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Digital Transformation in the Construction Industry

Implementation, Organisational Structure, and Value

Master's thesis in the master's program Design and Construction Project Management

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ABSTRACT

Digitalisation is an area in the construction industry that has been subject for discussion in the sector in recent years. It is considered an opportunity to increase productivity and efficiency. However, its full potential has not been achieved yet. Construction companies struggle with implementation and changes in organisational structure and are trying to understand how value is generated in projects. Therefore, this thesis focuses on the implementation of digitalisation, the need for organisational structure, and attempts to define the value adding activities for the construction industry. To examine this, a qualitative study has been conducted, where interviews and observations have been done in a large Swedish construction company. The findings from this thesis showed that the implementation of digitalisation does not function in a structured and organised way. However, it is found that the company has an ambition to push the implementation of digitalisation forward. This is mainly based on a low understanding of change management and an organisational structure that not flourish digital development. Regarding digitalisation the construction industry is deeply tool-oriented where the change processes mainly focusing on implementation of digital tools. The important parts of productivity and efficiency in projects is one reason why tools are central for the development. The thesis concludes that a shift in focus from tools, towards operations and information management. The unification of data is necessary for the company in question and a valuable resource in the future. In addition, a better understanding of digitisation, digitalisation and digital transformation is needed, to process the digital change and boost the value. To achieve this change central digitalisation strategies must come from upper management of the company.

Keywords: Building information modeling, BIM, Business opportunities, Change management, Digitisation, Digitalisation, Digital transformation, Implementation, Organisational structure, Value

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LIST OF ABBREVIATIONS

BIM	-	Building Information Modeling
ACE	-	Architecture Construction Engineer
KPI	-	Key Performance Indicators
ROI	-	Return on Investment
RFI	-	Request for Information

ENGLISH – SWEDISH DICTIONARY

Division	-	Verksamhetsgren
Building	-	Hus
Civil	-	Väg och anläggning
Operations	-	Arbetsätt

PREFACE

I would like to extend my thanks to people that in some way have been involved in this thesis. It had not been possible to produce this report without your help.

- ❖ Mikael Johansson, my supervisor at Chalmers for help and guidelines to be able and perform a good thesis.
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1 Introduction

The construction industry has made a shift from handwritten drawings using paper and pencil to a digital nature where 2D drawings are made and presented digitally (Davis & Harty, 2013). Digital 2D drawing has developed to more advanced 3D technology. Davis and Harty (2013) argue that building information modeling (BIM) is an important technology for the construction industry. Some reasons for this wider use of technology has been to increase productivity and quality of the product, decrease project cost and reduce project delivery time (Azhar, 2011). Technology has been an important driver in reducing interferences within operations, but due to lack of integration between digital tools this change has not yet reached its full potential (Benham M & Fitzgerald Bigelow, 2015). Additionally, projects are more complex and better visualisation is an increased priority for project organisations (Chelson, 2010). Digital forms of visualisation, such as BIM technology, has been a central part in the architecture, engineering and construction (AEC) industry to increase design understanding (Azhar, 2011). It is a digital journey, similar to the digital change that is taking place in the production industry (Hardin, 2009), where digitalisation is implemented as a central pillar in the organisation's strategy (SKF, 2018). Research from SKF (2018) shows that more than fifty percent of the studied organisations in the production sector use this as a strategy. Including digitalisation as part of the strategy shows an increased motivation for working systematically with implementation of digital work processes (SKF, 2018).

The construction industry is now facing this change, where digitalisation gets more focus in the organisation. Productivity and efficiency are central concerns in the construction industry, where BIM is considered key for this change (Miettinen & Paavola, 2014). Furthermore, Kaufmann, Ruau and Jacob (2018) argue that a digital strategy is fundamental to continue the change in the construction industry. The digitisation of the construction industry and a change towards digital ways of working has been trending. Kaufmann et al. (2018) explain that it is not just a growing trend nowadays, but that there is pressure from several directions. Demands and expectations that companies work in a digital way are rapidly increasing, especially from the client. More clients today demand a certain level of digitalisation, which increases the pressure on many actors in the industry (Kaufmann, et al., 2018). Further on, Kaufmann et al. (2018) find that the new generation of engineers expect digitalisation to be integrated in daily work. Kaufmann et al. (2018) also mention the acceleration in new technology entering the market, both in terms of software and hardware. The broad range of technology tools increases the complexity in evaluating whether products generate value or not.

With the accelerating digital transformation, popularity and usage of *digitisation* and *digitalisation* has increased (Bloomberg, 2018). The subtle distinction between these two words, often mistaken for a mere spelling mistake, makes all the difference. This does, however, feed into the confusion about how the words should be used and separated. Bloomberg (2018) explains the digitisation as "The straightforward Term". A word focused on the transformation from analogue to digital. In practise, a digitisation process converts an analogue signal to ones and zeroes, which now can be stored and processed in computers. In contrast to digitisation, digitalisation does not have a clear definition, which increases confusion among the parties. Blomberg (2018) explains digitalisation as a word "Fraught with Ambiguity and Confusion", and about interactions and how people interact with each other. On top of this, digitalisation is the use of digital technologies to develop the business model to increase efficiency and value to the operation. Digital transformation comes in focus for organisations that work with digitalisation projects (Bloomberg, 2018)). Bloomberg (2018) explains digital transformation as "Beyond Digitalisation" and that it relates to a strategic business transformation, being customer driven. Matt, Hess, and

Benlian (2015) explain digital transformation strategies in four dimensions. Importance of an ability to use advanced technology, opportunities can change what is value creating for the firm, a need for structural change in the organisation and financial power to proceed a transformation (Matt, et al., 2015).

This thesis examines how digital change is applied in different organisations within a large Swedish construction company and attempts to provide an understanding of the implementation processes. This was done by conducting 13 interviews, combined with additional observations from within the organisation. Finally, it examines how implementation is handled, what affects organisational factors, and what value may be generated from this change.

1.1 Aim and outcome

The aim of this thesis is to investigate key factors for success when undergoing digital change, how implementation and analysis are organised and if the organisational structure affects the result.

The outcome of the thesis is supposed to find how digital change affects the studied organisation in terms of value adding work processes. The thesis will give insights into whether anything needs to change and a unified picture of knowledge and digitalisation actions within the organisation.

1.2 Research questions

The following questions will be considered:

- ❖ How does implementation and analysis of digital tools and operations function in the construction sector?
- ❖ Is there a need to change the organisational structure when undergoing digitalisation?
- ❖ What value comes from increased digitalisation for contractors?

1.3 Scope and limitations

The thesis investigates people in positions of responsibility regarding digitalisation at a Swedish contractor. These people, our interviewees, have a digital responsibility in the organisation. The majority operates from regional offices and, for this reason, have little project-orientation. Therefore, acceptance and understanding from operative divisions are given small parts of this thesis and may limit factors that affect digital change. Furthermore, interviewees that operate in projects are highly skilled and positive concerning digitalisation and new technology, this bias should be kept in mind.

Regarding literature, the areas of BIM, digital change and change management will be presented and discussed. Although the company under consideration does not explicitly use the expression BIM when referring to its digital operations, there is a crossover between the general definition of BIM and the operations in question. However, these inaccuracies may affect the results.

The focus of this thesis lies within management of digital change and strategic questions. A large Swedish contractor is analysed, covering major parts of the company. All divisions

will be covered, a few regions within the divisions will be investigated, both large and small. Even though interviewees come from different parts of the company, the result may not cover the whole organisation. Finally, as the study only takes place in one company, it may not provide a complete picture of the whole industry. Interviews and observations will focus on their personal thoughts about implementation processes, organisational structure and value adding activities.

1.4 Structure of the thesis

This thesis follows the structure below:

- ❖ Chapter 2 presents a theoretical background around digital tools, operations, organisational structure and change management.
- ❖ Chapter 3 presents the methodology used for data collection and literature research.
- ❖ Chapter 4 includes a presentation and analysis of the results from interviews and observations.
- ❖ Chapter 5 presents a discussion concerning how the literature and result is connected to each other.
- ❖ Chapter 6 contains a conclusion of the report and answers the research questions.

2 Theoretical background

This chapter describes BIM, digital tools, digital change and change management as key factors for change processes. Organisational structure and an understanding of digitisation, digitalisation and digital transformation are also mentioned.

2.1 Building Information Modeling

Building Information Modeling is also referred to as BIM. It is considered one of the most promising developed technologies and is widely used in the industry (Azhar, 2011; Estman, Teicholz, Sacks, & Liston, 2011). Bloomberg (2018) explains that digitalisation comes with a confusing definition. BIM is stuck with the same challenge, no precise definition and different understandings. BIM has been hard to define and comes with no single definition in the architecture, engineering and construction (AEC) industry (Miettinen & Paavola, 2014). The technology is not only used as a product, it is used in many forums, such as roles and operations. Emphasis should not only be on the changes of handling drawings and visualisations, but also that BIM affects all of the processes involved in putting a building together (Estman, et al., 2011). The BIM handbook, by Estman et al. (2011) argues that BIM is used as a buzzword. A trend that is rising fast and is used by the software vendors wrongly. This is one reason why BIM has ended up with confusion and variation in practise.

Even if there is no clear definition accepted by the AEC industry, many researchers are trying to define the term to be able to continue developing the area. Azhar (2011) explains the BIM technology as a virtual model that can be used in many ways such as, planning, design, construction and facility management. Miettinen and Paavola (Miettinen & Paavola, 2014) instead define BIM as a digital representation of a building in 3D and being object-oriented. Using different tools directly linked to BIM, together with the parametric modeling, a new level of spatial visualisation is developed, increasing the efficiency of project management. They continue arguing that BIM can also be seen “as a repository of project information to exchange the information with related software applications” (p.84). Chien, Wu and Huang (2014) argue that the BIM technology, with its digital information models, achieve high-quality construction and management of the built product. This report will continue to use the word BIM and define it as a digital representation, combined with a high level of information, available with related software.

2.2 Digital tools in the construction industry

Miettinen and Paavola (2014) show that BIM is implemented in a hybrid practice, where BIM tools combined with digital tools and non-digital tools form the result of the product. Separating digital tools and BIM tools seems hard, with no clear line, therefore, this report will present digital tools and BIM tools in the construction industry built on each other.

The major impact all tools have on the industry does not always lead to increased productivity and efficiency. The reason this industry is considered to be one of the least digitised industries is connected to the construction industry being slow to implement digital tools in the production (sbs Group, 2017). Change is now taking place in many areas and the technologies need to be evaluated and understood by the involved parties. Arayici, et al. (2011) argue that a successful implementation of BIM needs an implementation of a strategy in the organisation. The essential part in the digitalisation is the BIM technology, which brings a transformation from a 2D based drawing information system into an object-based system on 3D information (Arayici, et al., 2011). The implementation of BIM technology is not just about the technology, it is also about the people and operations that connect to BIM. An argument for this change is the pressure in the industry to provide value for money, sustainable design and construction. According to Arayici, et al. (2011) this is one reason

why the BIM technology is changing the way of working. The object-based information system changes the representation of the information, being machine readable for automation. The aim of the change is therefore focused on another way of overcoming barriers and challenges to increase productivity, efficiency, quality, and in this way work with sustainable development of the industry (Arayici, et al., 2011).

Information is also indicated as an important factor to handle. A fragmentation of structure within the projects of the construction industry has contributed to a complex communication structure, which affects the possibility of effective communication (Arnold & Javernick-Will, 2013). This complex communication structure in projects, combined with a high amount of data generated in construction projects, disintegrates the operations and struggles with productivity and efficiency (Arnold & Javernick-Will, 2013; Benham M & Fitzgerald Bigelow, 2015). Project Management Software is technology involving tools used for managing and communicating project-specific information (Arnold & Javernick-Will, 2013), these systems are computer based and a form of IT-system. Enterprise resource planning programs, project management application service providers, or web-based project management systems are examples of software that is used to simplify the communication bridge.

Another category of technology used in the construction industry is augmented reality (AR) and virtual reality (VR). They are different, where AR is an interactive experience built on real-world imagery objects (Benham M & Fitzgerald Bigelow, 2015). In contrast, VR is a simulated experience that may be a representation of the real world or not. The technology is complex but is found to be user-friendly and provides a high level of visualisation, which has made it interesting for the construction sector. VR and AR have not been used on a large scale yet but have seen an uplift in usage in recent years. It has been used for employees to compare planned and actual completion, interact with plans, secure workers, and document progress (Benham M & Fitzgerald Bigelow, 2015). Wearable technology used for the same purpose as VR and AR and builds on the same idea but is based on usage of smart helmets, smart glasses, or smart vests with gps. The advantage of the technology is that it can present an individual or project in real time. The technical units that are used are in most cases carried by the body, compared to VR and AR, the hands are now free and can be used for interacting with the environment or to provide safety. Emerging technology in the same area to these tools are 3D scanning and printing, usage of mobile devices on site for data collection and communication and usage of drones on site (Benham M & Fitzgerald Bigelow, 2015).

2.3 Sources of value from digitalisation

The ACE industry is changing their work processes and is adopting new innovative ways of working, such as BIM (Vass & Gustavsson, 2017). Clients are using their ability in a wider range to demand more digitalisation and, especially, BIM in their contracts with contractors (Vass & Gustavsson, 2017). The public clients strive towards a strategic intention that drives the digital innovation process forward. Worldwide clients demand digitalisation both in the internal external work towards the contractors. One of the large Swedish public infrastructure clients are today demanding BIM on a larger scale than before, and it is found, due to low understanding, that everything has not worked as planned and the increased digitalisation has been slower than expected (Vass & Gustavsson, 2017). The ambition towards an increased BIM level is clear, but there are challenges in demonstrating the business value of BIM (Vass & Gustavsson, 2017). As a result of the struggle to demonstrate business value, bids are instead driven up as the contractors attempt to pass on their internal implementation costs to the public clients.

A case study of a pilot project in Sweden on the Röfors Bridge, indicated that an object-oriented working strategy has a positive outcome in these projects (Malmkvist, 2013). Malmkvist (2013) argues that complexity and size both affect the outcome. The more complex and larger in size, the more the positive effects from using a model increase. During the project, the project group identified increased productivity owing to the increased digitalisation compared to the traditional way of working (Malmkvist, 2013). It is hard to identify the added value, and many of the values are indirectly connected to the project. The indirect values do not necessarily need to be connected to the project budget, but this can be the case. Calculated and indirect values, combined with a project-based structure, make the motivation towards increased digitalisation seem difficult. The Next chapters give a picture of the value digitalisation brings and the challenges.

2.3.1 Direct value

In a study by Barlish & Sullivan (2012), three case studies were compared to each other in order to calculate the difference between them. BIM projects and non-BIM projects were compared to each other in order to calculate the differences. Case 1 was based on two non-BIM projects that have been compared to two BIM projects in similar functional areas (Barlish & Sullivan, 2012). These results included a decrease in RFI by 50% in the BIM project. The cost resulting from the number of change orders decreased from 12% to 7%, corresponding to a reduction of 42%. The project delay decreased from 15% to 5%, it's an improvement of 67%. In case 2, the investment cost was being compared to the total cost (Barlish & Sullivan, 2012). All disciplines had to submit their bids in two different formats, one in a non-BIM delivery and one with a BIM delivery. The result showed that the total design costs from the engineers and architects increased with 31% for the BIM delivery, and that the technical costs from the model increased with 34% as well. Construction cost, instead, decreased with 5% with a BIM approach. In the end, this study indicated total savings of 2% with all investments of BIM. In case 3, the same metrics were used as in case 1 (Barlish & Sullivan, 2012). RFIs decreased with 34% and the cost from change orders decreased from 23% to 7%, corresponding to a reduction of 70%. The project delay decreased from 15% to 7%, an improvement of 53%. Case 3 has also been evaluated for its investment costs. The design costs from engineers and architects increased with 29%, technical costs for the model increased with 47%. The construction cost was reduced by 6% and the total costs summed up indicated total savings of 1%.

Barlish and Sullivan (2012) argue that many factors affect the results from the cases, and it is hard to calculate exact numbers in the BIM area. The size of the project, team members' knowledge of the technology, communication in the project, and several organisational external factors. These factors have not been evaluated in the case studies as they are subjective in nature. The results are built on return metrics and investment metrics, but it is important to understand that BIM's success is affected by the project and the organisation (Barlish & Sullivan, 2012).

Key factors that increase productivity are RFI reduction, reduced rework, schedule compliance, decreased change orders (Chelson, 2010). Each of these affect the work processes in different ways but the overall effect is net savings of cost. According to Chelson (2010) BIM-projects have 10% of the RFIs that a typical project has, and this also brings savings in management time for the contractors. The reduction of rework and ideal time due to site conflicts indicate savings for subcontractors of a total 9% of the contract, where the highest savings identified are clash detection during reviews. Chelson (2010), concludes that the strongest determinants of success that come from BIM projects, due to site productivity, are human factors and not the technical factors.

2.3.2 Indirect value

It is not quite as straightforward to provide numbers around the indirectly added value. A direct link between use of technology and organisational performance is concluded to be problematic and even misleading (Kang, O'Brien, & Mulva, 2013). Important is to change the methodology against operations and not the technology itself (Kang, et al., 2013). To gain better benefits from IT development, redesigning the business practises and using the templates available in the software is crucial. Kang et al. (2013) argue that technology needs to be aligning with the construction management work processes. In that way the information in the projects can be shared across the organisation, and work processes can be analysed and, as a result, issues in the processes would be fixed and new opportunities could be found to improve work. According to Kang et al. (2013), process analysis should be a key step in the development of an IT strategy. The use of IT and related processes should be treated as complementary, where both the digitalisation and operations should influence each other to achieve value in the projects.

Waste management is another important factor in the construction industry. Digitalisation can be used for waste management to decrease the material waste (Liu, Osmani, & Baldwin, 2015). The value from digitalisation comes especially from BIM and its benefits. Sustainability and the environmental aspects have become a main factor in construction projects, and there is a high focus on minimising the material usage. Research on the UK market indicates that waste generated from construction and demolition activities makes up 32% of the total waste generated in the country (Liu, Osmani, & Baldwin, 2015; Ahankoob, Khoshnava, Rostami, & Preece, 2012). Other research indicates that the waste generated in construction is 44% of the total in the country (Liu, et al., 2015). Due to bad data, the numbers are hard to define, and it is a challenge for the waste management to handle. The use of BIM can reduce waste in many ways such as reduced rework in the construction phase, synchronized design and site layouts that minimise the numbers of additional handling and moving, and quantity take-off give correct quantity and, therefore, materials are not overordered (Liu, et al., 2015; Ahankoob, et al., 2012). BIM gives the highest potential positive impact on waste minimisation in the design phase (Liu, et al., 2015).

Another aspect is the inappropriate work planning, that lack communication between workers and supervisors, and insufficient safety training are key factors to a high number of accidents and injuries (Azhar & Behringer, 2013). Great efforts have been made and tougher laws from the government have been enacted, although no significant decline has been identified (Azhar & Behringer, 2013). BIM is found to reduce the number of accidents and to increase the safety on-site (Sulankivi, Kähkönen, Mäkelä, & Kiviniemi, 2010). The BIM technology can be applied on excavation risk management plans, crane management plans, fall protection plans and emergency response plan models (Sulankivi, et al., 2010). The technology can increase safety by bridging the safety issue closer to the construction planning, better visualisation of the safety plan, increased safety communication in different mediums and warning about risk that can be found in the project.

2.4 Implementation

BIM, and digitalisation in general, entered the market in the mid- to late 2000s. One reason for this new approach came from the need to tackle low construction productivity and obstacles that hampered innovation in the sector (Won, Lee, Dossick, & Messner, 2013). It has its struggles, and, in the beginning, progress was mostly by trial and error. Implementation has been hard and has faced challenges. Various reports indicate different types of challenges, but three issues when implementing a new technology have been identified as main obstacles for path adoption (Young Jr., Jones, & Bernstein, 2008). To increase the knowledge and understanding of digitalisation, the main challenge is the

industry. This is rooted in the struggle to provide adequate training for the employees. Partly, this is due to few people in an organisation or project having adequate knowledge of the subject. Cost is also viewed as a major obstacle in the implementation of new technology, there are often high costs associated with software and required hardware upgrades. At last, Young Jr et al. (2008) argue that higher in the hierarchy it is harder for the people to embrace digitalisation on their agenda. Senior management buy-in is considered one of the greatest challenges in making digitalisation part of the strategies. The reason for this is that senior managers are often in higher positions and have on their agenda to justify costs and efforts linked to digitalisation. Senior managers are also “used to doing things a certain way” and struggle to change directions. This is in contrast to junior staff, who are considered to be the least challenging. This is due to junior staff being in fewer decision-making positions and still learning the industry. They are, thus, more likely to try new methods and practices. Junior staff have generally also been exposed to digitalisation during the college education that, in most cases, involve these questions.

Major parts of the groups that have been working in a digital project with BIM as a central pillar, want to stay in BIM projects (Chelson, 2010). In the study Chelson (2010) presents, experience of the working strategy with BIM reveals that 90% of the users do not want to go back to the traditional model in managing projects. The resistance against adopting BIM is often built on people who have not tried the method yet. One reason for the low scale of implementation comes from the lack of skilled people that know BIM and digitalisation (The Chartered Institute Of Building, 2010; NBS, 2017). People with a digitalisation focus, should have a responsibility to implement digitalisation and innovative tools. The challenge is that there are people in the projects that need to change a behaviour that is deep rooted in the project working strategies.

Implementation of new work processes or strategies has always been hard for organisations to handle. To call a technology adoption successful or not depends on many factors (Won, et al., 2013). The first part is the need to get all employees onboard and to strive towards the same goal in terms of innovation. Organisational factors, such as maintaining corporate culture and a relation between the people involved, affect the development process. The project-based structure also increases the complexity in achieving change and innovation for the construction industry. Additional factors that affect the implementation processes are legal precedents in the industry, communication density, organisational barriers and the individual employees' resistance to change.

Inter-organisational innovation is considered to be an obstacle in the adoption of digitalisation (Won, et al., 2013). The potential from increased digital innovation falls short and does not function as well as it could. Significant inter-organisational barriers are poor collaboration among participants, poor interoperability among BIM software and lack of subcontractors who can use BIM technology. Won et al. (2013) argue that inter-organisational innovation is important to manage in order to change the working strategy and method in the organisation. One of the critical success factors that need to be managed when implementing digitalisation and changing the structure of projects is the collaboration to success (Chelson, 2010; Won, el al., 2013).

The Swedish construction industry is lagging behind in terms of digitalisation compared to other industries (Svensk Byggtjänst, 2017). The report also strongly indicates that a majority of the companies strive to increase the level of digitalisation. More than half of all Swedish companies find digitalisation to be positive for the organisations and in larger companies more than 75% find it positive. Companies do not always consider digitalisation as an income source, but rather a means to increase savings (Svensk Byggtjänst, 2017). Even if the construction industry has an ambition to move towards BIM and a digital method, the education level is low among the employees and few education packages are offered around

the subject. A reason for this is the low level of offered digitalisation services in the construction industry. An observation is that larger companies in more cases offer digitalisation services (Svensk Byggtjänst, 2017). To ensure competitiveness, the study that Svensk Byggtjänst (2017) provided, indicates that digital questions are required to be managed by the CEO of the company and as a central pillar for the board of directors.

Azhar (2011) argues that the low numbers of BIM projects are an indication of implementation problems in projects. The study from Svensk Byggtjänst (2017) gives strong signals that BIM is still not implemented on a larger scale. Kang et al. (2013) argue that there are two probable reasons as to why organisations achieve limited advantages from technology. Firstly, most of the decisions that are needed for IT investments are based on the instincts of upper management, with little or no concrete data. Secondly, innovations tend to focus on the technological aspects of the projects, instead of taking advantage of the change and adjusting the operations. In Swedish companies, the attitude is positive but what is missing are the strategies and understanding of the implementation processes. More importantly, to overcome the static position, are clear guideline definitions to follow during implementation (Azhar, 2011). The issues are that the management in the projects cluster around the questions of how to push the implementation in the right direction. Project organisations have, in most cases, employees with an ambition to drive the questions forward and, in other terms, increase the level of digitalisation. Obstacles the organisations face are a low level of structure and working strategies for how to establish new digital methods. Findings by Azhar (2011) indicate that project groups are looking for clear consensus on how to implement and work with digitalisation. Central strategies are important to boost the development of digitalisation in the projects ahead. This is even more important in order to drive the development together in the same direction. In the end, this is done to turn out with the largest potential value adding processes in focus.

2.5 Change management

Implementation of digitalisation and a move to digital processes includes a significant change within the organisations. These changes are not just affecting the top organisation, but just as importantly, in the projects. The daily work for the individual employee changes dramatically as a result of increased digitalisation. The application and medium used for work platforms are not the only change in the organisations. A difference that is even harder to manage is the operational change of the day to day work. It can be a complicated process, especially when changes only happen if there is a clear indication that it will bring benefits to the organisation or the employees that need to change behaviour (Merschbrock & Nordahl-Rolfsen, 2016). Therefore, it is important that the company is shown the benefits and why change is needed. If not, the company will struggle with resistance among employees. Additional sources of increased resistance include the fear of the unknown, as well as employees experiencing a lack of knowledge in this new domain (Erdogan, Anumba, Bouchlaghem, & Nielsen, 2005)). The research also shows that employees feel threats to their status and, thus, find it hard to see the benefits of the changes.

Change management in organisations and internal communication with people responsible for the processes are important concepts in the basics of handling change (Erdogan, et al., 2005). The research argues that this gives rise to a connection between how people act and think, and the effective approach to attack this is with communication and employee empowerment. By strategically managing change with good communication and strengthening the empowerment of the individuals, the operations will result in a positive outcome.

The balance between the internal system and the wider system, which it is a part of, must be managed in order to maintain a strong position in the market (Hayes, 2018). This is crucial

to all types of systems prosperity, but it has not fully worked in the construction sector. Actors within the construction sector have been working with digital change and have seen a willingness to embrace these innovations. A problematic part with this change has been controlling and achieving change. This is rooted in a lack of experience, training and knowledge of how to implement the work processes (Matthews, Love, Mewburn, Stobaus, & Ramanayaka, 2017). Change management should therefore focus on defining and implementing procedures that can deal with the digital innovation in the organisations.

Processes for change in an organisation can be managed by a process model that provides a conceptual framework, used by individuals to manage change processes (Hayes, 2018). The models help identify issues that need to be handled in order to secure the desired outcome of the goal. The model also has the ability to identify how well the process is going and how to improve the performance. Hayes (2018) has divided change management into seven core activities:

1. Recognition and start
2. Diagnosis
3. Plan
4. Implement and review
5. Sustain change
6. Leading and managing the people issues
7. Learning

The change process is divided into seven elements, because decisions and actions tend to have different targets in the process (Hayes, 2018). The model is often interactive and is not always following the linear sequence above. The first step focuses on recognising the need for change and to understand the start. Diagnosing is the element considering the change required and where a vision is created. In the third sequence, focus is on planning and preparing the organisation for change. After the planning phase, implementation takes place, as well as review of the progress. The fifth sequence contains important steps for maintaining the change. During these steps, it is important that the leadership leads and manages the people's issues and gets an understanding of the nature change during the process.

Alternatively, change management can be handled using another framework. An approach where change is handled with a top to down approach or a bottom to up approach (Kobus, Westner, & Strahringer, 2017). The top to down approach, also named as the traditional, is deficit based and has the ability to only fit what is wrong in the processes. The upper management has ownership of the implementation of change and pushes the outsiders that are associated with the problem away. The bottom to up approach instead is an asset-based approach where the focus is on the community. While the implementation takes place, the community holds ownership instead of the leadership. The approach minimises social distance for the changing process and includes all parts of the process.

2.6 Organisational change

M. Bosch-Sijtsema, Gluch and Anil Sezer (2019) gives clear indications that digital roles is a positive development in the industry. In relation to this, Malmkvist (2013) finds that Digital roles in construction organisations are close to a must in the organisation scheme but, in the future, digital roles may not be needed to the same degree. Today, digital roles have the purpose to push development of digitalisation forward. Malmkvist (2013) argues that, in the future, traditional roles need to change daily work towards a digital way, and in that way, the number of digital roles can be reduced. Fewer hours invested in digitalisation is necessary to increase profitability (Malmkvist, 2013). Employment of people with digital

skills is an important resource for innovation and, in the construction industry, to increase digitalisation (Davis & Harty, 2013).

A study on Swedish construction companies, indicates large gaps between IT departments and the operational business (M. Bosch-Sijtsema, et al., 2019). This gap of knowledge has developed tensions between these two groups within the construction sector. Still, expertise in IT is a success factor for organisations in order to handle the change in processes (Bosch-Sijtsema & Gluch, 2017). Malmkvist (2013) gives indications that this change process can result in new organisational cultures and probably another type of leadership. M. Bosch-Sijtsema et al. (2019) found that digital roles have developed differently in different companies and countries. In almost all companies and projects, digital roles are established, but in most cases, undefined and lack a clear identity in the organisation processes (Bosch-Sijtsema & Gluch, 2017). Even if no direct identity is detected, a view is that these people are support functions with great technical knowledge.

2.7 Digital transformation

Technology itself, integrated in companies, is one part of the complex puzzle of understanding a transformation in digitalisation (Vial, 2019). To continue being competitive as a company in a digital world, Vial (2019) argues that it is important to have digital strategies. Companies across major parts of industries explore digital technologies and define benefits and value in technology itself (Matt, et al., 2015). But technology affecting business operations, work processes and organisational structures, and therefore digitalisation being a complex transformation for organisations (Matt, et al., 2015). To handle the digital transformation there is a need to establish a digital transformation strategy. This approach serves a central purpose, defining how to deal with coordination, prioritisation and implementation of digital changes. This strategy should cut across other business strategies in the organisation and be aligned with them to entail a clear development.

Digital transformation builds on changes and transformations of digital technologies and involves business processes and practises for organisations to handle a new digital world (Matt, et al., 2015). It will enable major business improvements, increased value adding activities to the client and create new business models. Change entails a shift that brings big data, analytics and cloud platforms in focus. A continuous change in technology and a digital transformation requires an understanding that it can entail in changing business landscape (Matt, et al., 2015). A digital transformation strategy is the alignment between IT and operational businesses, and an important part in pushing digitalisation forward.

3 Method

A thesis can be conducted in different ways and a lot of approaches can be used. For the subject that has been investigated, the research approach most suitable is the qualitative approach. A semi-structured interview study has been carried out in combination with different types of observations, to increase strength for the outcome. In this chapter definitions of chosen methods of research are presented, as well as an analysis of collected data.

3.1 Background of selected methods

The research approach was based on a qualitative approach, where semi-structured interviews were conducted in the company under consideration. For the research purpose, this strategy was adopted to increase understanding of underlying motivators in the area. Fundamental and key factors to qualitative research is the analysis of social interactions from respondents, by their own words (Merriam & S. Grenier, 2019). As argued by Bryman and Bell (2011), a qualitative approach is a subjective method: for this reason, it is chosen as suitable for this thesis. There are different ways to carry out qualitative research, but according to Jamshed (2014), the most common method to collect data is by doing interviews. To reinforce results from interviews, observations are also included in the thesis. Observations also belong to a research method with a qualitative approach (Jamshed, 2014).

The structure of a research project is often divided into two different approaches: deductive and inductive (Saunders, Lewis, & Thornhill, 2016). A deductive approach constructs a hypothesis based on what is known. This is considered a theoretical base (Bryman & Bell, 2011). The hypothesis is then tested, and, in that way, conclusions are formed. An inductive approach is opposite to a deductive approach (Bryman & Bell, 2011). An inductive approach focuses on empirical data to form conclusions. This thesis has used a combination of the deductive approach and inductive approach, known as an abductive approach (Saunders, et al., 2016). An abductive approach focuses on both a theoretical framework and empirical data. This provides an opportunity to form conclusions in both empirical findings and theories.

3.2 Empirical data

In order to achieve high quality results, 13 interviews were conducted in a semi-structured approach. All interviewees work for a large construction company in Sweden and operate from different organisations in the company. The reason for this was to get a general picture of the whole company. Interviews were conducted in Swedish and then translated to English before the analyses of the result. The interviews lasted between 45 and 90 minutes and included a combination of closed questions and open-ended questions.

Interviews can be structured, semi-structured or unstructured, where the differences are the structure of questions and opportunities for respondents to answer. Semi-structured interviews present respondents with predetermined open-ended questions, allowing the interviewer to ask supplementary questions (Lantz, 2013). This was the reason for the choice of semi-structured interviews and provided more opportunity to have a dynamic dialogue. Jamshed (2014) argues that this method, with open-ended questions, gives depths in respondents answers. Questions for the interview were sent out to respondents two weeks ahead, to increase the value of the result. To increase the reliability and efficiency of aggregated data, recording interviews is considered as a good option. Recording can, according to Jamshed (2014), be controversial between the researcher and respondent and it had to be communicated.

Spontaneous observations were conducted with people of interest. Also, observations were made on site, as the author has been working on a project with these digital questions during last year.

3.3 Research ethics

During the period of this thesis, an ethical aspect has been under consideration, from start to finish. Especially during the interview phase ethics, the author of this thesis has kept the subject under consideration. Ethical principles often revolve around multiple of issues and can be divided into four main areas (Bryman & Bell, 2011):

- ❖ Harm to participants
- ❖ Lack of informed consent
- ❖ Invasion of privacy
- ❖ Deception

In order to minimise the issues within these areas, certain actions were taken in the interview phase. All interviewees received information about the subject, an introduction to the thesis and purpose of the thesis. Before the interview started, a question was asked whether it was accepted to record or not. Additionally, it was clarified to the respondents that the interview conducted anonymously. Interviewees also received a question sheet in advance to enable preparation and decrease stress.

During literature study and report writing, the main principle taken into mind was the honesty of data, meaning the report is free from fake data. Actions of carefulness, objectivity and social responsibility have been taken to minimise mistakes during research and writing.

4 Result and analysis

This chapter describes results from the empirical data collected in interviews and observations. There is also a short description of the studied company.

4.1 Digitalisation in the studied organisation

The studied company is one of the largest construction companies in Sweden. They operate in different areas such as, infrastructure, housing and commercial real estate. The organisation is structured in three business divisions named *Industrial Solutions*, *Civil* and *Building*. The civil and building divisions are project-oriented and are, in comparison to the industrial solutions division, subjects of greater focus in this thesis. Each of the divisions consists of several regions. Only regions, as well as support functions, overlapping with the interview subjects' fields of work were considered.

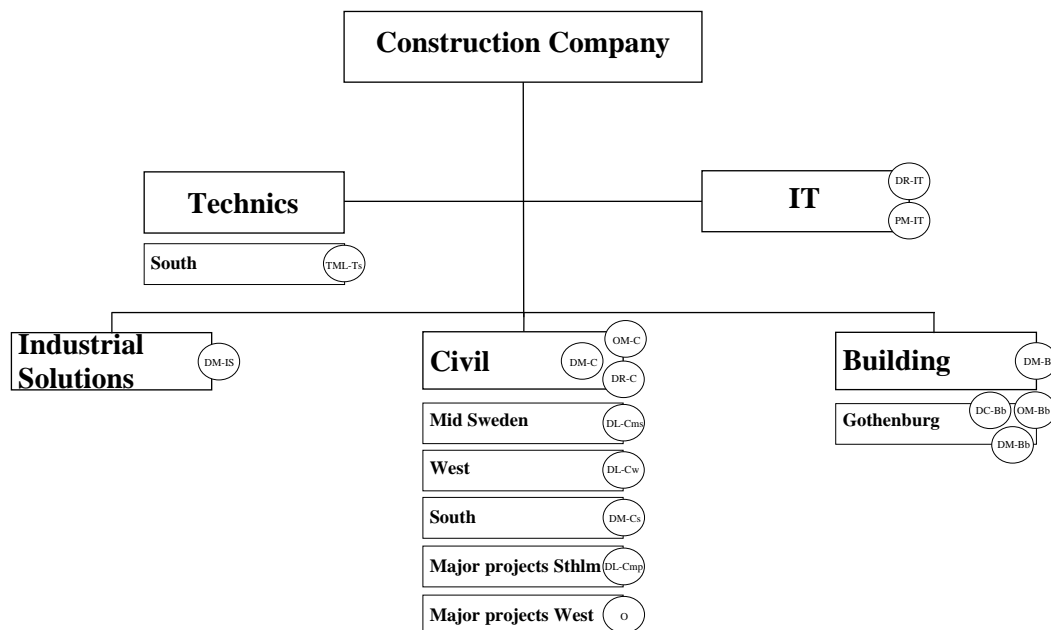


Figure 1 - Organisation scheme on studied company

In the company, there are suggestions that top management understand that digitalisation is important in order to continue being competitive in the industry. The company has a vision to be the industry leader in digitalisation, despite internal research concluding that strategies for digital development are non-existent from top management.

The lack of strategy has led to various initiatives within the divisions. *The industrial solutions* division does not mention anything about digitalisation guidelines, strategies or goals. In the operations of *the civil division*, increasing profitability and safety are priorities. Within this division, the opinion is that digital tools should be used to simplify and improve the work processes. No strategies or guidelines are identified within the division, but roles with digital responsibility occur. In the organisation, these roles are called *digital leaders* and are often carried out in addition to a primary role. Digital leaders currently lack clear role descriptions and their tasks vary. *The building division* has established a method called “Smart Projects” which includes strategies and guidelines for projects carried out this way, the idea is to actively work with digitalisation of operations. Similarly, to the civil division, the role of digital leader exists, albeit with no role description. There is also an additional role within this division, called *digital coach*. These roles are well established, and all projects have a digital leader. The role of digital leader is carried out in addition to a primary role and is supposed to support projects around digital questions. The role of digital coach

is a central function and operates across a region, covering multiple projects. Costs for the digital coach are often accounted for in the region budget. On the company intranet there are role descriptions for both digital leaders and coaches within the building division.

4.2 Interviews

This chapter describes result from the empirical data contributed by 13 interviews. In Table 1, all interviewees are presented with their work title and organisational orientation.

Table 1: List of interviewees taking part in the interview study

Title	Organisation	Coding
Development Manager, Digitalisation	Building	DM-B
Digital Coach	Building – Gothenburg	DC-Bg
Development Manager, Business development	Building – Gothenburg	DM-Bg
Operational Manager	Building – Gothenburg	OM-Bg
Development Manager	Civil	DM-C
Development Responsible	Civil	DR-C
Operational Manager	Civil	OM-C
Planning specialist / Digital Leader	Civil – Middle Sweden	DL-Cms
Design Manager / Digital Leader	Civil – Major Projects S	DL-Cmp
Production Manager / Digital Leader	Civil - West	DL-Cw
Development Manager	Industrial Solutions	DM-IS
Process Manager, Construction	IT	PM-IT
Development Responsible	IT	DR-IT

4.2.1 Organisational structure

The building division within the company made a dramatic change three years ago, reshaping the organisational structure. New roles were introduced at different levels to deal with digital change. These roles came from an insight at top-management of the building division that challenges, and opportunities, had to be handled in all regions and projects. Even though many roles are new and have been shaped during these years, there is an overall agreement among respondents operating in the building division (PM-IT, DC-Bg, DM-B, OM-Bg, and DM-Bg), that the change comes with positive effects. There were also strong indications from all interviewees that more roles with digital responsibilities are needed for the projects to deal with new technical areas and change processes, but ideas for how these roles should be constructed varied. All interviewees argued equally that investments were necessary on a project level as well as a strategic level. DC-Bg, DL-Cw, DL-Cms, and DL-Cmp, tightly linked to projects, called for an increased level of digital oriented employees.

“We need new types of roles in our projects. Our existing roles need to change and hold a new type of knowledge.”

OM-C

In the change in organisation structure, two new roles were introduced and now being used in *building division*, named digital leader and digital coach. Depending on regions across the country, digital coaches have different work descriptions with different approaches, but according to OM-Bg one of the main tasks is to coordinate a network for digital questions within regions and the divisions. A network both within the region but also a network between all digital coaches across the division, to share experience and further knowledge. DM-Bg also indicated that digital coaches are important for the organisation and argued that the digital coach is a central function for the change process. DM-B argued that the digital coach has increased the speed of change dramatically. From a coach's own perspective, it is all about understanding where digitalisation creates benefits. Fundamental for the digital coaches is to have digital leaders across all projects. There should be at least one digital leader in each project, and it is an additional responsibility on top of an already existing role, often a supervisor. Through the coach, digital leaders can establish a network of information across projects enabling knowledge and experience sharing. DM-Bg explained that digital leaders add close support and knowledge for all project members.

Compared to the building division, the civil division only has digital leaders, OM-C argued that digital leaders in civil work as “spiders in the net” and try to coordinate digital development. Digital leaders have more responsibilities in civil, compared to the digital leaders in *building division*, fewer than a digital coach. According to all interviewed digital leaders DL-Cmp, DL-Cw, and DL-Cms, there is still no role description and it is much up to the employees themselves to understand what is needed. Both digital leaders from *civil* DL-Cw and DL-Cmp explained that their time is not enough, and it is hard to find time for questions regarding digitalisation. There is a clear indication from all interviewees operating in *civil* that a change is needed, and more digital roles are needed. OM-C argued that new types of roles and a change in today's roles will come, where another type of information and knowledge is needed.

“We need to see IT as a competence centre and not just a support function. I wish our division would look closer to IT and try to get a better collaboration between the IT department and operational organisations.”

DR-IT

Both interviewees from *IT department* PM-IT and DR-IT implied there is a gap between the *IT department* and the operative *divisions*, lack of communication and cooperation, and argued that this is an obstacle which must be faced. DR-IT thinks that the operational business must stop using IT as a support function and instead as a competence centre. None of the divisions are trying to minimise the gap, and a change is crucial to achieve digitalisation. OM-C and DM-C argued that there is a low level of collaboration. Due to lack of knowledge within the divisions, DM-C concludes that a collaboration must be made on another level with IT. PM-IT experienced that digital coaches in some cases acted as a link between the divisions and the IT department. At the same time DL-Cmp and DL-Cw both experience a lack of cooperation in the projects with the IT department. DR-C argued that some IT employees need better project orientation. In terms of competence, they should belong to IT but operationally operate in projects. This gives two belongings, one where competences fetch and one where competences are spread.

“It is appropriate to put the costs on digital coaches central and costs for digital leaders in projects.”

PM-IT

Low margins in the construction sector have affected the development of digitalisation and, therefore, questions arise about where digitalisation costs should be placed to provide the best results. Interviewees agreed that subsidisation is a good method to deal with resistance in the industry, but it is important to handle it with care. Otherwise, there will be no effect. DM-B considered the results to be better in regions where the digital coach is funded by the region and not in the project. OM-Bg argued that operative work must be funded by projects and, therefore, digital leaders are funded by projects. Support in projects can be moved to the region, which provides a resource to be used in projects. According to a digital coach DC-Bg, it is important to handle subsidisation right and understand why and when it is okay to remove costs from projects. DC-Bg argues that reduced costs in terms of subsidisation, can lower incentives to get return on investments, as it does not affect the project budget. On the other hand, incentives can increase, since subsidisation generates opportunities to invest in digital change. DC-Bg also explained that a digital coach is a role that is established in the company in order to handle digital change. When the organisation handles the digital development in a good way, DC-Bg believes that digital coaches would not be needed.

4.2.2 Implementation of digitalisation

Regarding implementation guidelines for tools and work processes, interviewees indicate that guidelines for implementation are in most cases non-existent. PM-IT explained that the *IT department* is not involved in the implementation phase. Their responsibilities are to enable implementation for the projects. PM-IT implied this is an obstacle in order to deliver good change processes and argued that IT must be more project oriented. Interviewees argue that implementation processes are separated between the *IT department* and the *operative divisions*, with low collaboration between them. PM-IT argued that project organisations often lack knowledge about change management and IT technology. Ambitions from all interviewees indicated that project organisations are looking for a closer collaboration with the *IT department* to be able to share ideas and experiences to improve results.

“Since we are a large company, there is a default mindset in the organisation. When we are developing something new, we turn inwards and look at our resources. Compared to start-ups, you turn your eyes outward and try to find someone that can solve the problem.”

DM-B

DM-B argued that the underlying meaning of this statement is that “large companies” cannot always argue that they are large. Slow decision making is often a defining characteristic for these types of organisations and, according to DM-B, the organisation should instead take advantage of being large. Economics of scale is needed in large organisations. If not, overheads are just an increasing cost and not value adding.

“Digitalisation is generally positive but an unstructured approach to information management could have a negative influence on the workload.”

DR-C

Interviewees understand that there is a need to understand why and how implementation should be structured. Even if there is an understanding of the importance of establishing central implementation strategies, they do not exist in the company. Implementation and monitoring of tools and work processes are handled differently between divisions, regions and projects. The *IT department* helps regions to obtain statistics on the number of users of different tools, but the most important monitoring is required in the projects themselves. Follow-up on the actual value adding from a change, depends on the individual employee in

the projects and whether there is a willingness to do so or not. DM-B argued that monitoring change might not be a priority in an organisation with a low level of digitalisation. Instead, DM-B, argued that a focus should be on increasing the level of digitalisation and understanding the right direction to go. DR-C instead argued that not all digitalisation is good, and it must be structured and evaluated before implemented.

“The challenge is not in the office, but rather in the projects.”

DC-Bg

All interviewees agreed that education and training should be placed close to the project organisation. It is important to get all involved people in the organisation onboard and let the change process transform the work and add value. It was found important for the company to increase the breadth of knowledge. The region Gothenburg under the building division indicated that this breadth is more important than the depth of knowledge for a small highly skilled group.

4.2.3 Value from digitalisation

Interviewees' understanding of value adding factors from digital change is fragmented in the analysed organisation. Some interviewees argued that all digitalisation is good for the construction industry, as opposed to the view that not all digitalisation is good, held by another portion of the interviewees. Even if the value adding analyses are fragmented, the majority thinks that digitalisation in the future can create new types of values.

“Digitisation, when we just change medium, is not value adding for the organisation. We do not agree on the difference between digitisation and digitalisation.”

DM-C

There seems to be a lack of understanding of the differences between digitisation and digitalisation. Almost all interviewees express their thoughts around digitalisation, but digitisation is mentioned less frequently. DM-C argued that there is a lacking understanding of differences between digitisation and digitalisation. However, the subject argues, this understanding is important when considering the value in the context of digital change. To improve digitalisation in organisations, DM-B believed that the first step must be to digitise the operations. This may not improve savings or generate value for the region or project, on the other hand, it enables the ability to begin the process of digitalisation. DM-B explained that digitalisation increases the value and that accepting that digitalisation is today's trend in our society is crucial.

“A digital process with self-controls has added value. A miss can cause major damages and increase cost. In the end, avoiding one miss can save costs equalling a whole employee.”

DM-Bg

All interviewees indicated a positive attitude towards digital change, but the majority was not able to put concrete numbers on the level of added value. It is understood that digitalisation can help avoid excess costs by minimising risks from design and production misses due to lack of communication and organisation structure. Despite interviewees favouring digital change, a majority question the concrete numbers of added value. Interviewees operating in IT department and developing teams have an understanding that digitalisation does not necessarily provide direct value for investments in projects, and intrinsic value is not always the only value. In the operative business, employees with a

digital focus (DL-Cmp and DL-Cw) struggle to argue for the increased cost of digitalisation and its value. DM-B argued that the next step is to get middle management on board and to help them understand the value-adding factors from digital change. Interviewees agreed that there is a high level of engagement among project members, but due to the importance of delivering good results, it is sometimes hard for project managers to motivate digital investment.

A major focus area for the organisation is information management. There is a clear view that information is becoming a new type of value for construction companies. It is still unclear, and most interviewees cannot point to the exact value information brings. In the organisation, there are ongoing information projects, an indication of an understanding that information management is the key to success. Even if understanding is growing, digitalisation processes do not have the information focus and instead focus is on tools and change in work structure. DR-IT argued that the construction industry needs to see information and data as an asset instead of a problem.

“One type of development can be wrong in a long-term information perspective but can be the best alternative to develop employees today.”

DR-C

DR-C explained that in some development areas there is, during periods, a need to separate processes in order to manage change. In the digitalisation area there is a need to educate project members, as a result of lacking experience in digital processes. DR-C continued to explain that some tools and digital changes being implemented have clear dead-ends and this is important to understand. Even if a tool or application is great for the organisation in question, in its future, it may be replaced with something that can bring more value for the work process. There is an understanding that information and data will be valuable in the future and DL-Cms believes that data can develop new ways to earn money. Added data in a structured way can increase the value that is handed over to the client.

The interviewees explain that employees in the projects have low trust in digital data and choose to disregard it. Instead, information is produced in such a way that it is considered trustworthy, in the traditional way, leading to the data being presented in two different ways. This has resulted in twice the amount of work. DM-B argued that next, focus should be to make all data coherent and work together. If the information is coherent, it will open up opportunities to trust all data and, in a second stage, be able to start analysing and processing information.

4.2.4 Digital strategy

All interviewees explained that the structure of implementation and change toward digitalisation leaves much to be desired, and that it is rooted in a lack of strategy. When asking about digital strategies, it is explained that central strategies lack the digitalisation part, and that digitalisation is just mentioned in the vision. DM-B explained that an organisation must have a strategy and that, due to a lack of a central strategy, the *building division* produced one for themselves. DL-Cms, DR-C, DM-C, DL-Cmp, and DM-B gave indications that a central strategy from the company is needed.

“In the short-term, operative managers are responsible for digitalisation. In a long-term perspective, there are no responsible groups and we do not have any strategy to rely on.”

OM-C

OM-C indicated that, as a central function for digital development in the *civil division*, it is difficult to understand how and what to do. As a result of a missing long-term perspective from top management in the company, it is hard for the divisions to understand the company's needs. DR-C says that digitalisation must operate from a central perspective and cannot be managed differently in the divisions.

All digital leaders (DL-Cmp, DL-Cms, and DL-Cw) from the *civil division* explained a feeling of uncertainty regarding digitalisation. DL-Cms argued that digitalisation is perceived as fuzzy, sprawling and with no clear direction for the change process. DL-Cmp says that the organisation needs to know what to do and not digitalise in all corners without a long-term plan. DL-Cw misses clear directives and is feeling abandoned by the region's leadership. According to development manager DM-C, the company is pulling in different directions and is trying to digitalise, but in doing so, DM-C argued, the organisation does not improve. The company lacks awareness when it comes to change management and individual employees have been free to run in their own direction.

"We need to find scale advantages as a large company. Overhead costs must provide scale advantages."

DM-B

DR-C argued that a long-term strategy is not just important for understanding the way ahead, it also helps managers to make decisions on what is acceptable to do. This clarifies the change process for the entire organisation and helps everyone pull in the same direction. With a long-term strategy, DR-C explained that an organisation will know that it is wrong in X number of years. Therefore, the strategy gives something to relate to and track progress, and in that way calibrate the change process over time, to increase value. DM-B also argued about the importance of working similarly, to run an effective organisation. If not, it is hard for employees to go between project organisations and, DM-B explained, that this effect scales advantages negatively. DM-B continued that overhead costs must indicate scale advantages. Large companies often have higher overhead, but if not handled properly, it will not generate advantages against smaller companies with lower overhead.

"It is important that we have industry-wide standards and in that way, we can focus on the right things."

DM-IS

DC-Bg, OM-C, DM-B, DM-IS, and DR-C argued that not everything connected to digitalisation must be developed in the companies themselves. Instead, industry-wide standards are needed. PM-IT believed that a single company does not have the ability to "solve the digital problem". PM-IT argued that companies need to elevate the industry together. OM-C thought there is a need to cooperate with clients and maybe find new forms of contracts between the client and the contractor.

4.2.5 Tools and operations

The organisation in question indicated uncertainty in the use of available tools and related operations linked to these tools. PM-IT, DM-C, DL-Cmp, DM-Bg, DR-IT, OM-C, DM-B, and DR-C all argued that the choice of tools for a project is not obvious and differs from project to project. There is a lack of requirement for what tools should be used in the context of digital tools. PM-IT explained that the company works in different silos, where integration between tools and work processes is non-existent, and that the development of tools and methods is carried out individually. DL-Cmp believed that work processes must be adjusted in combination with the development of new tools and applications. DL-Cmp

also believed that there are too many available systems in the company, which creates a non-manageable situation.

“Projects themselves decide many times what tools should be used and which work processes will be applied in the organisation. It is a must for top-management to set requirements, provided there is increased value. This value may not be found in the project itself. There is a need to understand the entirety of the organisation.”

DM-C

DM-C argued that a shift in the structure of projects is needed. There has been an overall freedom for project groups to organise work structure in their own way and it needs regulations from top management. DM-Bg believed that project organisations must be guided in the right direction, and requirements put on what tools should be used and in which way they should work. OM-C believed that interaction between tools and work processes are something the company should discuss. OM-C also argued that work processes need a higher focus on the change process. DM-B explained that a company with the same applications and routines across the organisation provides economy of scale.

“It is dangerous to stick with a supplier of apps, and it is important to change focus to work processes. An organisation should be confident in their operations, so a change in apps or an app supplier do not matter for the organisation.”

DL-Cms

There is awareness among some employees that a change in focus from tools to work processes is needed (DL-Cms, DR-C, and OM-C). DL-Cms argued the importance of putting work processes at the core, and the need to develop these processes around the organisation, rather than around the applications. In this way, tools can support a work process and develop the organisation in a way bespoke to them. DR-C argued that the requirements of information should advise the development of the tools. In that way, DR-C believed the approach on digital development could be changed. Many employees come from a tool-oriented background and DR-C believes that it does not solve all challenges. DR-C argued that there is a need for multi-dimension usage, where information can be accessed from all platforms and tools. DR-C explained that projects today address the information needs of the product. Instead, information should be handled by the needs of the business. On the other hand, OM-Bg explained that tools have increased knowledge among employees about certain sequences, such as self-controls and deviation. Information in these sequences are structured but the flow of information between these tools is not working.

“Increased usability of tools is of high importance. They are not as good as they should be.”

DL-Cw

Interviewees indicate that education about digitalisation is of high importance to continue the change process moving forward. PM-IT, DM-C, DL-Cmp, OM-Bg, DL-Cw, DL-Cms, and DC-Bg argued that digital education is needed to develop project members and work digitally. They believed that micro-training is the best choice for the most value. It should be conducted closely to the projects and apply relevant parts that directly affect project members. DM-C agreed on the importance of micro-education but explained that a digital tool would be self-instructional, this is not the case today. DM-C continued arguing that applications need to get better in terms of usability. PM-IT, DL-Cmp, OM-Bg, and DL-IS

also argued the importance of usability as an important aspect to increase usage and added efficiency from digital tools.

4.3 Observations

This chapter describes result from the empirical data collected by observations in the studied organisation. In Table 2, interviewees are presented with their work title and organisational orientation.

Table 2: List of people referred to during the observational phase of the study

Title	Organisation	Coding
Design Manager	Civil - South	DM-Cs
Technical Mission Leader	Technics - South	TML-Ts

4.3.1 The aftermath of a digital pilot project

The company under consideration conducted a pilot project together with a large Swedish client 2012, in order to increase knowledge and experience of digitalisation (Malmkvist, 2013). Observations at organisations that were involved in this project gave indications that the pilot project has changed work methods and the way digitalisation is viewed. TML-Ts explained that the south regional office under the *technical department* changed the work method after this project. TML-Ts argued that collaboration is important and that it is a greater collaboration between the consultant, client and contractor today, thanks to the pilot project. TML-Ts explained that an obstacle often is low customer trust, but he finds that the client is confident in this work method.

TML-Ts and DM-Cs explain that the use of models instead of drawings, in all stages, is the basis of the work strategy. Models are adapted for production and clients agree to review these models instead of drawings. DM-IS explained that the production teams are positive about the work processes and argue that digitalised model-based production increases value. TML-Ts believed that there are three important parts to make this process work:

- ❖ Design phase is production oriented
- ❖ Production team is engaged early in projects and understands the importance of digitalisation.
- ❖ Clients agree on digital change and accepting to work with these models.

After, a production consultant still has to transform the model into 2D drawings since the clients normally do not know how to store the file format. Even if this is extra work, TML-Ts argued that it still gives more value than working with 2D drawings from the start.

TML-Ts explained that the southern office of the technical department, is the only that has changed the work processes to a new, digitalised, structure. There are other offices in the company that have ambitions to follow but according to TML-Ts there is no time or knowledge to successfully carry out this change. Overall, there is not a lot of experience sharing between regions and the divisions, and therefore, lacking knowledge in how change in the work processes should proceed.

4.3.2 Attitudes towards digital change in projects

A positive attitude in the organisation towards digitalisation is clearly seen. Visits to projects indicated that many employees have an interest and curiosity in digital change. Among employees of all skill-types, who have not utilised digital tools or work processes before, most show a positive attitude towards the technology field. Observations gave evidence that an understanding of digital questions is of great importance. Tensions between high-tech employees and analogue-minded people have caused growing frustration. Lacking guidelines and education for employees causes frustration and struggles to solve problems that occur.

The greatest resistance towards a digital trend in operative work comes from top management in project groups. In some cases, there is greater resistance from this group, and often more questions why this change is good for the industry. Many times, this group is not against the digital trend that is pushed into the industry, but, however, numbers supporting the climbed efficiency is asked for. Top managers in project teams look for efficiency and need to rate the return on an investment, in this case digital investment, such as, an increased number of digital roles, software, hardware and digitalisation educational packages.

5 Discussion

In this chapter, reflections and reasoning around the content of the empirical data is presented. A comparison between empirical data and the theory can also be found.

5.1 Implementation and analysis of digital change

Based on the answers from the interviews, there are clear indications that a central digital strategy is non-existent. Overall, the attitude towards digital change is positive within the organisation but employees lack an understanding for how to carry this sort of change out. The need for strategies within the organisation has motivated groups in the different divisions to define local strategies for digitalisation. Similarities to the report by Svensk Byggtjänst (2017) can be found here. Employees from the IT department concluded that Swedish companies and their employees have a positive attitude towards digital change, but that implementation of digitalisation is still at its early stages. This indicates that employees are open to change and are trying, by the best of their abilities, to push digitalisation forward.

The positive attitude towards digitalisation is widespread in the company and among the interviewees. Observations indicate that there is little resistance to digital change nowadays. Despite the generally positive attitude, employees are hard pressed by upper management within each project to show the direct value generated. It is often required to prove that an investment will directly generate a return and bring value back to the project. The company also faces challenges in making the divisions pull in the same direction. With non-existent implementation guidelines, the level of knowledge appears to vary in the organisation, and development is going in different directions. This suggests an inconsistent understanding of change management, leading to increased uncertainty among employees. The project-based structure causes a clash in objectives, where one group tries to push digitalisation forward and managers in projects try to slow it down, due to the need to get value directly in the organisation from investments made. Initiatives for implementation of digital tools and operations many times come from groups higher up in the hierarchy, but the implementation itself needs to be done at the project level. As referred to earlier, project managers are unwilling to take on these costs. By taking advantage of the low resistance to digital change within the company, and by defining clear strategies that include digitalisation, it would be possible to aid the implementation of digitalisation. Central strategies that clarify implementation would give upper management in projects an opportunity to actually push development forward. They would be equipped with the confidence that the value of projects would not be considered in isolation, and that costs of development would be accounted for.

Another obstacle for implementation to proceed is concluded from the observations in section 4.3. It is argued that a main factor for successful digitalisation implementation is to have clients onboard with this method, if not, this would be a brake pad. Won et al. (2013) argue that obstacles for implementation of digitalisation is to get all employees in the same direction, as well as a need to maintain corporate culture and relations, even if major changes happen. They also argue that a project-based structure makes development more difficult to handle. That argument can be linked to the large differences between projects, regions and divisions that are found in the organisation and has changed focus to maintain a stronger breadth instead of pushing digitalisation forward. Indications in the organisation that clients are often struggling to keep up with their demands may be due to legal precedents, just as Vass and Gustavsson (2017), and Won et al. (2013) mention as an obstacle in the construction sector. Results from interviews and observations indicate that this may not be a problem and that, instead, bad collaboration with clients is the main obstacle. Observations indicate that one group in the organisation has succeeded with this collaboration and argue

that this is important. On the other hand, most of the regions do not find this collaboration to work well with the client. As the results do not outright agree with each other, challenging existing theories, the relationships between contractors and clients are indicated as highly important. The incoherent findings within the area make this a crucial, and challenging, part of the implementation of digitalisation. More frequent, and possibly wider, collaboration around digital change should be carried out with clients and contractors, in order to satisfy both sides.

A problem brought up during the interviews was that a lack of coordination between IT and the operative divisions exist. This leads to an uncertainty about who is responsible for development and pushing digitalisation forward in the organisation. The gap between these two major groups is exacerbated as a result of the IT department functioning as a technically knowledgeable group only. Currently, they primarily make the digital tools and operations available, but without carrying out the implementation. Both groups, IT and operations, are looking for better cooperation and to carry out the implementation process together. Interviewees indicated that a significant proportion of the employees in the organisation are not well aware of the importance of change management. PM-IT argued that a single company alone cannot solve the digital problem and that increasing collaboration between contractors, clients and consultants is critical. Won et al. (2013) also argue that the construction sector suffers from inter-organisational barriers with poor collaboration among participants. This issue can also be related to the research of Chelson (2010) and Won et al. (2013) that highlight collaboration within projects as a success factor for implementation of digital change. It is found that inter-organisational collaboration is rare, and companies struggle with internal collaboration between IT departments and the operative divisions. This is believed to be a result of the implementation responsibility being shared within companies. This process should be handled together, and the company investigated in this report must take measures to reduce the gap between the IT department and the operative divisions. Digital coaches have reduced the gap, but not fully. Another option could be to make portions of the IT department more project-oriented.

Interviews show that knowledge around digitalisation exists in the company and digitalisation projects are active on multiple fronts. There is, however, a gap in this knowledge between the decision maker and the employees as the operative level. A missing piece of the puzzle is the understanding of change management and the need for better digital knowledge. Knowledge remaining tacit, rather than being communicated clearly, is currently an obstacle to this end. There is a common belief that more micro education is needed in the organisation. According to the interviewees, hands-on education for project members is needed. The addition of *smart-projects* within the building division gives indications that education closer to the projects is accelerating. However, Young Jr et al. (2008) argue that the construction sector struggles to produce the right type of training for their employees. Furthermore, Svensk Byggtjänst (2017) concluded that education packages offered in construction organisations are scarce. The Chartered Institute Of Building (2010) and National BIM Library (2017) explain that there is a lack of skilled people in the construction sector that know BIM and digitalisation. The aforementioned seems to be less of an issue in the investigated company, as people with a proficiency for digitalisation seem not to be lacking. However, the company struggles with an incomplete understanding of change management and to broaden digital understanding among all employees in the organisation. The hampered breadth within the company may come from a mindset that projects are free to work in their own way, as long as good numbers are delivered. This mindset needs to change towards one where the implementation of digitalisation and associated processes within innovative projects is rewarded, even if it does not directly improve the profit margin. It would have a positive impact on the breadth of knowledge within the area of digitalisation and increase the company's competitiveness in future projects.

The main deviation between literature and interviews is within the area of digital strategies and whether it is used or not. The building division has, on their own initiative, established strategies to ease work towards a digital organisation. The remainder of the company does not have any digital strategies and employees lack strategies from top management. As explained, digital development is going in different directions, which is a problem the company is aware of. As the literature argued, companies in the construction sector lack strategies and guidelines for better change (Azhar, 2011; Kang, et al., 2013). Vial (2019) argues the importance of having digital strategies to transform the organisation. A digital transformation strategy is missing in the organisation which, according to literature, is an integral part in the transformation of the organisation. Using such a strategy, all divisions would be aligned in the way they understand development and its execution, as well as agree on the necessary communication. The implementation of a digital strategy, or even a partly digital strategy, would help defining a coherent change process for the organisation. Unambiguous communication of the long-term aim may increase the speed of change, but most importantly, provide clarity in where the company is heading with their digital strategy.

5.2 Effects on organisations when undergoing digitalisation

To succeed with digital implementation in the construction industry, digital roles are necessary in order to push digitalisation forward (Malmkvist, 2013). At the company, the number of digital roles has increased over the years and these roles are today spread across the organisation. The building division has taken this a step further and aim to have digital leaders in every project and a digital coach in every region. As OM-Bg mentioned, digital coaches are central functions in order to change the work structure. DM-B argued that digital coaches have sped up digital change. DC-Bg explained that digital coaches are not here to stay, when the digitalisation development processes function well, digital coaches are expected to be redundant. A similar view is found in the report by Malmkvist (2013) where it is believed that digital roles may not be necessary in the future, as organisations are expected to handle digital change efficiently without explicit digital roles. Missing in this argument is an understanding of digital transformation and what will happen on the side of digitalisation. *Digitalisation* alone changes the work structure but not how the construction industry will conduct business in the future. To enable changing business opportunities and additional value generating opportunities, *digital transformation* is critical. In order to understand the future of the construction sector, and to apply the experience from digitalisation, digital transformation is key. If this is not managed well, it may become difficult to stay competitive. Competitors will continue to discover, and take advantage of, new business opportunities against which today's models may struggle to keep up with.

Business divisions in the studied company are working independently of each other and the development of digitalisation is moving in different directions. Regarding questions about cooperation, it is concluded that all divisions think that the company will gain value if a better collaboration takes place. Although this is important, a bigger problem than this is the large gap between the IT department and the operative divisions. From the interviews, there are indications that both the building and the civil divisions are looking for better collaboration with the IT department. It is also found that digital coaches have reduced the gap, but do still not function as they are intended to. These tensions between the IT department and the operative divisions are also touched upon in literature. M. Bosch-Sijtsema et al. (2019) show in their research that Swedish construction companies struggle with large gaps between these groups, which increase tensions. DR-C argues that a change in the structure of the IT department is necessary. By shifting the operations of the IT department closer to the projects, employees would have a medium to both fetch knowledge (the IT department) and transfer it (the projects). This statement from DR-C is similar to arguments presented in the literature. Innovation often focuses on technical aspects and does

not take advantage of change processes (Kang, et al., 2013). More collaboration between the IT department and operative division would both aid in wider knowledge sharing, as well as achieve an alignment in the development of related technologies in its best way. By aligning these areas, innovation would change the business in ways more suitable for the operative work at the core of the business.

Interviews indicated that an attempt to relieve project budgets from increased costs, when a need for digital roles appreciates, is applied in the *building division*. Digital coaches support all projects within its region without affecting project budgets, as the costs are accounted for elsewhere. This role is subsidised for projects and has, so far, produced positive outcomes. Interviews also argue that subsidisation many times is good but must be handled carefully, if not, free help may not motivate project managers to get something in return. Moreover, it is explained that the expenses associated with operative work, such as the costs of digital leaders, must remain in the project budgets. Costs from digital coaches that do not perform operative work can be transferred to the region budget. Subsidisation of digital roles in project organisations lowers the tensions between employees with digital responsibilities and managers in project teams. However, it does not increase initiatives to push digitalisation forward on a large scale. Projects may need a carrot to increase the development and an understanding that this change may be more valuable for the company, rather than the project itself.

The way digital change is structured within the company may be perceived as a reason for why digitalisation has gone slowly. As mentioned by Kang et al. (2013), the construction industry has the wrong focus in order to develop a new efficient organisational structure. They explain that the current digital innovation focuses on technical aspects instead of taking advantage of change. It is argued that digital change is not just about technology but has, instead, greater benefits in operation adjustments. Findings in interviews also show that this innovation is tool-oriented and is putting operation adjustments and business opportunities aside. It is further found that employees with digital responsibility understand that tools and work processes should be developed together, even though this is currently not the case. DR-C argued that all development of digital tools is not bad but is it of high importance to understand that some development has clear dead-ends. DR-C continues to explain that the knowledge of dead end, can then be the best development to increase competence of the employees. This is also found in literature, as Arayici, et al. (2011) argued that BIM technology is more than just technology itself. It is a need to change focus toward people and work processes that connect to BIM (Arayici, et al., 2011). Interviews and literature provide a comprehensive understanding and conclude that the organisation understands the importance of developing work processes, even though this is currently not taking place. This can be attributed to the high degree of tool-orientation among employees with technical understanding, but where understanding of work processes and organisational questions is lacking.

5.3 Value from increased digitalisation

In theory, digital change is divided into digitisation, digitalisation and digital transformation, depending on what type of change process is affected. The literature gives a clear consensus about what the differences between these terms are. It is also argued that digitalisation is harder to grasp, and not as well understood, as digitisation. This was confirmed in the interviews, where the line between digitisation and digitalisation seemed rather blurred. The understanding of digitalisation was broad, but, for the majority of the interviews, digitisation was not an established term. DM-C argued in the interview that disagreement in the understanding of these terms affects the expectations of digital value generated. Just as DM-B explained, the first step in the change process is to digitise the organisation. This change

is necessary in order to digitalise, and, according to DM-B, this may not be value adding. Apart from this, interviewees agree that digitalisation comes with increased value. By focusing on the connection, as well as dynamics, between digitisation, digitalisation, and digital transformation, many of the questions around value would probably be straightened out. Adapting these concepts would help the organisation to work with process development with precision and accuracy, thus increasing productivity and unlocking additional value.

In the literature, different sources of value have been suggested and are found to directly or indirectly impact the project organisation. The case study on calculated value, by Barlish and Sullivan (2012), shows that digitalisation comes with high implementation costs. It was also found that design costs increased, and construction costs decreased. In the end, the case study concluded that a BIM project generates direct savings for the project. The report also argued that numbers are hard to calculate, as they depend on multiple factors. Observations, on the other hand, suggest that design costs are not increased in a BIM project compared to a non-BIM project. The design team in the observation has established the digital processes well and has been working in this way for many years, this may have affected the cost positively, where implementation is the part that has higher investments cost. This may need an understanding that the focus on value should be evaluated in a longer perspective. From the interviews there was no clear consensus whether all digitalisation is value adding or not. It was found that all interviewees struggled to put words on what is value adding when undergoing digitalisation. Employees, with digital responsibility in projects, found it hard to argue in support of the increased costs digitalisation comes with. They also experienced a lack of knowledge around the direct value generated. In addition to direct value, literature also explains that digitalisation comes with indirect value, affecting projects and organisation positively. Kang, O'Brien and Mulva (2013) argue that structured information alone is valuable for the industry. They also explained that digitalisation supports waste management and safety, which was not mentioned in interviews or observations. The company, as a project organisation, is mainly motivated by direct value rather than indirect value. This stems from the lacking understanding of digital transformation, as well as an unawareness that digital change may affect the company as a whole, rather than a single project. As long as digital transformation is missing in the organisation, cases to prove these points will not be abundant. Unless this is addressed, the company will struggle to understand the value added by digitalisation.

There is an incomplete understanding of the bigger picture and of what may be affecting the company or future projects. Matt et al. (2015) explain, in a similar way, that benefits with digitalisation come from more than the technology itself. Research argues that it is a transformation for the organisation and that it affects business operations, their operations as well as the organisational structures. There were no indications that the digital transformation term is used within the company, but an understanding that digitalisation, in the future, could create new types of values. There was also a good understanding among the respondents that value of information is beginning to be established, especially structured information that can be used for decision making and analysis. The reason information is still seen as a problem and not something valuable, is rooted in the struggle to handle large amounts of data. The interviews revealed that information is not currently transferred well between tools and operations. A connection of the data collected from both tools and operations must, therefore, be established for this transfer to be carried out successfully. The interviews also suggested that more information should be handled using a digitised structure. There were fears that digitalisation would become more negative than positive. In the literature, Vial (2019) argues that technology itself is one part of the complex puzzle of understanding a transformation in digitalisation. To succeed while undergoing digitalisation and remain competitive as a company in a digital world, digital strategies are fundamental. This transformation change can, according to Matt et al. (2015), provide major business improvements, increase value for clients and create new business models. The

interviews clarified that the knowledge at the *IT department* and the *divisions* differ, which further increases tensions between these groups.

6 Conclusion

This thesis was about the understanding of digital change in the construction industry and how change affects construction companies. A combination of the theoretical background of digital development, digital tools and operations found in construction, and change management, along with a quantitative study at a construction company, helped establish some interesting findings. From the result, it was clear that the company lacks central strategies involving digital development processes. This has caused uncertainty for employees supposed to push development forward. There is a need for digital strategies, and some great examples of change and initiatives within the company exist, possibly stemming from an understanding of digitalisation among employees. However, the lack of application of change management prevents efficient implementation of tools and operations. There are also findings that show that the digital journey has gone in different directions and at different speeds, both within regions, but also within business divisions. This is understood and acknowledged.

The need for digital change is understood, but internal communication and cooperation is deficient which increases the amount of complications. Fundamental to successful digital transformation is the cooperation between groups, and in this case, between the IT department and operational divisions. To improve collaboration, a digital transformation strategy is needed. This would provide requirements as well as a plan for organisational change, which would reduce the gap between groups within the organisation. The connection between the different phases occurring while undergoing the digital change discussed in this thesis will lay the foundations for the model presented in figure 2.

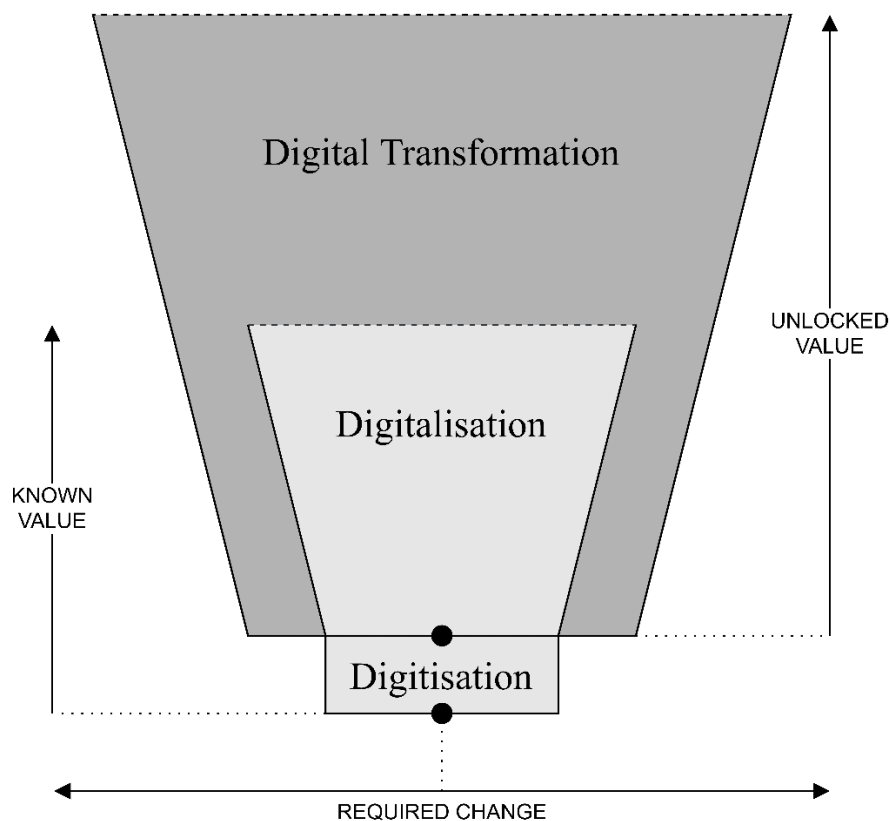


Figure 2 - Required change to generate value from digitisation, digitalisation, and digital transformation, where the two separate processes required (digitisation & digitalisation *and* digital transformation) have been highlighted.

Based on literature and results from interviews and observations, this thesis introduces figure 2 to explain how digitisation, digitalisation and digital transformation can be illustrated in the construction industry. The main purpose of the model is to show that digital change can be illustrated by two separate processes. These processes illustrate that the required change has different ratios to value within the various development areas. The point of the plot is not necessarily to predict an exact number for the value added, but rather to illustrate a general trend in the value generated by digital change. Digitisation and digitalisation development are parts of the same process in the model and are the most commonly understood aspects of digital change in the construction industry. The organisation must first be digitised, which essentially requires change in the *medium* used. During digitisation, major changes are required and the result of value in productivity and efficiency from this change is low. However, it enables digitalisation to be applied in the organisation. Digitalisation requires changes in the *tools* and *operations*.

In addition to this, a new *organisational structure* is needed. With these changes, the value in the organisation increases, as both productivity and efficiency improve rapidly. To take this one step further, a second process, digital transformation, is introduced as a parallel process to digitisation and digitalisation. Digital transformation can be applied in organisations alongside digitisation and digitalisation. Digital transformation requires changes in *strategies* and *business concepts*. This will result in a new type of value unlocked by new business opportunities and better information management. This could be a value currently unknown to the business, but which is uncovered, and can be tapped into, as digital transformation is carried out. The model shows the importance of understanding the differences between digitisation, digitalisation and digital transformation when carrying out a digital change in an organisation.

6.1 Answering to the research questions

How does implementation and analysis of digital tools and operations function in the construction sector?

Based on the interview study, implementation of new tools and operations are unstructured and proceeds differently depending on the division, region and project. This is caused by an incomplete understanding of the change and, therefore, change is moving slowly in the organisation. Change management is fundamental to achieve a good implementation process. Gaps between the *IT department* and *operative divisions* divide implementation responsibilities between these groups, this causes confusion about who is responsible for what. Lastly, it was found that digital strategies increase the speed of implementation.

Is there a need to change organisational structure when undergoing digitalisation?

Findings in the literature and interview study both indicate that digital strategies are fundamental while undergoing digital change. Missing strategies is one reason for a low degree of digitalisation in the industry. These strategies should be a foundation for how to handle the change in roles, responsibilities, and internal collaboration between them. The internal communication problems between groups in the organisation do not only cause the change process to slow down, but also results in the digital development moving in different directions. Findings also indicate a positive outcome from own initiatives, coming primarily from the building division, where digital roles have been established. Subsidisation of digital coaches is found to have a positive impact and may be a good alternative to accelerate digital change. Digital coaches reduce the gap between the IT department and the operative divisions. Whether this is the best option to increase collaboration is not answered in the

thesis. An interpretation of the interview study could be that the operative divisions are not the only areas in need of restructuring, but that the IT department may need to shift closer to the projects as well. However, it is clear that organisational changes are needed to push digitalisation forward.

What values comes from increased digitalisation for contractors?

When discussing the value of change, it is important to understand what type of change takes place and where the value originates from. There is a need to understand differences between what digitisation, digitalisation, and digital transformation is in order to evaluate its value. Digitisation does not always generate value, but it enables for digitalisation, which, in turn, can provide value for the organisation. Studied organisations struggle to name the differences between digitisation and digitalisation, and also struggle to estimate the return of value adding activities. The literature gives the same indications and argues that hard values are hard to study, and most studies on hard values are based on case studies with uncertain parameters. Interviewees give an understanding that information and data, combined with digital change, can add value. This is in line with literature around digital transformation, which is claimed to add a new type of value to the organisation.

6.2 Suggestions for improvement

Based on the evaluation of the literature study, interview study and observations, several suggestions are made for the studied company. These suggestions could improve the value from the digital journey that the company is pursuing.

- ❖ Clear guidelines and directions for which tools and operations should be implemented and how the implementation should be carried out.
- ❖ Improve the understanding of change management for employees that work with change processes.
- ❖ Include digital change in the central strategies that are communicated from the upper management in the organisation.
- ❖ Reduce the gaps between business divisions as well as the gap between the IT department and the operative divisions.
- ❖ Increase the understanding of digitisation, digitalisation and digital transformation and apply that understanding to change the organisation's view on value.

A summary of the results shows that the organisation functions well and proceeds to implement digital tools and operations, but that there is a lack of knowledge about what is the best change and how change should be carried out. A greater focus on change management and an understanding of where value is added from different perspectives are needed to succeed with digital transformation.

6.3 Future studies

This study produced interesting results but also highlighted additional areas that should be considered closer. Future studies within this area could be:

- ❖ How should implementation of tools and operations be structured to give the best result for a construction organisation?
- ❖ What type of new values can be unlocked while undergoing digital transformation in the construction sector?
- ❖ How should the gap between the IT department and the operative business be minimised?

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APPENDIX

I: Interview

Introduction

- ❖ Presentation of the master thesis
- ❖ Explain that the interview will be anonymous
- ❖ Ask if there is okay to record the interview

Part 1: Focus on interviewee

- ❖ Education backgrounds?
- ❖ Past experiences?
- ❖ Current role?
- ❖ Requirement specification on your role?
- ❖ How many years at this company?
- ❖ What are the challenges within the digitalisation area?
- ❖ What is your view on digitalisation?
- ❖ Concerning digital questions, who do you report to?
- ❖ Do you have a personal interest in digital development for construction sector?

Part 2: Development with digital tools

- ❖ Central goals for the digital development in your working area?
- ❖ Are there any guidelines or demands that needs to be followed in your working area?
- ❖ How does testing and analysis of digital tools work under the implementation phase?
- ❖ How do you think implementation of digital tools work?
- ❖ Do digital tools increase efficiency and add value according to you?
 - Do you have proof and calculations on added value?
- ❖ Is there any lost value due to, not all processes are digital?
 - Is there any part that is more crucial?
- ❖ Do you miss something in the question of digitalisation an to continue work with digital change?

Part 3: Organisation structure and work processes

- ❖ Has there been any changes in your organisation, while undergoing digitalisation?
 - ❖ If yes: Has it worked or affected work processes?
 - ❖ Is there a need for organisational change to success with implementation and increase value?
- ❖ Have any new roles been established or responsibilities, due to the change?
- ❖ Is there any structured way to follow up implementation and evaluate result?
- ❖ Has the organisation had a positive or negative outcome, due to digitalisation?
- ❖ Do you see any complications with the development due to today's organisational structure?

- ❖ Do you think there is a need for change in organisational structure, to increase maximum effects from tools and processes?
- ❖ What is the capacity in the company in question of digital knowledge?
- ❖ Does the company use education packages to increase knowledge among employees?
- ❖ Is it an organic development in question of digitalisation among employees in project groups?
- ❖ Information: How has the amount of information been affected, when undergoing digital change?
 - ❖ Is there any value in this information?
 - ❖ How do the company handle information?
 - ❖ How do the company handle information after analysing the situation?
Information management?

Part 4 – Summary and Future

- ❖ Where is the cost of digital development put?
- ❖ Is it possible to subsidise digital development? What would be the result?
- ❖ What are the project employees view on increased digitalisation?
- ❖ What is the future of digital change?



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