality improvement measures

The quality of a qualitative case study is evaluated according to validity and reliability. The validity of the study is determined by credibility, transferability and confirmability, whereas reliability corresponds to the dependability of the study (Lincoln & Guba, 1985). To ensure that **credibility** was established the authors of the study triangulated data analysis with theory (Lincoln & Guba, 1985). When examining and interpreting data we had a theoretical perspective, due to the abductive character of the study. Both peer debriefed and analyzed the data-set, and both attended interviews. All interviews were transcribed and discussed shortly after they were conducted, the peer debriefing also prevented researcher bias, which also established confirmability. To further establish confirmability multiple data sources were used to verify and complement each other, at three different case companies and the results were evaluated through discussions with the supervisors.

Also, a kind of audit trail was presented, as suggested by Lincoln and Guba (1985) the

thematic map contains raw data and the research path to the themes are presented, which ensures transparency in the research. The description of the development and the research, such as the interview guide, also establishes **transferability** in the research. Also, context of the data was kept during the analysis to ensure transferability.

To improve **dependability** during the research the evaluations of the results were completed by both authors and by supervisors throughout the process. A factor which could have affected the dependability negatively is that each respondent evaluates digital maturity from the perspective of their own digital maturity. This bias was prevented through three different case companies with seemingly different levels of digital maturity, which gave a nuanced data-set.

4 RESULTS AND ANALYSIS

According to the collected data, this chapter was divided into three sections to answer the research questions. First, the levels of digital maturity, which addresses part of RQ1: Which levels can digital maturity be divided into and what characterizes each level? Second, the characteristics of each maturity level, which addresses the other part of RQ1: "...and what characterizes each level?". Lastly, key dimensions that allow transition between maturity levels, which addresses RQ2: When progressing upwards along the digital maturity scale, what is required to transit from one level to another? The answers to the research questions were derived from the thematic maps, which present how our empirical data supports. The results are found in Thematic maps from data analysis process.

4.1 The levels of digital maturity

By triangulating analysis of literature of existing digital maturity models, with interviews and workshops with employees at organizations with an insight in managing digital transformations, it was possible to identify appropriate levels of digital maturity. Kane et al. (2015a) used *early*, *developing* and *maturing* in their model and since their perspective on digital maturity corresponded to the adapted perspective of this study, three main levels of maturity were chosen. The levels were initially also called early, developing and maturing, dividing the scale of digital maturity into three levels was supported by the data collection of this study.

However, by analyzing data from interviews, patterns were recognized within each maturity level. Considering the collected data, we argue that the names Kane et al. (2015a) suggests for the maturity levels are insufficient. The reason being that they solely describe the succession of digital maturity along the digital maturity scale. As the practical problem is identified as organizations not knowing what to do to become digitally mature, the effects of each level are interesting from the user's perspective. Which is why the levels were renamed according to what the perceived effects of reaching each level will have for the organization.

Early results in **awareness** within the organization through communicating top management’s understanding of why becoming digitally mature is necessary; *developing* results in **experience** through experimenting with new digital initiatives; and the outcome of *maturing* is **autonomy** through process automation, real-time analytics and by naturalizing digital within the organization. The levels were inspired by Porter and Heppelmann’s (2014) capability maturity model for smart, connected products, since a relationship between the capabilities of the technology the organization uses and the capabilities of the organization, has been recognized in data analysis. The relationship is presented in the characteristics of each level.

The characteristics of each level are explained in the following section.

4.2 The characteristics of each maturity level

Respondents discussed digital maturity from six perspectives: *strategy, culture, leadership, information and process management, analytics* and *IT infrastructure*, where the capabilities in digital technology were discussed frequently. Thematic maps that show our data analysis as support for the results are displayed in Thematic maps from data analysis.

4.2.1 Awareness

Respondents emphasize the necessity of an exploratory and curious *leadership*, “*During early the leadership, along with coworkers explore what to do and how to do it*” (R15)¹. The **Leadership** in *awareness* is characterized by controlling employees, hence, low flexibility for employees in terms of working hours and location. One respondent describes “*The leadership at an immature level is characterized by measuring employees by the hours they put in*” (R13). Foremost, the leadership is defined by creating an understanding in the organization by spreading awareness and appointing ambassadors, one respondent describes it as “*It often starts with a few ambassadors who gain a deeper*

¹ All references to citations in this section can be found in Table 5, 4, 5, 6 and 7

understanding of what digitalization can involve” (R16). The idea is to raise awareness and inspire change through the ambassadors.

Culture is an important dimension to investigate when defining a maturity level. An organization at an awareness stage of digital maturity is characterized by bureaucracy, as organizational structure, and thus, a segmentation, where tasks are performed in silos due to disseminated objectives within the organization. Respondents describe it as “... *it is divided into functions and units, which doesn’t work if you want to digitalize*” (R12), respondent 13 and 14 both emphasize the presence of bureaucracy and segmentation, leading to a sub-optimization of the organization.

A dimension that was determined as important for characterizing the level awareness was **Processes**. Consequently, in awareness, the organization has a structure and philosophy regarding process management and processes are established and continuously improved, as a respondent describes, “*At early continuous improvements are made in processes*” (R12). The same respondent also underlines the importance of mapping processes and flow of information.

Information is created, communicated and stored digitally to some extent. However, there is still paperwork, hence, information flows are not entirely digital but occasionally interrupted where input of data and information is manual into systems, one respondent describes “...*but you still leave a paper to the installer instead of sending an electronic message to the installer’s Ipad*” (R8).

Additionally, there is still a considerable amount of manual work in awareness and the level of automation is therefore low, one respondent described it as “...*low automation rate and IT maturity*” (R13).

Analytics is another important dimension when defining the maturity levels. At an awareness level of maturity, analytics are scarcely used but there is access to good quality data and an understanding of the data is also important. This confirmed by many respondents, among others “*You must be digital and have organized data, everything should be accessible digitally*” (R4) and “...*you need to understand it (the data)*” (R4).

IT Infrastructure is an important dimension since it enables digital information and process management amongst others. Hence, the systems are not compatible and in many cases, do not communicate with each other. Thereof, manual input of data and information into systems, respondents describe it as “...today we still work in different systems, I think it is difficult to make them compatible with each other” (R8).

In terms of **Strategy**, which is also an important dimension to define a digital maturity level, the organizations merely talk about digitalization, “at early you talk about digitalization in the organization and might conduct smaller initiatives here and there” (R16). The respondent implies familiarization with the concept.

In conclusion, the first level of digital maturity is characterized by gaining insight in the need to change the ways of creating, delivering and capturing value in the organization. It is important to understand what digitalization is and more specifically, what the implications will be for the individual organization. At this stage awareness is raised within the organization and knowledge of the implications is communicated broadly.

4.2.2 Experience

The second level of digital maturity is characterized by preparation of executing on the strategy and implementing new initiatives. Therefore, experimenting with pilot projects and acting on the insights and awareness gained in the first level is commonly occurring. The **Leadership** in experience is coaching and exploratory. Respondents accentuate “... and then you progress towards coaching (leadership)” (R15)² and that it is an iterative process, “You have to iterate information and knowledge with acting on initiatives to move forward on such a scale and remember that different parts of the organization will be on different stages of the scale” (R16). The experience level is further characterized by a more inspiring leadership, the decision-making is moved down the hierarchy to facilitate pilot projects and driving change not just vertically but also horizontally, which is also emphasized by Respondent 16.

² All references to citations in this section can be found in Table 10, 9, 10 and 11

Processes at an experience level, contain controlling capabilities which means that they are improved by digitalizing statistical process control, as discussed during workshop 2, the result being more information about what to improve. The respondents primarily emphasize the necessity of cross-functional ways of working as well as engaging in what other departments are doing. *“... it’s about understanding that initiatives can affect other parts of the organization”* (R16). This is to gain a holistic perspective and make use of synergies.

The implications of controlling capabilities in processes are also that **Analytics** are implemented digitally, which allows top management to gain perspective of the overall performance within the organization, which is also important to become more digitally mature. Hence, measurements are used to improve operations within organizations, underlined by a respondent *“... the measurements are there to see if we make our deliveries in time”* (R8).

In terms of **Strategy**, a digital strategy and vision is being developed according to the organization’s perception of the meaning of digitalization for them. The digital strategy is being developed according to how digitally mature the organization aims to be. An additional focus for the business strategy is business ecosystems since data analysis indicated that being part of such an ecosystem is a step on the way of becoming digitally mature. One respondents describe it as *“It is important to understand ecosystems and value networks and how to be a part of them.”* (R15). Since the perspective of how business is conducted changes along the scale of digital maturity, from a traditional perspective towards a collaborating internally and ultimately externally. An IT strategy is also thought to provide a governance structure for IT systems (R1).

The **Culture** at an organization at the experience stage is characterized by a curiosity of digital technology and eagerness to run pilot projects and learn. Therefore, investing in experience, competency and skills within the organization is an indicator of being at the level of experience. There are ambassadors, informal or formal leaders with an interest and commitment to leading the change. The managers of the pilot projects are

encouraged to communicate results of the projects to present “quick wins” and inspire the change. According to a respondent, *“Finally at developing, people start understanding what it is all about and start bragging about things they’ve done”* (R16). Leadership is also characterized by aligning and communicating the joint objectives and vision within the organization, which is also confirmed by the literature of Kane et al. (2016).

In conclusion, the experience level is characterized by inspiring and allowing pilot projects where digitalization initiatives are tested, as well as communicating the effects of the tests to the organization.

4.2.3 Autonomy

The third level of digital maturity is characterized by optimizing capabilities and autonomy capabilities in **Processes**. As inspired by Porter and Heppelmann (2014), optimization allows predictive diagnosis which leads to optimization of the product’s performance and enables autonomy, where a process runs and enhances performance by itself. It also entails that a process is streamlined through digitizing all information and systems are compatible to interact with each other, erasing manual transmission in-between them. One respondent described the autonomy level as, *“You use digital capabilities to ensure the automation rate and the rate of machine learning which entails that everything can be run automatically”* (R4)³. Hence, the autonomy capabilities (Porter & Heppelmann, 2014) allow process automation where administrative tasks are automated and robotics implemented.

One respondent describes the benefits of automatization as, *“If you come to maturing you can build more digital business models and scale up without adding resources”* (R12) this is underlined by another respondent *“To reach digital maturity absolute automatization must to be the goal”* (R6). To enable scalability without adding resources, is the ultimate indication of being at the stage of autonomy, *“How much you can automate through robots is an indication of how digitally mature you are”*

³ All references to citations in this section can be found in Table 14, 13, 14, 15, 16 and 17

(R14). More specifically it implies that processes can be scaled up, adding handling units, without increasing human resources to deliver the same output.

At the highest level of digital maturity, cognitive capabilities in a system, such as having cognitive interface is considered an indicator, as one respondent phrases “...we are *integrating cognitive capabilities in processes. Both when analyzing big data but also to have a cognitive interface towards the user*” (R13). Integrating optimizing and autonomy capabilities entail a quicker response to changes in the marketplace, as one respondent describes “*Mobility and agility is important here, you have to be adaptable in terms of processes and tools*” (R15). Adaptability and flexibility is also recognized as essential to be able to compete in the changing business landscape (Andal-Ancion, Cartwright, & Yip, 2003).

At autonomy, **Analytics** are at the optimizing level used in a predictive manner to drive business development and improvement initiatives. At the autonomy level, data is accessible in real-time and the data analysis is automated and conducted on an organizational level, allowing synergies from data analytics throughout the organization. One respondent described this as “*Digital is very cross-functional and a lot is centered around data, therefore data has to stream between different parts of the organization*” (R13). External input of data was discussed on the topic of analytics on autonomy, one respondent gave an example of how it can be beneficial to make automated decisions and predictive analysis of real-time data. “...*imagine you have all data available, a truck is on its way to the Pyrenees. It’s connected but not serviced recently. If the system can access external data about the weather and recognizes that a snowstorm is on its way, it can also conclude that the goods will not reach its destination in time, due to old tires and bad weather for an example. It will then examine alternative means of delivery and compare the price to the delay-penalties. Finally, it will make a decision on whether to deliver the goods in an alternative way or not*” (R4).

The **Strategy** of an organization on autonomy is characterized by adaptability to changes in the digital business environment, and digital is integrated into the business strategy rather than having a separate digital strategy. Also, the level is about executing

on the strategies developed in the earlier levels. One respondent phrased it as naturalizing digitalization, *“the highest level it is part of your everyday-life with change and velocity in developing new technology”* (R16). At autonomy, strategy is also characterized by collaboration with other actors in the value network. Innovation is reached by collaboration between customers and partners, and data is exchanged with actors in the value network. An example of how work across value networks can look like is *“If I were to sell through digital tools, I’d have to educate them (customers/partners) in my tools (systems), in how the software works and how it is supposed to be delivered”* (R5).

In terms of organizational **Culture**, the main characteristics at autonomy is that it is learning and cross-functional through collaboration. One respondent phrased it as *“Managers have to be more open to trusting each other and understand other organizations”* (R15), this also underlines the value-network philosophy.

Organizational silos are broken and employees’ gazes are expanded beyond their own business area, facilitating synergies throughout the organization. Sharing and trusting each other indicates transparency, which is prominent in the organizational culture at autonomy. Transparency is important to reduce politics and bureaucracy as barriers to digital maturity. A means to reach transparency and collaboration is through structures for knowledge sharing and a flatter organizational structure. One respondent underlined this, *“... In a perfect world, a management structure would be unnecessary”* (R4).

At autonomy, the **Leadership** is characterized by being visionary and humble, one respondent described it as *“...managers don’t have to be experts but they have to listen and learn of the ones who are”* (R13). They should also think outside the box, leaders are often eager to experiment with new technologies, they are also in less control of their employees and underlying leaders, and strive to empower them. Respondents underlined this with *“being digital entails less control and more empowerment”* (R13) the same respondent describes *“managers must be digital and visionaries, think bigger than their own sphere”* (R13). The empowerment entails moving decision-making mandate down the hierarchy and thus, creating a more flexible organization, one

respondent described, “... *it will be faster to go from vision to decision, which facilitates faster change*” (R12).

One characteristic that we found about the **IT infrastructure** that indicates the organization is at autonomy is that there are no or few fixed system integrations, as a respondent also concludes “...*if the integration between systems is constructed so that one changes in one system doesn’t require redoing the integration*” (R12). This means that if a change is required it is only required in one system, the integrated systems will automatically update. Being digitally mature also entails that there are synergies amongst the systems, one respondents underlined this, “*I don’t think a process can become digitally mature if there aren’t synergies in the systems*” (R8).

In conclusion, the Autonomy level is characterized by transforming the culture to accept new, digital technologies, in other words, naturalizing the digital strategy. It is also characterized by automatically optimizing processes through process automation. Essentially, it is not a state but rather a continuously developing level.

4.3 Key dimensions that allow transition between maturity levels

Based on the interviews from the case studies, we found several important actions and areas to focus on to allow transition from one level to the next. Our findings show that a few dimensions are important along all transitions when progressing upwards along the digital maturity scale, and some dimensions are more important than others during specific transitions.

Another important finding from our data is that there are some prerequisites that are required to qualify for the level Awareness. These prerequisites are important for organizations to work on before they start their journey towards digital maturity, to do things in the correct order. The prerequisites will be treated as key dimensions allowing transition to Awareness, which is an important finding in the study. However, we have not added a fourth level before awareness. Thematic maps that display the coding of data which led to conclusions are presented in Thematic maps from data analysis.

4.3.1 Prerequisites for qualifying in the Awareness digital maturity level

Leadership is an important dimension to work on to progress towards Awareness. Leaders and top management are the ones that need to initiate the transition towards digital maturity and they need to be aware and clear about what needs to be done. One respondent said “*Self-awareness, awareness about the need to change*” when asked about the first things to be done when progressing to digital maturity (R15). Another respondent answered, “*There will never be any changes until someone stands on the barricades and says that a change is needed*” (R12), which also indicate that leaders need to spread awareness to the organization in the beginning. This finding confirms the importance of a strong leadership that research literature has argued, for example the digital maturity model of Kane et. al (2015a) that have leadership as a dimension, and Westerman and McAfee (2012) who argue that investments in leadership capabilities are important to become digitally mature.

Another key dimension that we identified in the first transition is **process management**. Many respondents explained that to digitally transform processes, they must first be standardized and mapped. One respondent answered, “*we agreed that we needed to have our processes in place before we could start to digitalize*” (R16), and another said “*We manage the electronic orders very well. But when orders are placed regarding the countryside and a division has been done, problems can arise since we don’t have much experience from similar cases. Those cases make the digitalization harder and I think we have to work with standards to do those electronically*” (R8). This finding emphasizes and elaborates what Andriole (2017) argue about, that processes need to be modularized before they can be digitally transformed.

Leaders have raised awareness about changes needed for the coming time and therefore woken the idea among employees. Another benefit of reaching this level is the effects of working with process management. Process management gives structure to operations and tasks and by working with this, the collaboration across functional silos increases and the organization becomes more cross-functional.

4.3.2 Transition from Awareness to Experience

Our findings suggest that **Leadership** is an important dimension when progressing upwards along the whole digital maturity scale, respondents suggest it is also important during the transition from Awareness to Experience. According to our respondents, the organization cannot progress in digital maturity without the top management's support, especially when ways of working needs to be changed. One respondent argued "*I think it's about leadership and change management. Top management must dig into digitalization and understand that it's important to work for a change in the beginning*" (R16), which emphasizes that change management is also an important discipline to have. Another respondent said "*Perseverance is important to progress further here. All changes bring friction, but you can never surrender, but still have to be responsive*" (R15), which also confirms the need change management capabilities among leaders to meet the friction that arises.

Strategy is an area that managers also need to focus on during this transition to further progress on the digital maturity scale. Our findings show that organizations do not need to clear out all aspects digital maturity in their strategy at this level, it's more important that they focus on raising the competence around digital tools and digital transformation in general, and planning their future competence requirements. One respondent argued "*Insight into what competencies are needed when you become digitally mature is an important strategic component. You need to understand what capabilities you will need. That is something you need to know to reach developing*" (R12), which implies that planning for the next transition, from Experience to Autonomy, should also be a part of the strategy here, at least concerning competence development. Another respondent answered, "*It's about awareness, to raise the digital IQ or competence*" (R14).

Another important focus to allow transition from Awareness to Experience is **experimenting**. Our findings were clear about the fact that starting to act and change things for the digital is more important in this transition than to create a solid digital

strategy, and there are several arguments for this. One argument is that you win the trust and stimulate curiousness among employees which paves the way to continue changing things, or as one respondent expressed it *“You can do it continuously and win buy-ins. For example, if you change locks to work with chips instead of keys, and connect it to the time reporting system. Many employees might see the benefits about this small change and then you can take the next step”* (R15). Another argument is that testing changes to ways of working creates a momentum of the digital transformation as expressed by (R16) *“We try to bring along the ambassadors and then each time we have discussed that we have been working with information and knowledge for a while now, we must start to do something as well”*.

The effects of reaching this level is closely correlated to developing, meaning it can be viewed as a level where an organization is starting to see changes. As one respondent put it, *“... the step you take before that is more about doing pilots etc.”* (R12) when asked about transitioning to Experience. Since the organization has started to experiment with digital technologies, employees are getting more used to digital tools in their day-to-day activities, hence a cultural transformation is starting to take shape at this level. One respondent mentioned, *“Lastly at developing, people start to understand what it’s all about and start to brag about things they have done”* (R16).

4.3.3 Transition from Experience to Autonomy

Our data suggests that just as in the transition to Experience, **Strategy** is also an important dimension to reach Autonomy. Two respondents emphasized the need to make strategic prioritizations to reach Autonomy, or in their own words: *“It’s important to evaluate oneself in this transition and determine how mature you are in different dimension to choose what to focus on”* (R16), and *“The prioritization on where to begin must be done in top management, it depends on what they deem most important in the strategy and where they want to allocate the investments”* (R13). Another respondent stressed the importance to have common goals in the organization to make this transition: *“It’s more important with the common goals the more digitally*

mature you become, since everything gets more cross-functional” (R12). The cross-functional aspect of respondent R12’s argumentation was also mentioned by respondent R15 who argued *“My view is that to execute one needs to work more cross-functional”*, which is also a component of the strategy that is important to consider during this transition.

Just as in the previous two transitions, **Leadership** is also important during the transition to Autonomy. However, change management was more emphasized during this transition, and specifically more emphasis on leadership to drive a cultural transformation. For example, one respondent argued *“There is no such thing as a digitally mature culture, but there is an organizational culture that fosters digital maturity, and it’s a lot about an open attitude to change and new things. Then we are back to change management”* (R16). Another characteristic of the leadership dimension in this transition is the use of ambassadors to drive change, which two respondents argued: *“You need to push from top management and have a sponsor, for example the CEO, that drives the transformation”* (R13) and *“At Ericsson it is important to find employees that are passionate about the projects they manage”* (R14).

When organizations reach autonomy, the key benefits are flexibility and agility. Since processes are easily scalable without high costs and analytics are used throughout the organization for cross-functional analyses to support predictive development, organizations can scale their businesses up and down quickly and respond quickly to market changes. As one respondent described, *“Digital is cross-functional and is much about data, and then data must flow between different parts of the organization”* (R13). Another respondent argued *“If you reach autonomy, you can build more digital business models that you can scale without adding resources”* (R12).

5 TOWARDS A FRAMEWORK

The following chapter describes the development of DMF, what the objective is, who the intended users are and the method of evaluation, all was derived from literature and empirical data.

5.1 Development of the Digital Maturity Framework

In accordance with the abductive approach, an embryo to the DMF was created based on findings in research literature. The creation of the DMF was inspired by the process for developing or improving existing maturity models presented by Maier et. al (2012). This section provides a description of how the development of the framework proceeded with the assistance of the phases presented by Maier et al. (2012).

5.1.1 Phase I: Planning

The first phase of developing the maturity grid involved planning and defining why it should be developed. The steps to take in this phase are *define audience*, *define aim*, *define scope*, and *define success criteria*.

The work orientation of the maturity grid is specified by its expected users, which is both the one leading the assessment and the subject/subjects of assessment, the **audience** for the framework was defined by means of empirical studies. During interviews at the case companies a perception of intended users was developed. A member of the top management with a role such as Chief Digital Officer or similar should be the one leading the assessment of digital maturity and thereby using the framework, or a management consultant with appropriate expertise. Subjects of the assessments are employees from various parts of the organization, a diverse selection is suggested.

The **aim** was to clarify the intention for the assessment, and this was done during the pre-study as the practical challenges were analyzed. The aim of the DMF is mainly analytical (Maier, Moultrie, & Clarkson, 2012), meaning that the aim for the evaluation or assessment is to result in a learning experience and help in prioritizing between

improvement initiatives, to reach digital maturity. The framework also aims to raise awareness about digital maturity.

The **scope** of the DMF was defined prior to data collection with guidance from the pre-study, the groundwork for the scope was mainly empirical studies combined with literature studies as articles guided which contexts digital maturity had been mentioned in previously. The scope of the DMF is large organizations in manufacturing and service industry based on the cases we studied.

The defined **success criteria**, to determine when the development of the grid is accomplished are usability and usefulness. Usability addresses the degree to which users understand the language and concepts used in the grid. Usefulness is defined by the organizations' perception of whether the assessment stimulated learning effects and led to effective plans for improving a process. (Maier, Moultrie, & Clarkson, 2012)

5.1.2 Phase II: Development

The development phase defined the architecture of the maturity grid and in this case, the DMF. To do so, the *process areas* and *maturity levels* needs to be selected, and the *cell text* needs to be formulated. An example of how the data fed into the DMF and Evaluation tool can be viewed below.

Table 2: Example of how the data fed into the Digital Maturity Framework and evaluation tool

| | |
|------------------------------------|---|
| Representative quote | “There is a lot of paper” |
| Code | Paperwork at awareness |
| Theme | Processes |
| Cell text in the DMF | Paper work still exists |
| Question in Evaluation tool | Is information often handed over in paper format? |

The goal in selecting **process areas** was to identify areas of an organization that were

affected by the level of digital maturity. These areas were identified from coding data collected from interviews (see example in Table 2) with program leaders, process improvement managers and digital transformation program managers. The process areas of the DMF are **Processes, Analytics, Culture, Leadership, Strategy, and IT-Infrastructure.**

The **levels** of digital maturity are defined and explained in 4.1 The levels of digital maturity, and are **Awareness, Experience, and Autonomy.**

As the DMF is not a grid the **cell text** is not an intersection of process areas and maturity levels, instead the cell texts were developed during workshops with management consultants. The participants were chosen based on their experience of developing maturity models as well as experience in how to formulate questions to clients subject of assessment. The workshop respondents were asked to inspect the results from the data analysis, i.e. the characteristics of each process area for each maturity level, and formulate questions to ask subjects of the assessment to determine maturity level. The cell text is presented in the DMF in Figure 2.

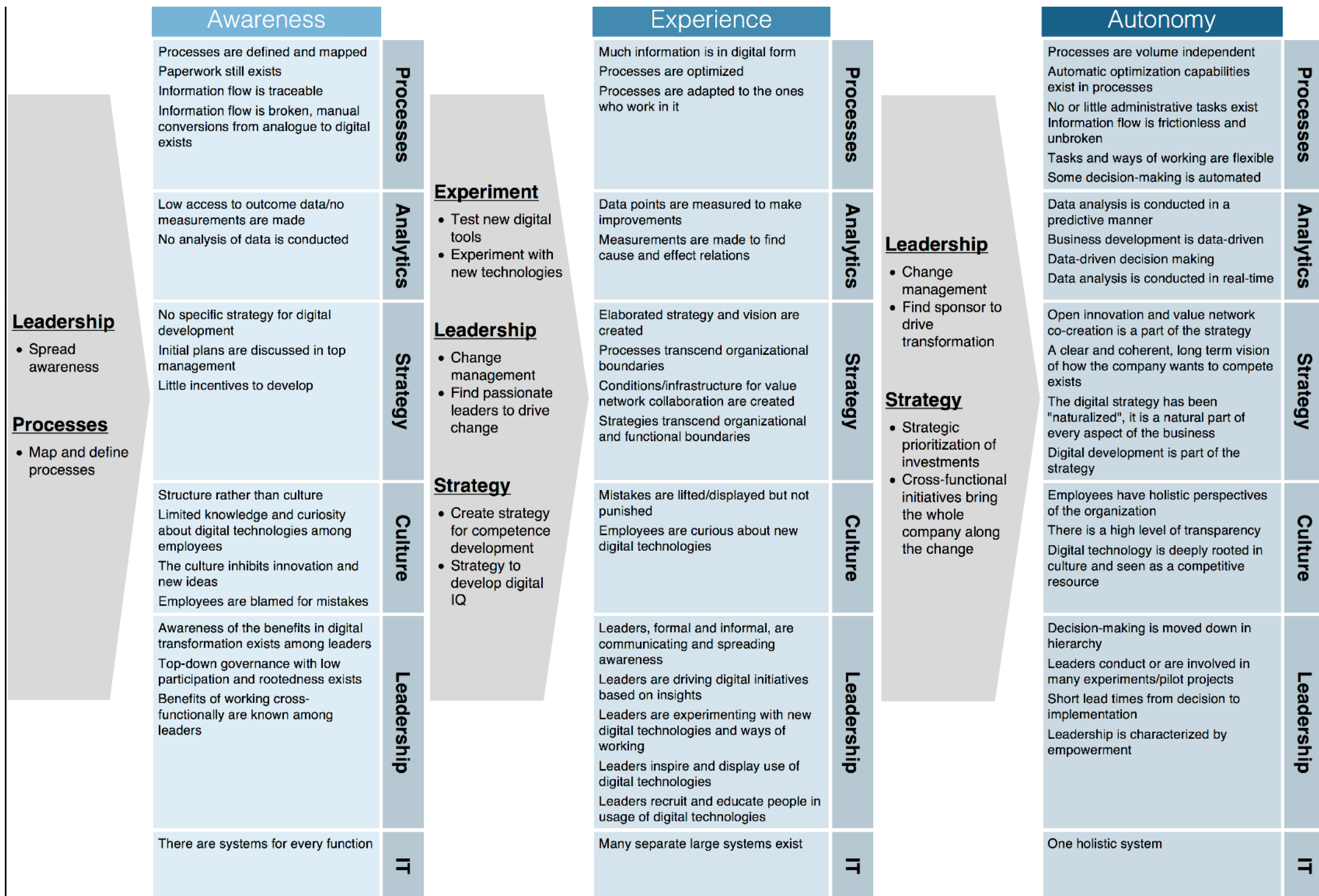


Figure 2: Digital Maturity Framework

5.1.3 Phase III: Evaluation

The evaluation phase iterated empirical data and theory, hence, the framework evolved continuously according to feedback from respondents and continuous literature studies. A workshop was held with management consultants, experienced in using maturity evaluation models, this resulted in several questions for each dimension along the digital maturity levels. Table 3 shows the evaluation questions, which can be used as an assessment tool for organizations that want to determine their digital maturity. The figure presents an idea of which kinds of questions can be asked, however, it is still at an initial stage, further validation and development is necessary.

Table 3: Evaluation tool for the Digital Maturity Framework.

| | Awareness | Experience | Autonomy |
|-----------------------|--|---|--|
| Evaluation Processes | <ul style="list-style-type: none"> • To what degree are the processes defined? • How frequently do you have to redo tasks due to manual errors? • Are there requirements of reformatting data? • Can information be traced digitally? • Is information often handed over in paper format? | <ul style="list-style-type: none"> • To what extent do different systems communicate with each other? • Does data change format in information flows? • Are the control-variables manually regulated to control the processes? | <ul style="list-style-type: none"> • To what degree is the process affected by deviation? • To what degree is the process responsive to real-time data? • Is the process controlled manually or automatically? |
| Evaluation Analytics | <ul style="list-style-type: none"> • To what degree is outcome measured? • To what degree do you have access to outcome data? | <ul style="list-style-type: none"> • Which outcomes are measured? • Are outcome and control variables measured? • Is data analyzed to find cause and effect relations? • To what extent is process data used to guide improvement initiatives? | <ul style="list-style-type: none"> • Is data used to control processes? • To what degree can real-time data be used for real-time improvements? • Is data used in forecasting to predict incidents in the future? • To what degree has the forecasts been correct? • To what degree does the process need to be monitored manually? Or is it optimized automatically? • To what degree are decisions made automatically? |
| Evaluation Strategy | <ul style="list-style-type: none"> • Is there an objective when integrating digital technologies in the organization? • Is there a plan to achieve that objective? | <ul style="list-style-type: none"> • Is there a plan to reach the objective with digital development? • Collaboration with partners and suppliers? • Does the flow of information stop at organizational boundaries? | <ul style="list-style-type: none"> • To what degree are people in the organization familiar with the objective and vision? • To what degree is the digital strategy integrated in the organizational strategy? |
| Evaluation Culture | <ul style="list-style-type: none"> • What is the attitude when facing obstacles? • Do employees find it restraining to operate digital technologies? | <ul style="list-style-type: none"> • Are you encouraged to use new digital technologies as solutions to problems? | <ul style="list-style-type: none"> • To what degree is knowledge about digital technologies shared amongst employees? • To what degree does management share and update employees on current affairs? • To what degree do employees experience that they have the necessary information needed to complete their tasks? |
| Evaluation Leadership | <ul style="list-style-type: none"> • Does employees understand why there is a necessity to progress towards digital maturity? | <ul style="list-style-type: none"> • How often are employees offered training in new systems or technologies? • To what degree does the manager inspire a curiosity for digital technologies? • Is there a managerial effort in supporting digitalization initiatives? | <ul style="list-style-type: none"> • To what extent do managers welcome suggestions regarding progress towards becoming more digitally mature? • To what extent are new ideas investigated and tested through pilot projects? • To what degree are employees supported when proposing a new initiative? |
| IT | <ul style="list-style-type: none"> • Are there different systems for different functions? | <ul style="list-style-type: none"> • Does the usability of the systems match the users' expectations and requirements? | |

6 DISCUSSION & CONCLUSIONS

The objective of this study was to *create a framework to evaluate digital maturity* by answering the research questions (1) *What levels can digital maturity be divided into and what characterizes each level?* And (2) *When progressing upwards along the digital maturity scale, what are the key dimensions that allow transition from one level to the next?* We have developed a framework that describes the characteristics of the digital maturity levels Awareness, Experience, and Autonomy in terms of Processes, Analytics, Strategy, Culture, Leadership, and IT Infrastructure, which nuances the contributions of prior literature. Additionally, we have provided guidance as to what dimensions are the most important to focus on to allow transition to the next digital maturity level, depending on what level one is at. These contributions have provided deepened understanding of digital maturity and paved the way for future research opportunities to further develop the research area of digital maturity.

6.1 Theoretical contributions

This study has elaborated prior literature on digital maturity levels and their characteristics. Our findings provide more nuance to the dimensions strategy, leadership, and culture that Kane et. al (2015a) includes in their model as well, and how the characteristics of these indicate an organization's maturity level. Furthermore, our findings add to this by introducing the dimensions, processes and analytics as well, which cover a broader spectrum of digital maturity. This addition contributes more detail to the literature on digital maturity, and have thus succeeded in closing the identified academic gap.

By introducing the process dimension to the DMF, we made another valuable contribution to research literature. Our findings imply that the digital maturity in the process dimension is closely related to process maturity, found in the CMM by Maier et. al (2012). Our empirical data concludes a link between the digital maturity levels and the capability maturity levels of processes. This finding can help scholars understand parts of digital maturity by looking to research literature on process maturity, which is a

more developed area of research than the one on digital maturity. Thereby, we have contributed to the overall understanding of digital maturity.

Another important theoretical contribution of this study is the guidance of what organizations should focus on to increase their digital maturity, depending on what level of digital maturity they are in. Scholars have not come up with theory regarding the activities or necessary steps to take along a digital maturity scale. Our findings contribute with dimensions that organizations should focus on during different stages of digital maturity, which in combination with the contribution of the characteristics of levels, provide a more complete and practically applicable framework to research literature on digital maturity.

Research literature has emphasized the role of a clear and coherent strategy when progressing in digital maturity (Kane et. al, 2015a), and that a strategy should be the starting point of the path to digital maturity (Ross et. al, 2017). Our findings, however, suggest that a clear and coherent strategy is not the most important thing in the beginning of a digital maturity journey. Two important things which we argue that organizations need to start working on, if they are on Awareness, is process management and experimenting with digital technologies. These two dimensions will facilitate organizations' progression along the digital maturity scale according to our findings. However, our results also stress the importance of strategy, but at a later stage of digital maturity.

6.2 Managerial implications

Our research shows that the progress towards digital maturity begins with an evaluation of current digital maturity, which needs to be initiated and supported by management to succeed. Additionally, a holistic organizational perspective is important for management to adopt to gain momentum and produce results. Prior to using the framework, the prerequisites are important to consider, if the key dimensions, *leadership* and *process management*, are mature enough, an organization can transit towards *awareness*. The prerequisites aim to facilitate management in creating the right

conditions to use the framework.

The intended users of the DMF are described in chapter 5.1.1 and our findings are applicable for large organizations at any level of digital maturity in the manufacturing and service industry, due to the diversified resource environments in the case studies. The prerequisites pose as a gateway to qualify for using the framework. Also, small and medium sized enterprises might still benefit from using the framework as inspiration towards becoming more digitally mature.

Furthermore, the diversity in our cases is also reflected in our results. Our framework is holistic in its nature, and most the data that contributed to the framework comes from respondents at Ericsson, which all have positions that require holistic perspectives in their organization. However, respondents with less-holistic roles contribute with more detailed information about digital maturity in processes and organizational tasks etc. This is an important implication for management. Managers need to understand that both holistic and detailed perspectives matter as digital maturity is being evaluated, hence employees from diverse functions of the organization should be included in the evaluation.

The most essential managerial implication that was found during the research was the importance of change management, reaching digital maturity and the level of Autonomy is not just about transforming technology and processes. It is mainly about transforming the culture to become more accepting of digital technologies, since we realize that it may, be impossible to be inclined to change the goal should be to foster a culture to at least not fear change. This is done through appointing visionary and passionate individuals as ambassadors. Preferably with different perspectives on the subject as well as different knowledge bases to achieve trustworthy results.

When organizations use the framework, it is important to consider that initially, at the early levels of maturity one can have the perspective of processes but as the organization progresses along the digital maturity scale the perspective widens and comprises the organization instead, this is derived from process maturity. Additionally,

it is important to consider that there are different optimum levels of digital maturity depending on what is being evaluated. It is not necessary for all processes to reach Autonomy for example, the optimum is determined by what the purpose is.

6.3 Limitations

Since prior literature was thin on digital maturity at the time of this study, our understanding of the concept was limited prior to the data collection. This fact could have affected our research process and the direction our data collection during the study. Due to this, we adopted an abductive research approach to allow a flexible process. This choice allowed us to learn more from research literature in areas we identified along the data collection, which in turn mitigated the effect of this limitation.

Our findings partly rest on the empirical data from three cases: Ericsson, Tekniska Verken, and BE Group. Although these cases are different in many aspects such as industry belonging, this unit of observation comes with limitations as well. All cases are large organizations (more than 700 employees), and therefore we have not been able to apply our findings to, or compare contexts to smaller organizations. We therefore strived to include characteristics in the framework that are as generally applicable as possible.

During our data collection, we identified that IT infrastructure is an important dimension when progressing in digital maturity. However, our respondents had limited knowledge of IT in general and could not hold a discussion insightful enough to contribute to the DMF in the level of detail we had hoped. To mitigate this limitation, we asked questions to respondents that didn't require much technical knowledge in IT but still provide the insights that we needed to the framework.

6.4 Future research

One aspect that respondents both raised questions about but some also argued about is whether all organizations should strive to reach Autonomy level in all dimensions. This issue has been addressed by Andriole (2017) who argued that “not every company, process, or business model requires digital transformation”. Respondents argued that it

is a strategic issue to prioritize investments when becoming digital mature, and respondents also argued that the digital maturity of the market and customers also affects how much an organization can benefit from becoming more digitally mature. This implies that several parameters affect what the optimum digital maturity for an organization is, and this should be studied further to shed light on the subject.

We identified several dimensions that prior literature both had and had not discussed in the context of digital maturity. Our contribution gives a little more nuance to the existing digital maturity models, but organizations could benefit from even more nuanced models since it is such a complex concept. To address this, scholars can consider each of the dimensions solely to provide more detailed charts of their digital maturity levels. For example, IT infrastructure is an important dimension, but our limitations prevented us to provide details on that dimension in terms of digital maturity. Scholars can study how IT infrastructure changes as an organization progresses along the digital maturity scale, and study how the IT infrastructure should be developed to support the digital maturity progression of the organization.

Future research can also attend to validating studies in other contexts than those of our cases'. The cases we selected for this study are large organizations in telecom and network manufacturing, steel production and distribution, and energy and broadband provider. Although this is a broad spectrum of industries, the framework can benefit from being applied in other contexts as well, such as smaller organizations or pure service providers such as management consultancy firms etc. Finally, the assessment tool for digital maturity should be validated and developed further.

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Appendix A: Workshop respondents

Table 4: Respondents for workshops.

| Workshop | Date | Time | Attendees |
|--|-------------|-------------|--|
| Workshop 1 Digital maturity | 2017-03-18 | 1h 10min | <ul style="list-style-type: none">• Jesper Hägg (author)• Louise Sandén• Lars-Göran Gustafsson• Mattias Petersson• Thomas Claudelin• Johan Hall• Viktor Birkebro |
| Workshop 2 Evaluation method of the indicators | 2017-05-12 | 1h 50min | <ul style="list-style-type: none">• Sandy Sandhu (author)• Jesper Hägg (author)• Louise Sandén• Peter Cronemyr |

Appendix B: Interview guide

Early (Awareness)

- 1) What do you think indicate that an organization is on the level Early?
 - a) What characterizes the leadership on this level?
 - b) What characterizes the processes on this level?
 - c) What characterizes the culture on this level?
 - d) What characterizes the strategy on this level?
 - e) Are there any other dimensions that you deem important to evaluate other than the above?

Developing (Experience)

- 2) What do you think indicate that an organization is on the level Developing?
 - a) What characterizes the leadership on this level?
 - b) What characterizes the processes on this level?
 - c) What characterizes the culture on this level?
 - d) What characterizes the strategy on this level?
 - e) Are there any other dimensions that you deem important to evaluate other than the above?

Maturing (Autonomy)

- 3) What do you think indicate that an organization is on the level Maturing?
 - a) What characterizes the leadership on this level?
 - b) What characterizes the processes on this level?
 - c) What characterizes the culture on this level?
 - d) What characterizes the strategy on this level?
 - e) Are there any other dimensions that you deem important to evaluate other than the above?

Reaching maturity level Early

- 4) What do you think an organization needs to do to qualify for the maturity level Early?
- a) What does the company need to change?
 - b) What is the most important thing to do?
 - c) What prerequisites are required?
 - d) Where do organizations need to start to begin their digital maturity journey?

Reaching maturity level Developing

- 5) What do you think an organization needs to do to transit to the maturity level Developing?
- a) What does the company need to change?
 - b) What is the most important thing to do?

Reaching maturity level Maturing

- 6) What do you think an organization needs to do to transit to the maturity level Maturing?
- a) What does the company need to change?
 - b) What is the most important thing to do?

Staying and keep developing on maturity level Maturing

- 7) What do you think is important to do to stay at the maturity level Maturing?
- 8) What is important to do to continue developing on the maturity level Maturing?

Appendix C: Workshop 1 material

Background

The objective of our thesis is to develop a tool to map digital maturity in processes. The tool should be used to evaluate one process at a time, and the result should show the digital maturity of an organizations processes. This analysis could then be used on several processes, which indicates which processes that is in most need to become more digitally mature, but it can also indicate what dimensions of digital maturity that an organization needs to develop in, independently of processes.

We have developed an embryo to a model based on prior literature, but will not present it now. The model contains a certain number of dimensions that all can have different digital maturity levels, see conceptual image below.

| | Maturity level 1 | Maturity level 2 | Maturity level 3 |
|-------------|------------------|------------------|------------------|
| Dimension 1 | | | |
| Dimension 2 | | | |
| Dimension 3 | | | |

Example

Digital maturity can be evaluated on a whole organization, and in those cases leadership and culture are common dimensions to evaluate digital maturity of. Leadership and culture are in this case examples of what we mean by dimensions of digital maturity.

Purpose

With the background in mind you probably wonder: What is digital maturity? How do you know if a process is digitally mature? We hope to answer these questions during the thesis and we believe Propia AB have valuable input to the answers of those questions.

The purpose of this discussion is therefore to shed a little light on the term digital maturity from a practical perspective. We want to know what you believe digital maturity is based on your experience. Discuss freely around the topic, but try to answer the following questions:

- What dimensions of a process should digital maturity be evaluated in?

- What are the indicators that a process is digitally mature?
- What are the indicators that a process is digitally immature?

No deliverables are expected of this workshop, holding a valuable discussion is the most important thing.

Appendix D: Thematic maps from data analysis



Tekniska Verken



Ericsson



BE Group

Characteristics of Awareness

Table 5: Characteristics of Awareness, Leadership

| Awareness | | | |
|-----------|---|---------------------------------------|------------|
| R | Representative quotes | Code | Theme |
| 15 | I think it is exploratory and a curious leadership | Explorative leadership in awareness | Leadership |
| 15 | You know that you have to do something! | Aware leaders in awareness | |
| 15 | During <i>early</i> the leadership, along with coworkers explore what to do and how to do it | Aware leaders in awareness | |
| 13 | The leadership at an immature level is characterized by measuring employees by the hours they put in | Controlling leadership | |
| 13 | ... also that it's not encouraged to work with tasks outside of your area | Controlling leadership | |
| 13 | ...and learning new capabilities is not encouraged | Education not encouraged in awareness | |
| 13 | Low rate of trustworthiness | Low trust on awareness | |
| 14 | Assuming that you have an understanding and awareness, where different alternative are examined on how to become more digitally mature. | Awareness in awareness | |
| 14 | Awareness of silos is a first step at early | Awareness in awareness | |
| 16 | It often starts with a few ambassadors who gain a deeper understanding of what digitalization can involve | Ambassadors | |
| 16 | From a leadership perspective it is difficult | Change mangement | |
| 16 | We work a lot with spreading awareness, it is hard at first but | Awareness | |

| | | |
|-----------|--|--|
| important | | |
|-----------|--|--|

Table 6: Characteristics of Awareness, Culture

| R | Representative quotes | Code | Theme |
|----|--|----------------------------------|-------|
| 12 | Ericsson is very divided into functions and units at that won't work if you want to digitalize | Siloed organization in awareness | |
| 13 | And the sub optimizing the results for your own unit | Non-holistic perspective | |
| 13 | ...and a lot of bureaucracy | Bureaucracy on awareness | |
| 14 | At an immature state you are silo:fied | Segmented in awareness | |
| 14 | Att jobba i silos är ett tydligt tecken på att man är digitalt omogen | Silo:ed working in awareness | |
| 6 | Navigating politics correctly to reach a higher level of digital maturity | Internal politics | |

Table 7: Characteristics of Awareness, Processes

| R | Representative quotes | Code | Theme |
|----|---|--|-----------|
| 4 | We actually looked at the estimated rate of automation in processes. At level 1-3 (early) manual work is prominent. | Manual work in awareness | Processes |
| 13 | There is a lot of paper | Paperwork on awareness | |
| 13 | Low automation rate and IT maturity | Low automation on awareness | |
| 12 | If you're at early you can continuously improve processes | Continous process improvement on awareness | |
| 12 | We think that to become more digitally mature you must know where the data is and trace information | Mapped information on awareness | |
| 12 | Double-storage of information is an indication of low digital maturity, or at least if it isn't one-source | Duplicate information storage indicate awareness | |

| | | | |
|---|--|---------------------------|--|
| 6 | Inadequate information management is a barrier to become digital mature | Information management | |
| 8 | ...but you still leave a paper to the installer instead of sending an electronic message to the installer's Ipad | Paperwork is low maturity | |

Table 8: Characteristics of Awareness, Analytics

| R | Representative quotes | Code | Theme |
|----|--|-----------------------------|-----------|
| 12 | At early is all about extract data from processes to know where it is | Data access on awareness | Analytics |
| 4 | The most basic is that there is data of good quality when analysing data | Access to data on awareness | Analytics |
| 4 | You have to sure that there is access to data and there is an understanding of what it is. If you have old and complex systems where data is immovable is not very mature. SAP for an example it can be impossible to access data beacause it is connected to legal entities, not physical | Access to data on awareness | Analytics |
| 4 | You must be digital and have organized data, everything should be accessible digitally | Access to data on awareness | Analytics |
| R | Representative quotes | Code | Theme |
| 16 | At early it can be about talking about digitalization and implementing smaller experiments | Testing | Strategy |

Table 9: Characteristics of Awareness, IT Infrastructure

| R | Representative quotes | Code | Theme |
|---|--|---------------------------------|-------------------|
| 8 |today we still work in different systems, I think it is difficult to make them compatible with each other | System incompatability immature | IT-Infrastructure |

Characteristics of Experience

Table 10: Characteristics of Experience, Leadership

| Experience | | | |
|------------|---|---|------------|
| R | Representative quotes | Code | Theme |
| 15 | ... and then you progress towards coaching (leadership) | Coaching leadership experience in | Leadership |
| 15 | If external competence is utilised I think that the leadership will be ad-hoc. Because then employees and managers know just as much and the road ahead will be exploratory | Exploring leadership experience in | Leadership |
| 16 | You have to iterate information and knowledge with acting on initiatives to move forward on such a scale and remember that different parts of the organization will be on different stages of the scale | Iterative process | Leadership |
| 16 | Within this organization it is a lot of silos. When digitalizing you have to work as a flatter organization. There has to be possibilities to lead projects and changes by others than leaders | Decision-making is moved down the hierarchy | Leadership |
| 16 | ...and the mandate is shifted downwards in the hierarchy for the organization to become more seamless | Decision-making is moved down the hierarchy | Leadership |

Table 11: Characteristics of Experience, Processes

| R | Representative quotes | Code | Theme |
|----|--|--------------------------------|-----------|
| 4 | Level 4-5 (developing) is manual work with somewhat automatized customer support | Partly automated in experience | Processes |
| 16 | .. we have to work more cross-functionally. We try to | Cross functionality | Processes |
| 16 | ... it's about understanding that initiatives can affect other parts of the organization | Cross functionality | Processes |

Table 12: Characteristics of Experience, Culture

| R | Representative quotes | Code | Theme |
|----|---|------------|---------|
| 16 | Finially at developing, people start understating what it is all about and start bragging about things they've done | Quick wins | Culture |

Table 13: Characteristics of Experience, Analytics

| R | Representative quotes | Code | Theme |
|---|---|-------------------------------|-----------|
| 8 | ... the measurements are there to see if we make our deliveries in time | Data access indicate maturity | Analytics |

Characteristics of Autonomy

Table 14: Characteristics of Autonomy, Leadership

| Autonomy | | | |
|----------|--|---|------------|
| R | Representative quote | Code | Theme |
| 15 | When processes and organizations are digitally mature, I think that the leadership will be less dependent. | Natural leadership in autonomy | Leadership |
| 13 | ... managers don't have to be experts but they have to listen and learn of the ones who are | Humble leaders on autonomy | |
| 13 | ...managers must be digital and visionaries, think bigger than their own sphere | Visionary leadership | |
| 13 | Being digital entails less control and more empowerment | Empowering leadership on autonomy | |
| 16 | Old hierarchies can become hindering. In digitally mature organizations leaders are more supportive, we work hard and more decisions are made lower down | Decision-making is moved down the hierarchy | |
| 12 | ... it will be faster to go from vision to decision, which facilitates faster change | Quick changes in autonomy | |

| | | | |
|----|--|--|--|
| 15 | You can create more set of regulations to make the automatic decision-make safer | Analytics and big data for decision making in autonomy | |
|----|--|--|--|

Table 15: Characteristics of Autonomy, Culture

| R | Representative quote | Code | Theme |
|----|--|---|---------|
| 15 | More analysis and digital decision-making is the culture in maturing. | Data-based decisions on autonomy | Culture |
| 15 | Decision-making is moved downwards in the organization | Low-hierarcial desicion making in autonomy | |
| 15 | Managers have to be more open to trusting eachother and understand other organizations | Cross-functional understanding | |
| 15 | To not loose momentum and slander change in the coffee-room indicates that a culture is more accepting of changes. | Culture allows changes in autonomy | |
| 15 | It is important to understand ecosystems and value networks and how to be a part of them. | Understanding the value network in autonomy | |
| 12 | In the latter maturity levels you work cross-functionally and integrated. | Cross-functional work on autonomy | |
| 12 | Transparency is important in descisions | Transparency on autonomy | |
| 13 | A learning culture characterizes digital | Learning culture at autonomy | |
| 13 | Transparency is also important | Transparency on autonomy | |
| 13 | Transparency and sharing is important, you must work across team boundaries. | Cross-functional on autonomy | |
| 13 | Knowledge sharing is important | Transparency on autonomy | |
| 4 | Cross-functionality is important. An end-to-end strategy that everyone work according to | Cross-functional work in autonomy | |

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| 4 | You must have a think about how digitally mature you are as an employee in any given position at the firm. In a perfect world, a management structure would be unnecessary. Then you'd have a system that would detect when you arrive at work and what your competencies are, to allocate you to a task. | No bureaucracy in autonomy |
| 14 | Cross-functionality is when supply collaborate and communicate with sales, it's important to become digitally mature. | Cross-functional working in autonomy |
| 14 | There will not be controlling hierarchies, managers must know which competencies they have around them. | Non-hierarchical in autonomy |
| 14 | You don't need traditional decision-points where you should escalate the decision higher up in the hierarchy. Instead there is support to make the decision lower down in the hierarchy. | Low-hierarchical decision making in autonomy |
| 15 | Other competencies will be essential in leaders, humbler and be able to interact with different units. | Cross-functional interaction = Digital maturity |
| 16 | It's important that digitalization is integrated in all parts of the organization and become a natural part of the leadership. | Naturalizing digitalization |
| 12 | Taking data-driven decisions is an important part to reduce politics. | Data driven decisions on autonomy |
| 16 | When you are digitally mature there isn't a digital strategy since it doesn't have any self-worth, it's a tool to become digitally mature. | Naturalizing digitalization |
| 6 | Knowledge sharing indicates digital maturity | Knowledge sharing |

Table 16: Characteristics of Autonomy, Processes

| R | Representative quote | Code | Theme |
|----|--|--|-----------|
| 14 | How much you can automate through robots is an indication of how digitally mature you are. | Level of automation indicates maturity level | Processes |

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| 14 | Right people have the right information | Information flow seamless |
| 4 | ... the other is how to become more volume independent, now we need more people if we scale up in a process, the goal is to avoid scaling up. | Volume independency in autonomy |
| 4 | This is a vision, you use digital capabilities to ensure the automation rate and the rate of machine learning which entails that everything can be run automatically | Automation level parallel to digital maturity |
| 4 | At level 6-7 everything was 100 % automated or even autonomous | Fully automated in autonomy |
| 4 | We tried to estimate volume independency. We told people in process activities that 'what happens if you get 10, 100 or 1000 times more handling units?' | Volume independency in autonomy |
| 13 | If managers spend less time navigating bureaucracy and administration we would be more digitally mature | No administration on autonomy |
| 13 | Automatization is more frequently occurring | High automation on autonomy |
| 13 | Before, you paid invoices manually, now it is automatable. Less employees working with administrative tasks is an indication of being at maturing level | No administration on autonomy |
| 13 | Exactly, this is end-to-end, self-service and one-patch there is no need for manual interference. It is one take on being at maturing | Fully automation on autonomy |
| 12 | If you come to maturing you can build more digital business models and scale up without adding resources | Low cost scalability on autonomy |
| 12 | Many administrative functions will disappear with digitalization | No administrative work in autonomy |
| 12 | Autonomous processes must be at the last level of digital maturity | Autonomous processes on autonomy |

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| 15 | ...and some decisions can be made digitally and automatically | Automated workflow in autonomy | |
| 15 | Mobility and agility is important here. You have to be adaptable in terms of processes and tools. You wont have all the answers but you need to be aware of the changes to come. | Agile and responsive to changes in autonomy | |
| 6 | To reach digital maturity absolute automatization must to be the goal. | Process automation | |
| 6 | Volume independent processes indicate being at the maturity level | Process automation | |
| 6 | A process that is self-improving is digitally mature | Process-automation- and streamlining | |
| 13 | A process that can improve itself without manual interference is mature. It is happening right now, we are integrating cognitive capabilities in processes. Both when analyzing big data but also to have a cognitive interface towards the user | Cognitive capabilities | |

Table 17: Characteristics of Autonomy, Analytics

| R | Representative quote | Code | Theme |
|----|--|---------------------------------------|-----------|
| 12 | At maturing, analytics is an integrated part of the business | Analytics integrated in BM | Analytics |
| 12 | If you think about Spotify who do real-time analytics, they also change their processes | Real-time analysis is mature | |
| 12 | At maturing, cross-functional analysis is conducted for improved output, independent of organizational structures. | Cross-functional analysis on autonomy | |
| 13 | Digital is very cross-functional and a lot is centered around data, therefore data must stream between different parts of the organization | Cross-functional on autonomy | |
| 13 | If data is contained in silos you can't create better understanding | Cross-functional on autonomy | |

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| 4 | How we go from reactive processes and look back at numbers to how we look forward and become more proactive. | Predictive analysis in autonomy | |
| 4 | ...imagine you have all data available, a truck is on its way to the Pyrenees. It's connected but not served. If the system can access external data about the weather and recognizes that a snowstorm is on its way, it can also conclude that the goods will not reach its destination in time. It will then examine alternative means of delivery and compare the price to the delay-penalties. Finally, it will make a decision on whether to deliver the goods in an alternative way or not | External data input in autonomy | |
| 4 | ... the more mature you become, the more you have to use data in a predictive manner. | Predictive analysis on autonomy | |
| 4 | If you're somewhat digital you need a system that gives you real-time feedback of analytics. So you always have current analysis to base decisions on. | Real-time data in autonomy | |
| 4 | At maturing you're more proactive and use machine-learning to support new projects. Amazon is a good example where they predict which kind of product will be bought of which kind of customer. Hence, they can ensure that the product will be available in stock near the customer. The availability will also result in more sales | Predictive analysis on autonomy | |

Table 18: Characteristics of Autonomy, Strategy

| R | Representative quote | Code | Theme |
|----|--|------------------------------------|----------|
| 16 | The highest level it is part of your everyday-life with change and velocity in developing new technology | Naturalizing digitalization | |
| 6 | The objective to aim for value-networks indicate maturity | Knowledge sharing through business | Strategy |

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| | | ecosystems | |
| 5 | If I were to sell through digital tools, I'd have to educate them (customers/partners) in my tools (systems), in how the software works and how it is supposed to be delivered | Work across value network digital maturity | |

Table 19: Characteristics of Autonomy, IT Infrastructure

| R | Representative quote | Code | Theme |
|----|--|---------------------------------|-------------------|
| 8 | I don't think a process can become digitally mature if there aren't synergies in the systems | System synergies is mature | IT-Infrastructure |
| 12 | ...if the integration between systems is constructed so that one changes in one system doesn't require redoing the integration | No fix on integrations autonomy | IT-infrastructure |

Key dimensions that allow transition to Awareness

Table 20: Transitioning to Awareness, Processes.

| R | Representative quotes | Code | Theme |
|----|---|---|-----------|
| 4 | ... something that trends toward standardization and fewer variations, you are not interested in the billions of configurations | Standardization required to become mature | Processes |
| 4 | If you are to do that you need to be able to look at the processes from a workflow perspective, how you do things when you are working. | Map processes to reach awareness | |
| 4 | ... not how the process mapping looks but all the activities done. An email sent to person A when orders are received for example. | Information mapping to reach awareness | |
| 13 | You look at how the process is constructed, then you can robotize it as it is. | Start with mapping processes | |

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| 5 | If you have for example 10 000 customers you might want to do the work digitally, but then the workflow must be standardized. | Digital maturity requires standardized processes | |
| 5 | ... because the more you digitalize the more strict you must be in your processes och descriptions and how you package the product | Digital maturity requires standardized processes | |
| 5 | The product needs to be pre-defined by market, country, and company. | Digital maturity requires standardized processes | |
| 5 | Stability in processes is very important to the digital maturity. | Digital maturity requires stable processes | |
| 15 | Because when you work digitally you will have quite sharp digital boundaries | Digital maturity requires standardized processes | |
| 6 | To become digitally mature processes need the right input-data and information flow | Information management | |
| 17 | we agreed that we needed to have our processes in place before we could start to digitalize | Process management | |
| 8 | We manage the electronic orders very well. But when orders are placed regarding the countryside and a division have been done, problems can arise since we don't have much experience from similar cases. Those cases make the digitalization harder and I think we have to work with standards to do those electronically | Digital maturity requires standardization | |
| 8 | How we should document contracts and drawings, we have improvement potential there | Standardized workflow required | |
| 8 | It is a decision that needs to be taken, how should we document this? How should we manage customers' orders? | Standardized information management | |
| 8 | I think it's about deciding how to work and what tools are needed to get there | Standardized workflow required | |
| 8 | ... and everyone should have the same ways of working. | Standardized workflow required | |

Table 21: Transitioning to Awareness, Leadership

| R | Representative quotes | Code | Theme |
|----|---|-----------------------------|------------|
| 15 | ...that the leadership with heart and soul is committed to it, and stand up to all resistance in the organization, that is key. | Committed leadership | Leadership |
| 15 | ...but it is such a profound and fast-moving change that the leadership must be 100% committed. | Committed leadership | |
| 15 | The leadership needs to be responsive in the change management and listen to employees' reactions. | Responsive leadership | |
| 15 | The first 100 days somebody needs to stand up and say: now the following applies... | Clear directions | |
| 5 | When it comes to these kinds of changes it's important to realise that you need top management's support | Top management important | |
| 8 | Management need to decide on ways of working and follow that through | Clear and strong leadership | |
| 15 | Self-awareness, awareness about the need to change | Aware leaders | |
| 12 | For a digital transformation to work a strong leader is required, because there are so many different functions that needs to follow through on this. | Strong leadership | |
| 12 | There will never be any changes until someone stands on the barricades and say that a change is needed. | Clear leadership | |
| 12 | There are many people that know what needs to be done and why this is important, but they can only accomplish anything in their own sphere, that's why we need a strong leader. | Strong leadership | |
| 12 | The leader needs to have a vision | Visionary leadership | |
| 12 | The leader needs to have insight on how the different parts of the organization works and collaborates. | Aware leader | |

Key dimensions that allow transition to Experience

Table 22: Transitioning from Awareness to Experience, Leadership.

| R | Representative quotes | Code | Theme |
|----|---|-----------------------|------------|
| 14 | Commitment from top management if not the CEO themselves manages these issues then a CDO must do it | Sponsor engagement | Leadership |
| 12 | I earlier phases it's about understanding that you need to change you waterfall perspective | Change waterfall view | |
| 17 | I think it's about leadership and change management. Top management must dig into digitalization and understand that it's important to work for a change in the beginning | Change management | |
| 17 | I believe in creating awareness, understanding and knowledge as a first step. | Awareness | |
| 15 | Perseverance is important to progress further here. All changes bring friction, but you can never surrender, but still have to be responsive | Perseverance | |

Table 23: Transitioning from Awareness to Experience, Strategy.

| R | Representative quotes | Code | Theme |
|----|---|------------------------------|----------|
| 17 | You need to have an idea and a strategy about how to manage all different initiatives that pop up and how much resources you want to allocate to them | Resource Strategy | Strategy |
| 12 | Insight into what competencies are needed when you become digitally mature is an important strategic component. You need to understand what capabilities you will need. That is something you need to know to reach developing. | Competence requirements | |
| 8 | ... well partly it's education that is needed. | Competence development | |
| 2 | In a situation like this you will need external competence | External competence | |
| 14 | It's about awareness, to raise the digital IQ or competence | Educate employees on digital | |

Table 24: Transitioning from Awareness to Experience, Experiment.

| R | Representative quotes | Code | Theme |
|----|--|---------------------|------------|
| 14 | ... and test different types of business models and ways of working. | Test and experiment | Experiment |

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| 15 | You can do it continuously and win buy-ins. For example, if you change locks to work with chips instead of keys, and connect it to the time reporting system. Many employees might see the benefits about this small change and then you can take the next step. | Experiment | |
| 12 | ... the step you take before that is more about doing pilots etc. | Testing | |
| 17 | We try to bring along the ambassadors and then in a given time we have discussed that we have been working with information and knowledge for a while now, now we must start to do something as well. | Start changing | |

Key dimensions that allow transition to Autonomy

Table 25: Transitioning from Experience to Autonomy, Strategy.

| R | Representative quotes | Code | Theme |
|----|--|---|----------|
| 17 | It's important to evaluate oneself in this transition and determine how mature you are in different dimension to choose what to focus on | Evaluation and prioritize | Strategy |
| 13 | You also need to choose where to start, you cannot do everything at the same time | Prioritize | |
| 13 | The prioritization on where to begin must be done in top management, it depends on what they deem most important in the strategy and where they want to allocate the investments | Prioritize | |
| 13 | ... then I think you need new competencies as well | New competence | |
| 12 | It's more important with the common goals the more digitally mature you become, since everything gets more cross-functional | Common goals | |
| 12 | ... common goals are also important | Common goals | |
| 15 | My view is that to execute one needs to work more cross-functional | Cross-functionality indicate digital maturity | |

Table 26: Transitioning from Experience to Autonomy, Leadership.

| R | Representative quotes | Code | Theme |
|----|--|------------------------------------|------------|
| 13 | You need to push from top management and have a sponsor, for example the CEO, that drives the transformation | Sponsor to reach autonomy | Leadership |
| 13 | One way to prioritize is to find people who are passionate about this and can push it forward, and they can lead the way in their area, and the rest will follow | Find ambassadors to reach autonomy | |
| 14 | At Ericsson it is important to find employees that are passionate about the projects they manage | Ambassadors to lead transformation | |
| 17 | I think that when you have come a bit on the way, you can't get self-righteous, you need to realize that it is a maturity journey | Perseverance | |
| 17 | Cultural issues are very important, and there aren't many in the organization that understands that. You can trust that it's enough to find new digital tools, digitalization is more about the soft dimensions. | Change management | |
| 17 | There is no such thing as a digitally mature culture, but there is an organizational culture that more or less fosters digital maturity, and it's a lot about an open attitude to change and new things. Then we are back to change management | Change management | |
| 17 | The willingness to change is a part of a digitally mature culture. | Change management | |
| 6 | To reach higher levels of digital maturity, the vision must be communicated. | Change management | |