UiA University of Agder

Master

Optimization of Bane NOR Eiendom's accessibility analysis

This thesis aims to optimize Bane NOR Eiendom's accessibility analysis by objectify the current analysis and implement lean methodologies to take more accurate actions on different train stations in Norway.

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This Master's Thesis is carried out as a part of the education at the University of Agder and is therefore approved as a part of this education. However, this does not imply that the University answers for the methods that are used or the conclusions that are drawn.

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Abstract

Accessibility has gained great interest, in line with the increasing attention giving to reducing CO2 emissions in the recent years. It is viewed as an important factor in urban development and growth. Bane NOR Eiendom (BNE), one of Norway's largest real estate and hub developers, conducts accessibility analyses to map the attractiveness of different transport modes to train stations. BNE's accessibility analysis consist of criteria for walking, cycling, public transport, and car, where an average score determine the level of accessibility for each transport mode. However, the current accessibility analysis has its challenges for BNE, in that it is subjective, difficult to verify, and based on qualitative criteria. Therefore, this thesis aims to optimize the accessibility analysis by using LEAN methodologies to shift from qualitative criteria and subjectivity to quantitative criteria and objectivity. Hence, making the analysis verifiable. To optimize the analysis it is important to determine the usage and knowledge of LEAN in BNE, due to the rising demand for efficiency and quality in the public sector. Therefore, both the analysis and the project execution model in which the analysis is conducted were of interest for this thesis.

A structured literature search, an in-depth group interview, and two workshops were conducted in order to collect empirical data for this thesis. Stepwise-deductive inductive approach (SDI) was utilize as a research design to bridge the theory with the empirical findings. Several interesting findings were made in this thesis, mainly being the lack of knowledge of regarding LEAN, its methodologies, multiple challenges with the current accessibility analysis, and BNE's utilization of agile methodologies without usage of the term. However, the most interesting finding was that the new proposed criteria provided similar objective scoring at various stations in Norway, as the previous subjective criteria. Therefore, the conclusions were drawn that LEAN methodologies can potentially optimize the current accessibility analysis, in which DMAIC, LSS and kaizen were proposed as potential methods of improvement. In addition, it was uncovered that BNE utilize both LEAN- and agile principles without realizing or naming it, which potentially can be further explored and implemented by BNE.

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Chapter 1

Introduction

The focus on accessibility has rapidly increased, in line with the increasing attention giving to reducing CO2 emissions worldwide in recent years (Fuglsang, Hansen, & Münier, 2011). Bane NOR Eiendom (BNE) is one of Norway's largest real estate and hub developers, who managing and operating 335 train stations and stops, 13 workshops and terminals, and operations buildings and infrastructure properties (BNE, 2021). BNE aims to achieve the net-zero emissions goal by providing accurate and sustainable accessibility to the Norwegian railway network. Achieving net-zero emissions is the goal of reaching global emissions neutrality by 2050, as stated in the Paris Agreement (Millot, Krook-Riekkola, & Maïzi, 2020). Despite accessibility being considered an important driver for the sustainable development of urban growth (Ford, Barr, Dawson, & James, 2015), it has been difficult to measure accessibility up until now (Lättman, Friman, & Olsson, 2016). Researchers have discussed two evaluations of accessibility, namely objective and subjective, which motivated this thesis to examine how BNE conducts their accessibility analysis and whether it is possible to optimize their work. Therefore, by implementing LEAN methodologies, this thesis aims to focus on quantitative data and objective criteria rather than human perception and the lack of verification. As such, this narrows this thesis down to two research questions:

RQ1: How can BNE's accessibility analysis be optimized and verifiable using LEAN methodologies?

RQ2: To determine the usage and knowledge of LEAN in BNE.

The demand for efficiency and quality in the public sector has increased over the past years, thereby raising the necessity for improvement (Denhardt & Denhardt, 2000). This has made companies such as BNE dependent on innovation to be competitive and reach their targets. Even though adjustments have been made to the current accessibility analysis, there remains room for improvement, especially in terms of measuring the level of accessibility for various transport modes (i.e., walking, bicycling, public transport, and car). To fully understand BNE's needs, an in-depth interview and workshops were conducted. The current criteria were assessed and objectified to provide a verifiable and accurate accessibility analysis. Additionally, the present work can potentially reveal evidence of LEAN utilization in the public sector.

This thesis consists of six chapters and is structured as follows: First, the background and scope are reviewed in Chapter 2. Following this, a presentation of the theoretical framework is provided in Chapter 3. Afterward, the scientific method is presented in Chapter 4, containing justification for why that particular method was adopted. Then, the main findings are analyzed and discussed with respect to the research questions in Chapter 5. Finally, in Chapter 6, the conclusion regarding the research questions is presented, and possibilities for further work and limitations are reviewed.

Chapter 2

Background and Scope

The background of this thesis aims to ease the transition from the summarized sections above to the theoretical framework. Meanwhile, the scope of this thesis can be viewed as the delimitation of the research (Akanle, Ademuson, & Shittu, 2020). In this sense, the delimitation is boundaries set by the researchers to maintain control over the thesis (Akanle et al., 2020; Baron, 2009). Writing a delimitation is an attempt to explain the activities that are not incorporated in the thesis (e.g., literature and methodology) (Akanle et al., 2020; Pajares, 2007). Therefore, the following chapter provides the background and scope of this thesis. The purpose of this chapter is to present BNE and their accessibility analysis. The chapter is structured as follows: In Section 2.1, BNE is presented, and the scope is defined. Then, in Section 2.2, the current accessibility analysis is reviewed. Finally, in Section 2.3, the limitations of this thesis are defined.

2.1 Bane NOR Eiendom

Bane NOR is a state-owned enterprise responsible for the national railway infrastructure (BaneNOR, 2017). BNE is owned by Bane NOR and is responsible for urban and local development by developing attractive and efficient public transport hubs (BNE, 2021). In other words, BNE focuses on property management and development. The presented work aims to specifically target train stations. Currently, four different types of analysis are conducted when developing or mapping train stations. While most of the analyses are objective, the accessibility analysis is based on subjective criteria. Through this thesis, BNE aims to investigate the possibility of developing an accessibility analysis, which includes the following:

- Optimizing the accessibility analysis by investigating the possibilities to transition from subjective to objective criteria with LEAN.
- Examining their current method and suggesting recommendations based on theoretical principles and findings to standardize and make the analysis verifiable.

The scopes listed above were partly predefined preliminary to project start-up. Meanwhile, BNE desired to transition from subjective to objective criteria and make the analysis verifiable. It should be noted that to understand the accessibility analysis, this thesis emerged into not only optimizing the analysis but also examining the process of the anal-

ysis. To justify the previous statement, there were identified inter-dependencies between the analysis and the process.

2.2 Accessibility analysis

The accessibility analysis functions as a tool to identify the possibilities and constraints of the train stations for all transport modes. Each mode has a set of predefined criteria, in which it is assessed and scored before an average score is set. The advanced structure of the analysis allows BNE to quantify the criteria. Therefore, the purpose of the analysis is to be a supplement that describes how attractive and effective a station is developed. In addition, it enables BNE to recommend or implement measures to reduce the constraints. The current analysis is performed following the criteria presented in Table 2.1.

Table 2.1: *Illustrates the current accessibility analysis with its source, criteria, and description.*

Source of accessibility	Criteria	Description
Walking	1. Walking distance	**(1)** A threshold of 15 minutes of walking distance around the station is mapped. An assessment of the population within walking distance and density around the station is considered.
	2. Reachability	**(2)** How the network of roads and paths sewn together to create a good road network for pedestrians is examined. A reachability score from 0 to 1 is used to quantify this.
	3. Road safety	**(3)** Intersections and infrastructure that ensure pedestrian traffic safety are assessed, as well as an assessment of previous traffic accidents where pedestrians have been involved.
	4. Perceived travel route	**(4)** Quality of the surroundings, active facades and audience-oriented activities are assessed specifically for each case. Signage of the station and the station's visibility in the landscape are considered. In addition, social security is assessed, with an emphasis on lighting and clear areas.
Bicycle	1. Distance	**(1)** A threshold value of 3 kilometers is used for bicycles. It can be assumed that more people cycle longer, but it is at this distance that public transport or cars gain a competitive advantage.
	2. Topography	**(2)** A textual assessment of the topography in the area is described using altitude data. Elevation conditions are assessed from important target points (e.g., residential areas or workplaces).
	3. Traffic and accidents	**(3)** Traffic volume (AADT), speed limit and previous accidents with cyclists are assessed. In addition, intersections and measures that separate cyclists and cars are considered.
	4. Quality of bicycle roads	**(4)** Bicycle paths and other infrastructure are mapped. The quality is also assessed, including coherence, marking and safety. In places where it cannot be assumed that there are bicycle lanes, sidewalks will be able to replace these.
	5. Bicycle parking	**(5)** The number of places is considered. In addition, the quality of the bicycle parking is assessed, as well as its distance to the platform, design and whether there is a locked bicycle hotel.
Public transport	1. Frequency/Schedules	**(1)** The frequency of the means of transport that serve the station about the surrounding areas is described and assessed specifically for each individual location. In addition, the scaling of the timetable is assessed to see how intuitive the timetable is.
	2. Surface coverage	**(2)** A 10-minute walking distance to the stops in the residential areas is used to assess how much surface coverage the public transport to the station serves.
	3. Exchange points	**(3)** The exchange point is assessed on the simplicity, how far it is between the means of transport, correspondence and how well the routes are coordinated.
	4. Travel time	**(4)** Assessment of on-board time. This is affected by the public transport route. In addition, the travel time from some destination points is compared with the car to quantify this.
Car	1. Traffic situation	**(1)** Concrete assessment of congestion in rush hours around the station, how accessible the stations are from the main roads and what speed it is to the station.
	2. Parking	**(2)** Parking capacity is mapped and occupancy (the proportion of parking spaces occupied) is assessed according to a set scale.
	3. Cost	**(3)** How expensive it is to choose a car is examined, including toll passes and the price of parking. Fuel costs are not considered.
	4. Distance to platform	**(4)** The walking distance from the car park to the platform is considered, specifically in each case.
	5. Time	**(5)** Assessment of how competitive the car is on time compared to other means of transport.

2.2.1 Comparison

This section aims to provide the reader with a parallel understanding of the accessibility analysis by comparing it with an industry process. To justify why this thesis uses the theoretical framework adopted, which is presented in Chapter 3, a comparison is presented. It must be emphasized that this comparison functions as a metaphor to provide the readers with an overall impression to which they might relate, as the accessibility analysis is industry-specific.

The accessibility analysis can be compared with an industry process. However, in this comparison, it is compared with a distribution facility (DBF). A DBF has its own sets of possibilities and constraints; for example, it is possible to process 200 orders per hour, while its constraints rely on the facility, meaning that it is not possible to process 300 orders per hour. Each component in the DBF gets assessed and scored. For instance, a sensor and the roller blades, of which the distribution line is comprised, are assessed and scored. The sensor can read 300 orders per hour, while the roller blades have a speed limitation and can facilitate only 200 orders per hour to the sensors. In this case, the sensor gets the highest score of 1, while the roller blade gets a score of 5. By performing such an analysis, the engineer can describe the efficiency of the DBF. In addition, this enables the engineer to recommend or implement measures to reduce the constraint(s), which, in this case, is the roller blades. The comparison is illustrated in Figure 2.1.

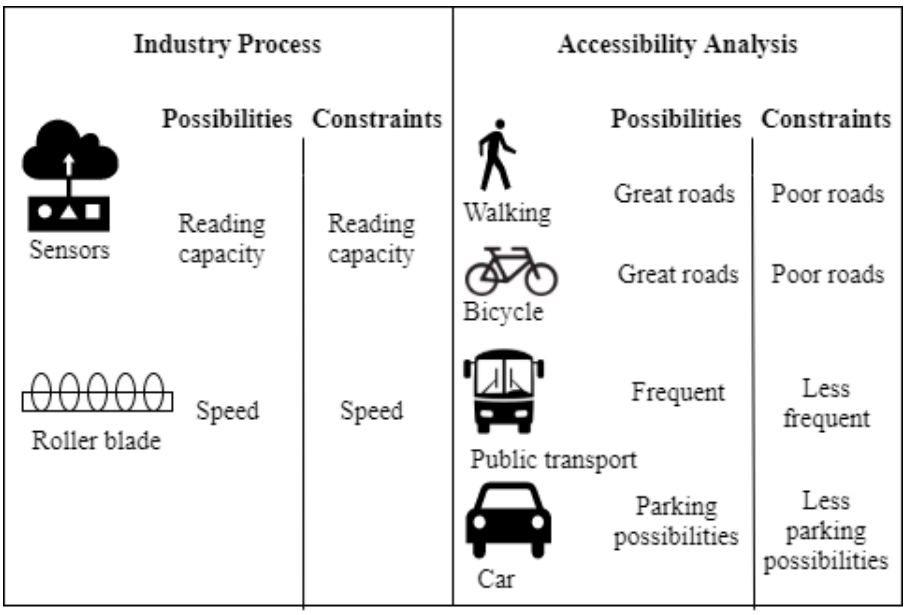


Figure 2.1: *Illustrates the comparison made in this section. The possibilities and constraints are based on similar conditions for both the "Industry Process" and "Accessibility Analysis."*

2.3 Relevance and limitations

The focus on accessibility has rapidly increased in recent years, thereby causing companies in the urban infrastructure and railway to be influenced by the rising demand for innovation and development. BNE's accessibility analysis is important for identifying the possibilities and constraints for all the users, in which implemented measures can contribute to reaching the net-zero emission goal set by the Paris Agreement. Due to the company's demand to create an objective analysis based on objective criteria, LEAN methodologies are considered as methods for improvement. Additionally, BNE's project model and execution are important to consider, as they impact the analysis. BNE conducts several analyses, but this thesis is limited to only the accessibility analysis, since this is BNE's most precision-based analysis; therefore, it might have a greater potential for improvement. Additionally, due to the given time- and resource frame, BNE will be the only organization for which the usage and knowledge of LEAN are determined. That said, it could have been possible to consider other organizations in the public sector. It must be emphasized that despite these limitations, this thesis might potentially appeal to other organizations in the public sector and serve as evidence of how LEAN methodologies could improve the public sector worldwide.

Chapter 3

Theory

This chapter provides the theoretical foundation of this thesis. The purpose of this chapter is to present the existing literature to provide an understanding of how LEAN methodologies, agile, and the Cynefin framework are interpreted and entrenched in the public sector. This chapter is structured as follows: First, Section 3.1 introduces the theoretical aspects of accessibility. In Section 3.2, theories regarding LEAN are reviewed. Furthermore, in Section 3.3, an introduction to agile as a project execution model is presented and compared with waterfall; prior to this comparison, a best practice framework is introduced. Finally, in Section 3.4, the Cynefin framework, which constitutes the cause and effect relationships in BNE's projects, is presented; this makes it possible to identify their current work methods and project selection in an applicable framework to suggest measures for optimization.

3.1 Accessibility

Accessibility is a key element of urban and transportation planning, as one of the primary objectives in urban planning is to promote accessibility (Fuglsang, Hansen, & Münier, 2011; Albacete, Olaru, Paül, & Biermann, 2015). In recent years, the focus on accessibility has increased, in line with the increasing attention given to reducing CO2 emissions (Fuglsang et al., 2011). Therefore, accessibility is considered an important driver for the sustainable development of urban growth (Ford, Barr, Dawson, & James, 2015). Accessibility is defined in different ways by researchers as the ease with which one place can be reached by another through transport networks (Fuglsang et al., 2011), the ease of living a satisfactory life by using the transport system (Lättman, Friman, & Olsson, 2016), and the people's ability to get to destinations via movement or transport (Albacete et al., 2015). The common element in these definitions is the ability to reach by ensuring accessibility for everyone, especially those with limited options for mobility (Manaugh & El-Geneidy, 2012). Up until now, however, measuring accessibility has been challenging (Lättman et al., 2016). First, researchers have discussed two different evaluations on accessibility measurements in an accessibility analysis: objective and subjective (Albacete et al., 2015). An objective evaluation is based on changes in transport modes to assess the demand and competition between transport modes related to individuals' needs (Geurs & van Wee, 2004). The objective evaluation by the authors builds upon the trend proposed by Vickerman (1974), Badland et al. (2009), Curl, Nelson, & Anable

(2011) and Aditjandra, Mulley, & Nelson (2013). Contrarily, a subjective evaluation is based on the perception of individuals in an area to evaluate accessibility (Albacete et al., 2015; Bertolini, le Clercq, & Kapoen, 2005; Handy & Niemeier, 1997). It must be emphasized that both the objective and subjective measures have uncertainty regarding the number of characteristics. Figure 3.1 illustrates two different stations with its characteristics. The more characteristics that are considered, the more precise the accessibility measure. However, having more characteristics requires significantly more data, whereas interpretation becomes more difficult (Albacete et al., 2015). Due to the challenges presented, it is necessary to investigate concepts that can cope with the challenges in the current accessibility analysis.

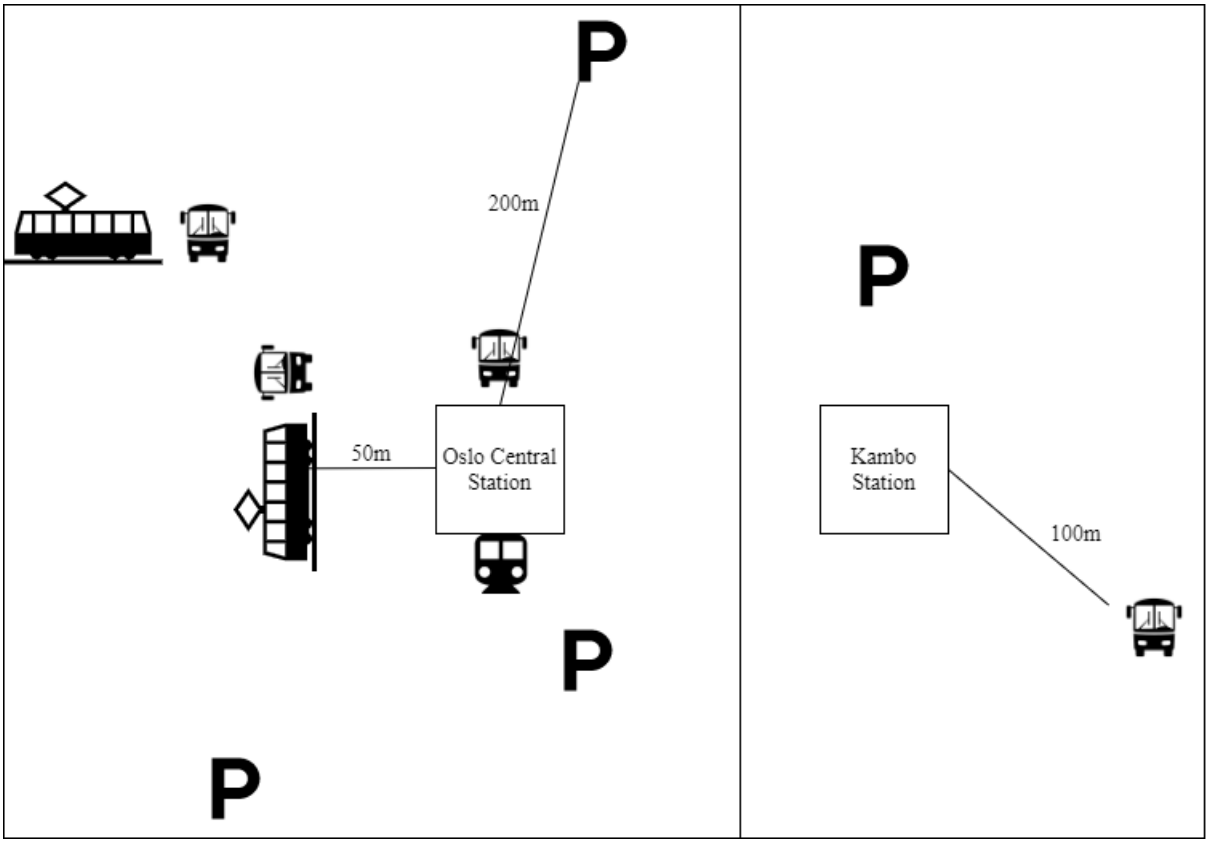


Figure 3.1: *Illustrates the characteristic of accessibility around Oslo Central Station and Kambo Station. It must be emphasized that walking and bicycling are at the same locations as buses and that the illustration is not correctly scaled. Hence, it functions as an illustration only.*

3.1.1 Mobility

Due to the global ability and willingness to respond to the global sustainability challenges in 2015, 17 sustainable development goals were agreed upon in the Paris agreement. Even though transportation does not feature as one of the individual goals, it is still a key element in sustainable development. By focusing more on transport modes such as walking, bicycling, and public transport, rather than cars, sustainable transport may indirectly address issues such as the reduction of gas emissions and contribute to sustainable cities development and clean energy (Barford et al., 2018). Hence, sustainable mobility can be defined as *the ability to meet today's transportation needs without compromising the ability of future generations to meet their transportation needs* (Richardson, 2005; Bergman & Bergman, 2019). Additionally, several cities worldwide have embraced the green transport hierarchy pyramid, as presented in Figure 3.2, which sorts different transport modes by their degree of sustainability. National transport systems embody

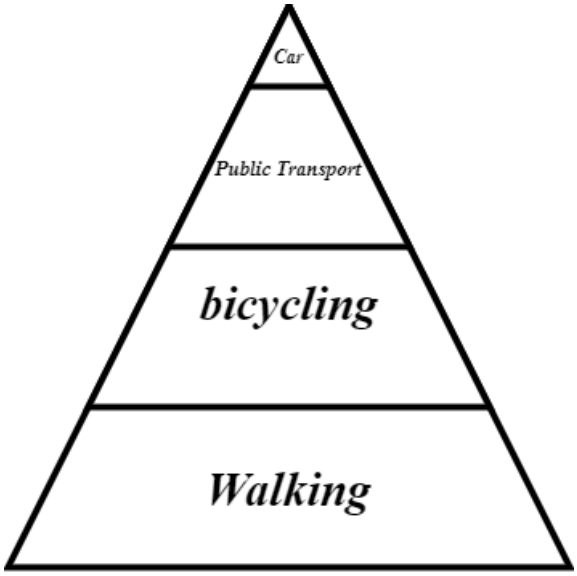


Figure 3.2: *Green transport hierarchy pyramid based on Bergman & Bergman (2019)*

infrastructure networks due to the strategic importance and value that these networks generate for their respective countries (Barford et al., 2018). This planning, nationwide, aims to generate knowledge of users' transport tendencies and expectations. To utilize the gathered knowledge, analytical tools are used to predict future outcomes and act accordingly (Barford et al., 2018). In addition to walking and cycling, public transport is viewed as a sustainable form of mobility (Bergman & Bergman, 2019). These transport modes are of particular interest due to the nature of this thesis, since BNE's accessibility analysis measures the accessibility of walking, bicycling, public transport, and car usage to their stations.

3.2 LEAN

LEAN can be viewed as a philosophy in which LEAN is in one's head and heart. It is how one approaches a job, customers, suppliers, and processes rather than the tools and techniques (Manos, 2007). Therefore, it can be viewed as a mindset. LEAN consists of two basic concepts: eliminate waste and create value (Pedersen & Huniche, 2011; Duque & Cadavid, 2007). To successfully achieve these concepts, there is a need to separate the value-adding and non-value-adding activities to eliminate waste so that ultimately, every activity is value-adding (Pedersen & Huniche, 2011); this in turn makes LEAN an improvement approach for optimizing processes within and between organizations, departments, and teams (Pedersen & Huniche, 2011; Souza, 2009). In relation to the accessibility analysis, this thesis views subjectivity as waste. To create value, the analysis must evolve to become objective and verifiable. To acquire a comprehensive understanding of the knowledge related to the LEAN term, this thesis opts to divide LEAN into three categories: LEAN learner, LEAN achiever, and LEAN thinker (Manos, 2007). The aim is to begin with LEAN as a LEAN learner, in which knowledge regarding the basic concepts of waste and value is established. To elevate toward becoming a LEAN achiever, the basic concepts of LEAN, including more complex concepts, must be applied within the organization. This means that the LEAN achiever category is more a physical stage, in which the goal is to achieve LEAN rather than understand it. The graduation from LEAN achiever to LEAN thinker occurs naturally when situations are viewed from a LEAN perspective (Manos, 2007). This model is illustrated in Figure 3.3, whereas the goal is to later assign BNE to one of the categories.

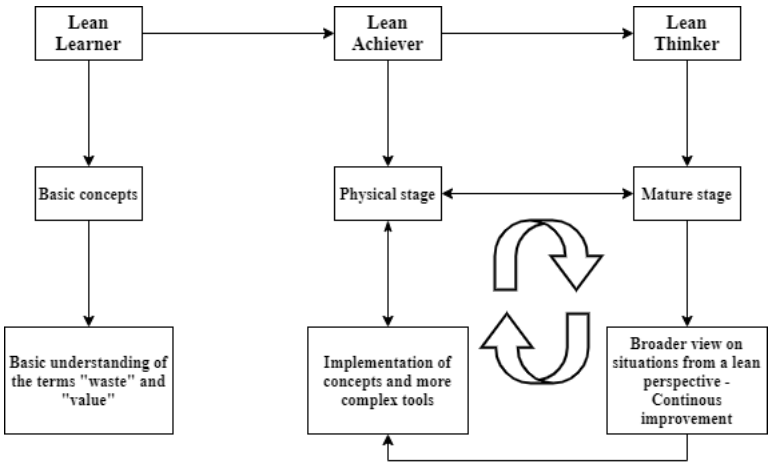


Figure 3.3: *Illustrates the categories into which LEAN is divided. The first, "LEAN learner," is about understanding the basic concepts, whereas the latter two are more concerned with the physical implementation and mature understanding of LEAN. The "LEAN achiever" and "LEAN thinker" stages are in a loop.*

The literature on LEAN revealed a pattern, in that it primarily considered organizations in the private sector. However, as this thesis focuses on BNE, an organization in the public sector, it was necessary to examine the reception of LEAN in the public sector. Therefore, the public sector is of interest in this thesis due to its own culture, traditions, and work

processes, particularly in their conduction of accessibility analysis (Drotz, 2014; Parker & Bradley, 2000; Bevir, Rhodes, & Weller, 2003). Over the past few years, the demand for efficiency and quality in the public sector has increased, which has raised the need for improvement (Denhardt & Denhardt, 2000). Early literature on LEAN in the public sector reveals that it is possible to apply LEAN and that many processes can gain greater efficiency by implementing aspects of LEAN (Radnor, Walley, Bucci, & Stephens, 2006). Recent literature reveals that LEAN has been utilized to improve the public sector, primarily in healthcare (Barnabè, Guercini, & Perna, 2019); in this regard, LEAN is used to address issues such as delays, costs, and speed of service (Holden, 2011). However, LEAN utilization is increasing in other public organizations, as well (Drotz, 2014). This in turn makes LEAN principles more adapted and adopted in the public sector, even though the implementation differs throughout organizations (Radnor & Walley, 2008).

3.2.1 Kaizen

Kaizen is a continuous improvement process based on making small changes on a regular basis, as a constant commitment to excellence (Singh & Singh, 2009; Imai, 1986; Cheser, 1998; Tatarnikova, 2019). In relation to the accessibility analysis, kaizen can be used to make small changes to the criteria. The kaizen approach involves an awareness of existing problems and a search for the slightest opportunity for improvement, thereby generating process-oriented thinking, since processes must be improved before greater results are obtained (Singh & Singh, 2009; Hammer & Champy, 1993). It must be emphasized that BNE's awareness of the problem regarding accessibility was related to the verification process and selection of data. Historically, kaizen has been centered on its application in the private sector, primarily in large manufacturing firms (Singh & Singh, 2009; Radnor & Boaden, 2008). However, it is proposed that similar methodologies might be transferred to other non-manufacturing contexts, as presented in Figure 2.1, whereas it has recently become common to apply kaizen in any area in need of improvement (Barraz et al., 2009; Singh & Singh, 2009; Cheser, 1998; Teian, 1992). It must be emphasized that the reviewed literature unanimously agrees that there is little evidence of the application of kaizen in the public sector. That said, some evidence suggests that public sector organizations might be improved by using kaizen (Rodgers, Antony, Edgeman, & Cudney, 2019; Radnor & Walley, 2008). One of the articles on this theme derives from work by Barraz, Smith, & Dahlgaard-Park (2009), investigating the effect of kaizen in Spanish local governments in three empirical cases. The conclusions indicated that there could be potential benefits in applying kaizen in the public sector with relation to work processes. Furthermore the literature review finds a small number of papers that focus on kaizen in the public sector, such as work processes in Spanish local governments (Barraz et al., 2009), human resources in the Mexican public service organization (Barraza & Pujol, 2010), and tax collection in the US (Barraz et al., 2009; Hasenjager, 2006).

3.2.2 Six sigma and LEAN six sigma (LSS)

Six sigma aims to reduce variation within specific boundaries (Rodgers et al., 2019) to identify and eliminate errors, defects, or failures within an organisation's processes (Antony, Rodgers, & Gupta, 2019), as often as 3.4 defects per million (Antony, 2004). The first implementation of six sigma was done by Motorola in 1987 and has later been recognized as the main reason behind their success. To successfully implement six sigma as an improvement business strategy, some key components, such as commitment from top management, training, and tools, are required (Drogomeretski, Costa, Lima, & Garbuio, 2013). However, as with any other improvement system in the past, six sigma also has its limitations. Some of six sigma's limitations include the availability of quality data, subjectivity in the prioritization of projects and tasks, and the calculation of defect rates that are driven by assumptions of normality (Antony, 2004). However, to minimize the limitations and increase the benefits of six sigma, companies tend to combine six sigma with other concepts, such as LEAN, to gain a competitive advantage.

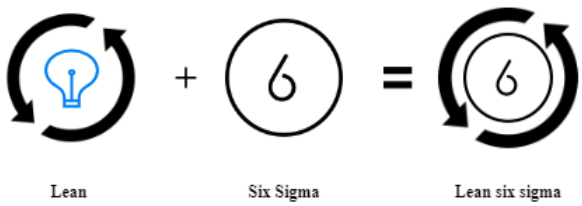


Figure 3.4: *An illustration of how LEAN + six sigma yields LEAN six sigma (LSS).*

The combination of LEAN and six sigma, as presented in Figure 3.4, is often favored due to their cultural similarities, since both approaches focus on continuous improvement (Drogomeretski et al., 2013), waste reduction, and employee involvement (Näslund, 2008). This makes LEAN six sigma (LSS) one of the most popular improvement systems in recent time, primary in manufacturing, but also in service industries and the public sector (Antony, Snee, & Hoerl, 2017; Rodgers et al., 2019; Antony et al., 2019). Thus, to address the limitations of both LEAN and six sigma, multiple studies on the combination of these approaches emerged. Several benefits of LSS, apart from continuous improvement, waste reduction, and employee involvement, includes increased customer satisfaction and increased awareness of problem-solving tools (Antony, Snee, & Hoerl, 2017). Regardless of the recognition of the comparability between LEAN and six sigma by numerous authors, there remains a gap in how to combine these methodologies in the best way possible (Sandner, Sieber, Tellermann, & Walthes, 2020). In addition, to successfully combine LEAN and six sigma, some critical aspects must be considered. Although there have been numerous studies on LSS, there remains a lack of concrete examination of the critical failure factors in implementing LSS (Albliwi, Antony, Lim, & Wiele, 2014).

On the other hand, recent literature has disguised the three most critical failure factors that must be considered, as follows (Albliwi et al., 2014):

- Lack of top management involvement, commitment, and attitude have been identified as critical failure factors.
- Lack of education and employee training are other critical factors that are often neglected due to costs.
- Lack of critical assessment of project selection and prioritization is the third most common critical failure factor in the current literature.

The largest pitfall, identified by Albliwi et al. (2014), is the absence of attention to these critical failure factors in the implementation of LSS. On the other hand, if a company pays attention to these critical factors, the implementation of LSS can be both efficient and effective in the public sector (Antony, Rodgers, & Cudney, 2017). As such, BNE must be aware of the critical failure factors in their implementation of LSS. Additionally, the accessibility analysis can potentially gain an advantage in that it becomes more verifiable with objective rather than subjective criteria.

3.2.3 DMAIC

One of the most common and effective improvement methods provided by six sigma (Mast & Lokkerbol, 2012) is DMAIC: define, measure, analyze, improve, and control (Mast & Lokkerbol, 2012; Dreachslin & Lee, 2007; Smętkowska & Mrugalska, 2018). It can be stated that BNE currently defines and measures its accessibility analysis based on DMAIC. However, this thesis also focuses on analyze, improve, and control. The five steps are connected and utilized to improve processes in different areas of a company and are crucial in the implementation of six sigma as illustrated in Figure 3.5 (Mast & Lokkerbol, 2012; Smętkowska & Mrugalska, 2018). Despite DMAIC's similarities to its predecessors, namely plan-do-check-act and the seven step method of Juan and Grynas, it is used to not only reduce variation but also serve as a method to change and establish new processes (Mast & Lokkerbol, 2012). To understand and implement DMAIC as an improvement method, the following steps are required:

- Define: The first, and arguably most important, step in a DMAIC cycle is to define and understand a given problem (Kaushik & Khanduja, 2009). The main purpose of this step is to define which organizational structure and resources are necessary to achieve the organizational goals. In addition, it is important to examine how responsibilities of actions are divided and verified; through this, it is possible to identify, understand, and solve a given problem (Smętkowska & Mrugalska, 2018). By improving a process, customer satisfaction could potentially increase due to higher quality, making customers' opinions a critical success factor (Dreachslin & Lee, 2007). BNE defines its criteria in the accessibility analysis.

- Measure: In the second step, measure, the main goal is to gather information about the process(es) that must be improved. This information will serve as the basis for the subsequent step (analyze). Moreover, it must be emphasized that the information will function as a benchmark in the control step, to investigate whether the process(es) are improved and/or the problems are solved (Smętkowska & Mrugalska, 2018). Critical flaws and problems with the current process(es) are often identified during this step (Chakrabortty, Biswas, & Ahmed, 2013). Based on the available data, BNE measures accessibility. However, it is not used as a baseline for an improvement process, as DMAIC suggests. The data is selected and incorporated into the analysis.

- Analyze: Different tools and methods are utilized to assess the risk, analyze the measured data, and determine the root causes of the problems (Smętkowska & Mrugalska, 2018). Information from customers may serve a great purpose here to identify dissatisfaction with the current solution (Dreachslin & Lee, 2007). To confirm the performed analysis, some test runs should be conducted to prove the validity of the identified problems (Smętkowska & Mrugalska, 2018). To analyze the accessibility analysis, it might be important to assess the available data and the data incorporated in the accessibility analysis.

- Improve: The main purpose of this step is to develop solutions based on the gathered information and analysis. It is necessary to eliminate the given problem, improve

the process, and implement changes during this phase by developing and testing several solutions (Smętkowska & Mrugalska, 2018). The benefits of the new solution should be immediate and correct specific problems (Kaushik & Khanduja, 2009). In addition, the newly presented solution should satisfy the customers (Dreachslin & Lee, 2007). To improve the accessibility analysis, data are objectified and implemented.

- Control: The control step is critical for ensuring that the problems do not reoccur. In this final step of the DMAIC cycle, it is important to ensure that the solution serves its purpose (Kaushik & Khanduja, 2009). Hence, the control step is a confirmation of how sufficient the solution is. However, to control the changes over time, continuous control of the solution is required - to potentially prevent new issues from arising (Smętkowska & Mrugalska, 2018; Dreachslin & Lee, 2007). To control the changes in the accessibility analysis, it might be important to control the feasibilities of the criteria. That is, BNE should verify whether the criteria serve the purpose for which they where intended. An illustration of these steps are illustrated in Figure 3.5.

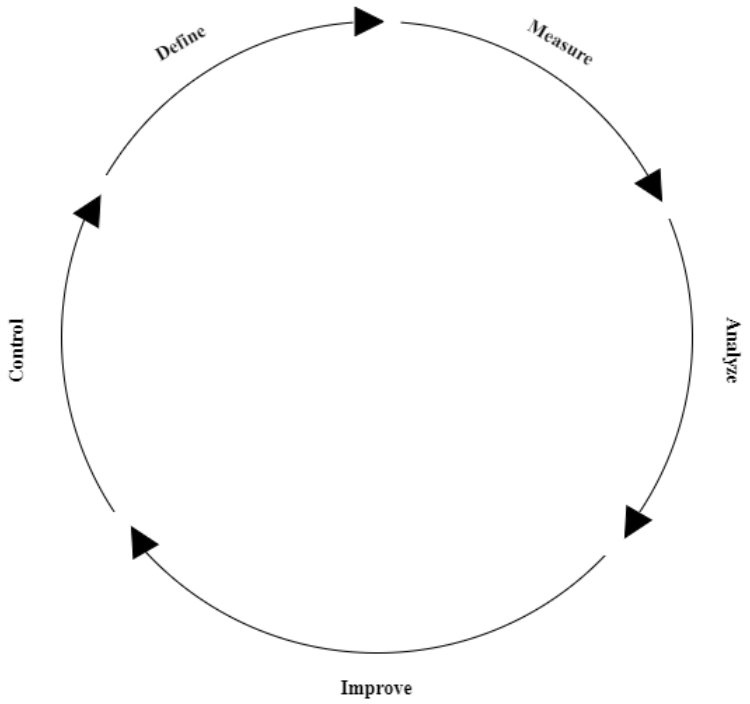


Figure 3.5: *DMAIC's five steps - define, measure, analyze, improve and control- form a continuous process*

3.3 Agile

The presented theories (LEAN, LSS, DMAIC, and kaizen) share similar characteristics with agile. Therefore, agile is introduced here. The concept of agile methodology gained increased visibility in 2001 with the introduction of the agile manifesto (Ribeiro & Domingues, 2018). This manifesto is an important part of agile, as it characterizes the values of agile methods and how they differ from traditional methods (D. Cohen, Lindvall, & Costa, 2004). Agile methods aim to allow an organization to be agile, whereas Jim Highsmith, one of the founders behind the manifesto, states that being agile means being able to change often, deliver, and change quickly (D. Cohen et al., 2004). It must be emphasized that agile methods originate from software development. However, agile's application has been widened to other aspects of an organization, with the underlying principles and values declared in the agile manifesto. This situation is reflected in academic research, as well. While the application of agile varies in practice, such applications share common characteristics (D. Cohen et al., 2004):

- Iterative development (D. Cohen et al., 2004)
- Focus on interaction and communication (D. Cohen et al., 2004)
- Self-manageable teams (Diel, Bergmann, Marczak, & Luciano, 2015)
- Flexible to changes (Diel et al., 2015)
- Minimize unnecessary specification, administration, documentation, and unproductive work (Nuottila, Aaltonen, & Kujala, 2016)

It is evident that the characteristics are based on the agile manifesto and Jim Highsmith's quote on being able to deliver quickly, change quickly, and change often. Iterative development enables teams to change quickly (D. Cohen et al., 2004). Interaction and communication are key elements in making decisions consecutively and hence delivering quickly (D. Cohen et al., 2004). Self-manageable teams and flexibility to changes rely on the individual's knowledge of their own responsibility rather than being centrally controlled, thereby enabling frequent changes. Last, the minimization of specification, administration, documentation, and unproductive work drives rapid delivery.

Despite the expanded implementation of agile approaches in recent years, acceptance of the method has been slow in the public sector (Ribeiro & Domingues, 2018). This situation is likewise reflected in academic research, in which studies on agile methods adoption in public sector organizations are uncommon and limited (Nuottila et al., 2016). The methodology in the public sector is not as clear as in the private sector (Ribeiro & Domingues, 2018), so the implementation of agile methods in the public sector might be challenging. The literature review reveals two main challenges: the lack of involvement of the final user and the lack of flexibility with integrating requirements during the project development (Ribeiro & Domingues, 2018; Wisitpongphan & Khampachua, 2016). In addition, Nuottila et al. (2016) identify and elaborate seven categories of challenges in the implementation of on agile methods in the public sector:

- Documentation: Employees misinterpreted the lack of documentation as non-existing documentation in a project.
- Education, experience, and dedication: The study revealed that it was necessary to drive agile practice as a single entity.
- Communication and stakeholders involvement: It was important to identify stakeholders preliminary to a project and consider them with communication when important decisions were made.
- Roles in project: The agile methodology forms a basis of self-manageable teams. However, it caused a lack of responsibility when employees do not understand their new roles.
- Development team localization: Some teams were more efficient than others, making coordination and communication more difficult.
- Legislation: The study identified some difficulties between the legislation and the principles of agile methods (e.g., delivery dates, costs, information confidentiality, and so on).
- Architecture complexity of software systems: Due to the complexity of the systems used in the public sector, the study reported some confrontation between agile methods and their established systems.

Agile implementation in public sector organizations comes with its own set of challenges. However, in relation to BNE and its accessibility analysis, agile might be applicable, as it shares similar characteristics with LEAN, LSS, and kaizen. Figure 3.6 displays how the research bridges the theory presented with agile.

Agile	Similarities to theory
Iterative development	**LEAN, LSS and Kaizen** Drive continuous improvement
Focus on interaction and communication	**LSS** Communication key when using DMAIC, as one can perform DMAIC different than the other
Self manageable teams	**LSS** At a strategic level (e.g., top management involvement)
Flexible to changes	**Kaizen** Make small changes to strive for excellence
Minimize uneccessary specification, administration, documentation and unproductive work	**LEAN** Basic principle of waste and value

Figure 3.6: *Illustrates a bridge between agile and the previously presented theory. The figure justifies why agile is introduced, namely that the features of agile and the presented theory either overlap or are similar.*

This thesis focuses on optimizing and verifying the accessibility analysis. By optimizing the analysis, it is directly connected to improving the analysis. To improve the analysis, it is necessary to revise the criteria repeatedly - in other words, an iterative development process. With an iterative development process, the analysis is benefited by driving continuous improvement, which is related to LEAN, LSS, and kaizen.

Agile in practice suggests focusing on interaction and communication. For example, when performing DMAIC, with the amount of data available, it is highly possible that two individuals obtain different results. Therefore, interaction and communication are key when similar results are to be obtained. Hence, the focus on interaction and communication is connected to LSS and DMAIC.

Additionally, agile in practice suggests self-manageable teams, which occurs more at the strategic level than the operational level; thus, it does not concern the accessibility analysis directly. LSS reveals that top management involvement is crucial for the implementation of LSS, also at a strategic level. Therefore, this thesis bridges agile and its self-manageable teams with LSS and top management involvement.

The agile manifesto and agile in practice share the common factor of being flexible to changes, similar to kaizen. While kaizen suggests making small changes frequently to strive for excellence, agility can enable BNE to be flexible to changes.

Agile in practice suggests minimizing unnecessary specification, administration, documentation, and unproductive work. On the other hand, LEAN, with its basic principle of waste and value, suggests the same. By minimizing the mentioned parameters in agile, the waste in LEAN is minimized, as well. Similarly, by doing so, more value is created. For instance, if the criteria in the accessibility analysis are more accurate, the specification gets minimized, and in turn, waste is eliminated and value is created.

3.3.1 Waterfall versus agile

The waterfall model is a sequential development model, whereas the agile model is a more adaptive model (Balaji & Murugaiyan, 2012). The similarities arise in that both of the models have a scope, cost, schedule, and performance (Palmquist, Lapham, Miller, Chick, & Ozkaya, 2013). In addition, the methods share the same goal: to deliver a quality product in a predictable, efficient, and responsive manner (Palmquist et al., 2013). However, while there are similarities, these methods are not the same. The main difference is the perspectives, which are backward-facing and forward-facing, respectively, to waterfall and agile. In a dynamic environment, the waterfall model struggles to deliver, as it constantly looks back at the fixed requirements and priorities (Palmquist et al., 2013). On the other hand, the agile model adapts its deliveries by constantly looking forward toward evolving requirements and priorities (Palmquist et al., 2013). It must be emphasized that both models have their pros and cons, but waterfall is presented in this thesis, as BNE might employ that particular project model. An comparison between these models is presented in Figure 3.7.

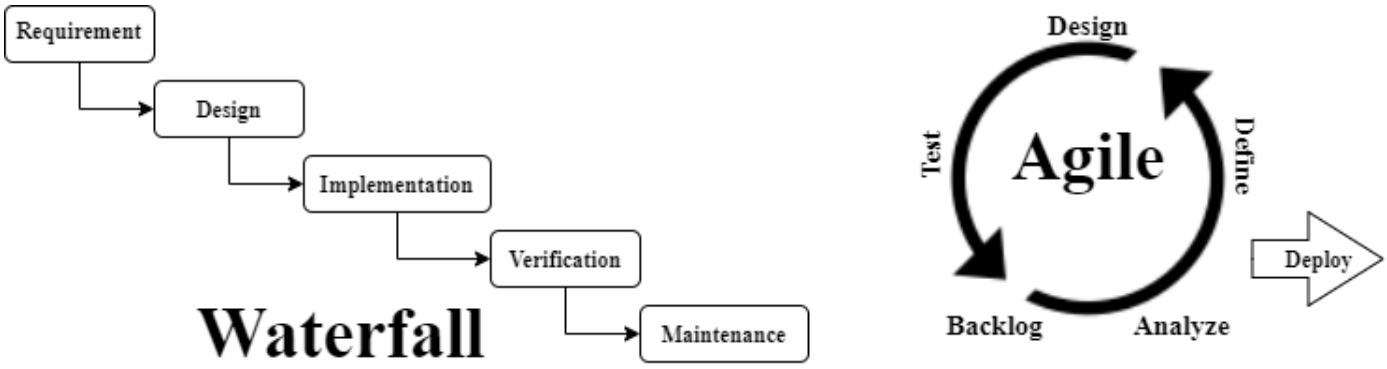


Figure 3.7: *An illustration of how project execution occurs in waterfall and agile project models*

3.3.2 Dynamic system development method

The dynamic system development method (DSDM) is neither fully a method nor a process model; rather, it is a framework of controls for rapid application delivery (RAD) (Stapleton, 1997; Sani, Firdaus, Jeong, & Ghani, 2013). However, it can be interpreted as a method, as it defines a process at a high level, meaning that it can be tailored for any technical and business environment (Stapleton, 1997). RAD involves creating what the organization needs when it needs it (Stapleton, 1997). DSDM is therefore a high-level framework based on wide experience, incorporating much of the current knowledge about project management (Howard, 1997; Voigt, Glinz, & Seybold, 2004).

The basic concept of DSDM is based on underlying principles that control how a project is pursued, in which time and resources are adjusted to satisfy the agility feature of DSDM (Howard, 1997; Sani et al., 2013). To achieve project success, the literature review revealed nine principles for DSDM (Howard, 1997; Sani et al., 2013; Voigt et al., 2004):

1. Active user involvement is critical
2. DSDM team members must be motivated to make decisions
3. The main concern is frequent deliveries rather than activities
4. The deliveries must be suited for the business purpose to be accepted as a delivery
5. Iterative and incremental development is important to build systems
6. All changes are reversible, meaning that no requirements are frozen
7. The baseline of requirements is at a high level
8. During the life-cycle of the project, testing is performed during the development rather than after
9. Collaboration and cooperation among stakeholders is essential

It must be emphasized that the DSDM framework can be applied for both agile and traditional approaches, as DSDM aims to be a best-practice framework (Voigt et al., 2004). Thus, DSMD shares common characteristics with the previously presented theory.

3.4 Cynefin framework

The Cynefin framework considers three types of ontologies: ordered, unordered, and disordered (Elford, 2012). These ontologies are divided into five domains: simple, complicated (ordered), complex, chaos (unordered), and disorder domains. These domains are used to match situations and problems with methods, tools, and techniques. Hence, a problem statement is related to the most suitable domain to potentially find solutions (Hasan & Kazlauskas, 2014). This framework was developed by Dave Snowden and is often applied to make sense of complex processes and take actions accordingly (Hasan & Kazlauskas, 2014; Snowden, 2002; Beurden, Kia, Zask, Dietrich, & Rose, 2011). The Cynefin framework has, in recent years, been utilized as a tool for classifying both issues and strategies in knowledge and strategy management, policy-making, and leadership training (Beurden et al., 2011; Snowden & Boone, 2007; Mark & Snowden, 2006). Snowden acknowledged that situations and problems are often complicated and examined the benefits of attempting to simplify them to bring order - especially since most researchers tend to bypass situations and problems that are complex. However, complicated systems can be understood by examining them over time, to predict future behavior (Hasan & Kazlauskas, 2014). Hence, the five domains of the Cynefin framework are used to understand the cause and effect relationship and take actions accordingly (Hasan & Kazlauskas, 2014).

- Simple/known domain: The cause and effect relationship in the simple/known domain is often linear, empirical-based, and indisputable (Mark & Snowden, 2006; Hasan & Kazlauskas, 2014; Elford, 2012). Models are often repeatable and predictive in this domain, focusing on objectivity and embedding knowledge in structured processes to ensure consistency and efficiency. The decision model in this domain is to sense the incoming data, categorize this data, and respond according to predetermined procedures (Mark & Snowden, 2006; Hasan & Kazlauskas, 2014). Thus, structured tools/techniques such as quantitative and statistical models are essential, not optional (Mark & Snowden, 2006).

- Complicated/knowable domain: In the complicated/knowable domain, a cause and effect relationship exist but is not necessarily fully known or known by only a small group of individuals (Mark & Snowden, 2006; Elford, 2012; Snowden & Boone, 2007). As a result, these relationships are separated over time and space and are difficult to understand (Mark & Snowden, 2006; McLeod & Childs, 2013). However, this domain has all the necessary prerequisites to move into the simple/known domain if these relationships are fully investigated. The core issue is whether there are time and resources available to invest in the movement. Since the complicated/knowable and simple/known domains are comparable, the decision model is quite similar. Both models sense and analyze incoming data, but in the complicated/knowable domain, the response to the data is in accordance with experts/advisors (Mark & Snowden, 2006) rather than the utilization of predetermined procedures.

- Complex domain: In the complex domain, an unordered domain, it is impossible to apply structured tools/techniques due to the high number of interactions and self-organizing systems/patterns (Elford, 2012; Mark & Snowden, 2006). As such, the

decision model differs from the decision models in the ordered domains. The decision model in the complex domain involves the examination of patterns/potential patterns to create a visible representation before taking any actions. To cope with the complexity in this domain, it is necessary to sense and respond to patterns by stabilizing them and managing them over time (Mark & Snowden, 2006; Elford, 2012).

- Chaos domain: While the other domains present visible cause and effect relationships, the chaos domain is different (Mark & Snowden, 2006; Elford, 2012). The systems in this domain are often turbulent, and the application of standardized tools/techniques are commonly ineffective, representing the core issue of chaos in the first place. Hence, it requires a decision model in which the actions are taken decisively to reduce turbulence and wait for patterns to emerge (Mark & Snowden, 2006).

- Disorder domain: To be assigned to the disorder domain, a system must be so unclear that it is a mismatch for all the other domains, and there is considerable disagreement between the decision-makers on how to proceed (Mark & Snowden, 2006; Snowden & Boone, 2007).

Figure 3.8 illustrates the described domains of the Cynefin framework and illustrates their key characteristics and properties to distinguish these domains. Furthermore, in Chapter 5, these domains are applied to BNE's current and potential point of view, to assign the organization to one of the domains. In addition, parallels between the Cynefin framework and Manos (2007) three categories of LEAN are drawn to illustrate how the domains and level of knowledge are potentially connected.

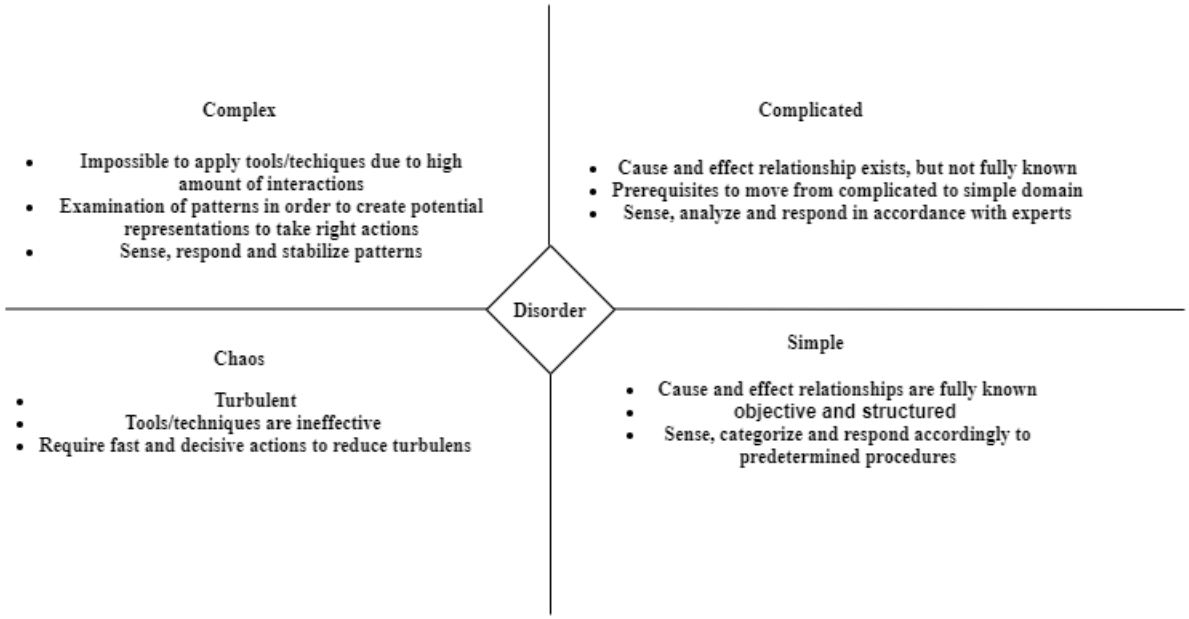


Figure 3.8: *Cynefin domains and their key characteristics and properties*

3.5 Theoretical framework

This section aims to combine the theory presented in Chapter 3 and establish a theoretical framework for this thesis, as illustrated in Figure 3.9. For the present work, the optimization of the accessibility analysis is the focus. Therefore, the accessibility analysis has an important feature in the theoretical framework in *L1, Figure 3.9*. The accessibility analysis is then divided into two components, namely the analysis and the project execution model, as displayed in *L2, Figure 3.9*. The project execution model can be interpreted as the process of conducting the analysis, in which processes must be improved before greater results can be obtained (Singh & Singh, 2009; Hammer & Champy, 1993). Therefore, to optimize the accessibility analysis it is crucial to research both the analysis, and the project execution model. The next layer, *L3, Figure 3.9*, illustrates the theory presented in Chapter 3. The theory is assigned accordingly to its preceding layer; thus LEAN, Kaizen, LSS, and DMAIC are intended to improve the optimization of the accessibility analysis, while agile, waterfall, and DSDM improve the project execution model. It must be emphasized that even though it is intended to be used in the way mentioned, this layer is flexible. For instance, if waste and value (LEAN) occur in the project execution model, it is possible for the researchers to apply LEAN, as there are similar characteristics in the theory, as described in the last part of the section on agile. Last, the Cynefin framework in *L4, Figure 3.9*, is positioned at the bottom. The Cynefin framework aims to match situations and problems with methods, tools, and techniques. In other words, it benefit the thesis by identifying BNE challenges related to the accessibility analysis and incorporates measures to enhance the Cynefin framework.

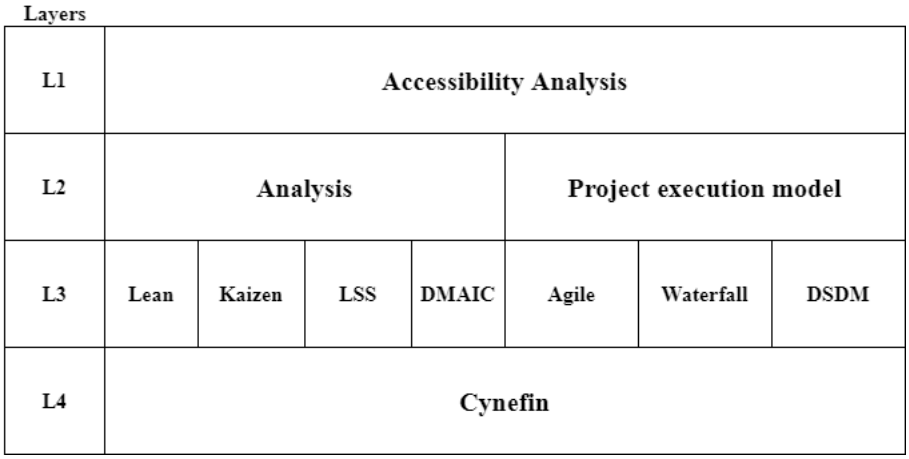


Figure 3.9: *Illustrates the theoretical framework of this thesis. The theory is divided into layers to break down the structure of the theory. Optimizing the elements at layer 3 and enhancing the Cynefin framework at layer 4 can potentially result in optimizing the accessibility analysis.*

Chapter 4

Method

The function of the methodology chapter is to provide insights into how the empirical data were collected, analyzed, and utilized throughout this thesis. In addition, the made during the research process are justified. This contributes to making the main findings of this thesis verifiable, which is important given research question *How can BNE's accessibility analysis be optimized and verifiable using LEAN methodologies?*

4.1 Research question

The authors were interested in writing a thesis about LEAN and researching the challenge of a large company in Norway; hence, Bane NOR Eiendom was selected for the present work. Preliminary to starting this thesis, the head of the faculty demanded a project proposal, presented in Appendix A.1, in which a research question needed to be formulated. The proposal, which contained a temporary research question, was discussed with the internal supervisor (UiA) and external supervisor (BNE) before being proposed. The research question can be viewed as an early step providing a point of orientation in the thesis (Bryman, 2007). Throughout this thesis, with the structured literature search and discussions with BNE, some challenges occurred. These were discussed and evaluated with the internal supervisor, which then yielded the current research question. In this process, the research question in the proposal was adjusted to suit the thesis and its purpose. A research question is often adjusted along the way to help readers understand the objective of the thesis (Thabane et al., 2008).

4.2 Research design

The preliminary stage of writing a thesis consists of accounting for the research question and research design. The research design can be viewed as a strategic framework, in which the goal is to bridge the research question and the implementation of research (Blanche, Durrheim, & Painter, 2008). In this thesis, a stepwise-deductive inductive (SDI) method was favored. SDI might resemble an abductive approach, but with its own characteristics. To understand SDI, it is necessary to distinguish it from the abductive approach. The abductive approach is viewed as a mixture of deductive and inductive approaches, in which it follows neither the pattern of pure deduction nor the pattern

of pure induction (Dubois & Gadde, 2002; Kovács & Spens, 2005). However, it is commonly used by researchers, in which the objective is to discover something new (Dubois & Gadde, 2002). The abductive approach aims to develop concepts or theoretical models rather than confirm existing theory (Dubois & Gadde, 2002). This approach is characterized as an approach where the researcher navigates around the theory and empiricism and adjusts the theoretical standing point alongside the progression of the empirical research (Busch, 2019). SDI is a stepwise process for which a combination of the deductive and inductive approaches is used (Tjora, 2021). While the abductive approach aims to develop theory, SDI uses the inductive approach as an "upward" process from the empirical findings to highlight the theory (Tjora, 2021). Furthermore, SDI analyze the theoretical findings against the empirical findings in a "downward" process (Tjora, 2021). SDI can benefit the study by creating a starting point for systematic progression in a qualitative research project, were it is important to gather data early in the project (Tjora, 2021). In this thesis some empirical data was collected after six weeks, which added the possibility to adjust the theories and perspectives that might be of interest for the empirical findings. That said, the data collection will be elaborated in Chapter 4.4. To summarize, SDI can be viewed as an iterative approach regarding the research design. As such, both the inductive and deductive approach is incorporated, as presented in Figure 4.1.

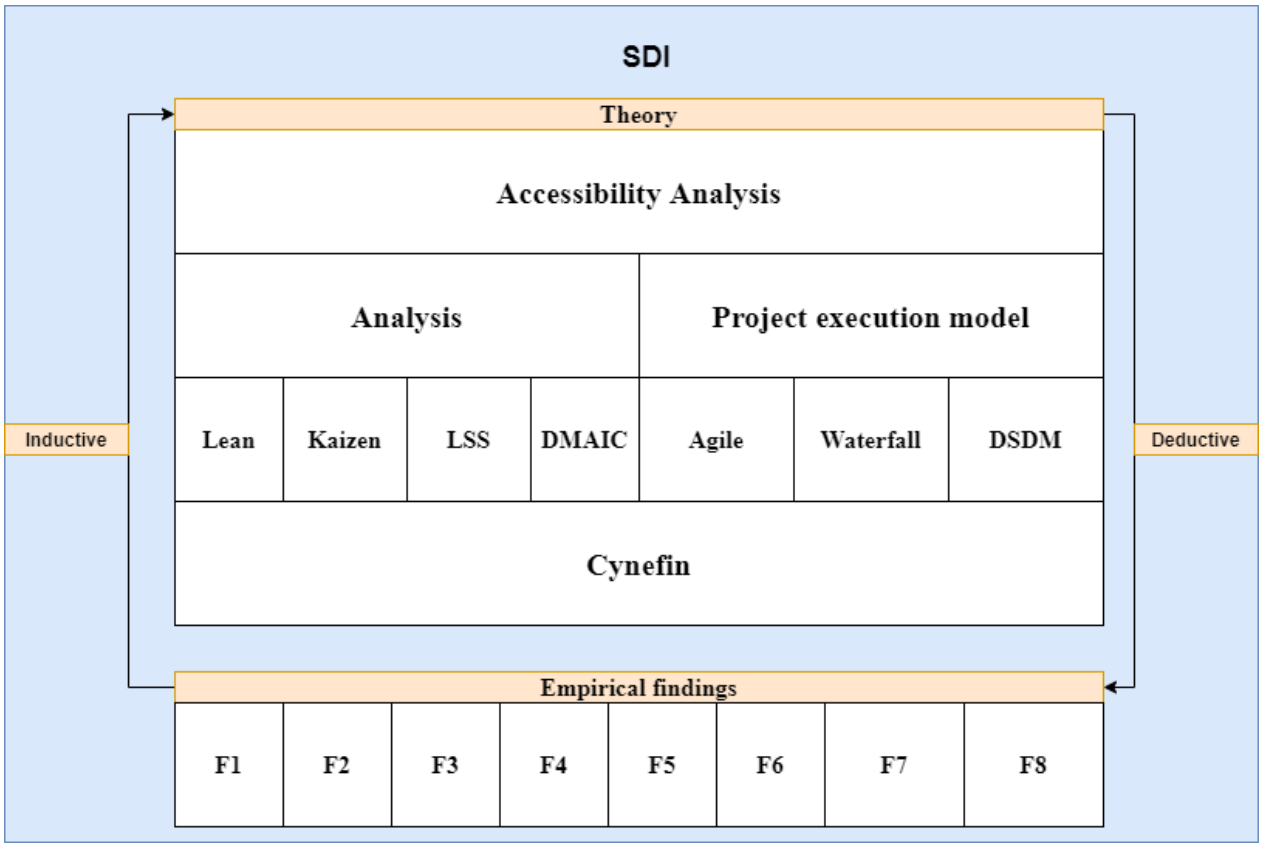


Figure 4.1: *Illustrates SDI as a research design and its iterative feature. From theory, SDI uses the deductive approach to analyze the empirical findings. While from the empirical findings, SDI uses the inductive approach to highlight the theory. It should be noted that the empirical findings F1 to F8 are for illustration purpose only.*

4.3 Structured literature search and analysis

The structured literature search was essential for this thesis, as it aimed to identify the research question and justify the relevance of addressing this research question (Brocke et al., 2015; Webster & Watson, 2002). However, it often is difficult to perform a literature search, in which researchers must make important decisions regarding the selection of databases, journals, defining search queries, and selecting criteria for the inclusion/exclusion of papers (Brocke et al., 2015; Boell & Cecez-Kecmanovic, 2014; Levy & Ellis, 2006). For the present work, Google Scholar and Oria (GoogleScholar, n.d; Oria, n.d) were used as databases for selecting the literature. Today's researchers are often required to develop new approaches to their literature search, as a result of the search engines becoming better, yet more complex (Brocke et al., 2015; Boell & Cecez-Kecmanovic, 2014; Bethard & Jurafsky, 2010). The scientific article search is complex in that the researchers must guess "good" keywords for a search engine and then consider articles citing and cited by the selected article (Bethard & Jurafsky, 2010). For this particular process, Connected papers (ConnectedPapers, n.d) were used to investigate articles citing and cited by the selected article. That said, if a literature search is performed correctly, it can improve the outcome of the thesis. To structure the literature and prepare it for analysis, a software called NVivo was used. The process of the structured literature search and analysis is illustrated in Figure 4.2.

In practice, the structured literature search was performed employing Google Scholar

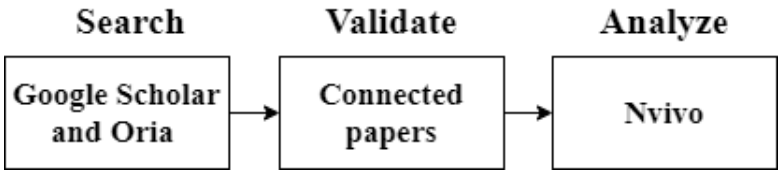


Figure 4.2: *Process of a structured literature search, in which the data is collected, verified, and analyzed.*

and Oria (GoogleScholar, n.d; Oria, n.d) by using relevant keywords in the search term to find corresponding literature. The researchers first used general keywords, such as following:

- *Keyword - Database; number of hits - Database; number of hits*
- Accessibility - Google Scholar; 6 290 000 - Oria; 773 087
- Lean - Google Scholar; 4 050 000 - Oria; 643 112
- Agile - Google Scholar; 978 000 - Oria; 133 621

With the general keywords able to define the concepts, this was often not sufficient to contribute to the research question. Therefore, a more specific search query was used, such as the following:

- *Keyword - Database; number of hits - Database; number of hits*
- Accessibility analysis - Google Scholar; 5 150 000 - Oria; 568 528

- Lean in public Sector - Google Scholar; 527 000 - Oria; 46 718
- Agile in public sector - Google Scholar; 97 100 - Oria; 15 417

After selecting a paper, the DOI or link was used to search for similar papers, and other papers citing and cited by the selected paper in Connected papers (ConnectedPapers, n.d), presented in Figure 4.3 . Thus, Connected papers functioned as a validator to find the origin of the literature and similar connections to cross-check statements with other authors.

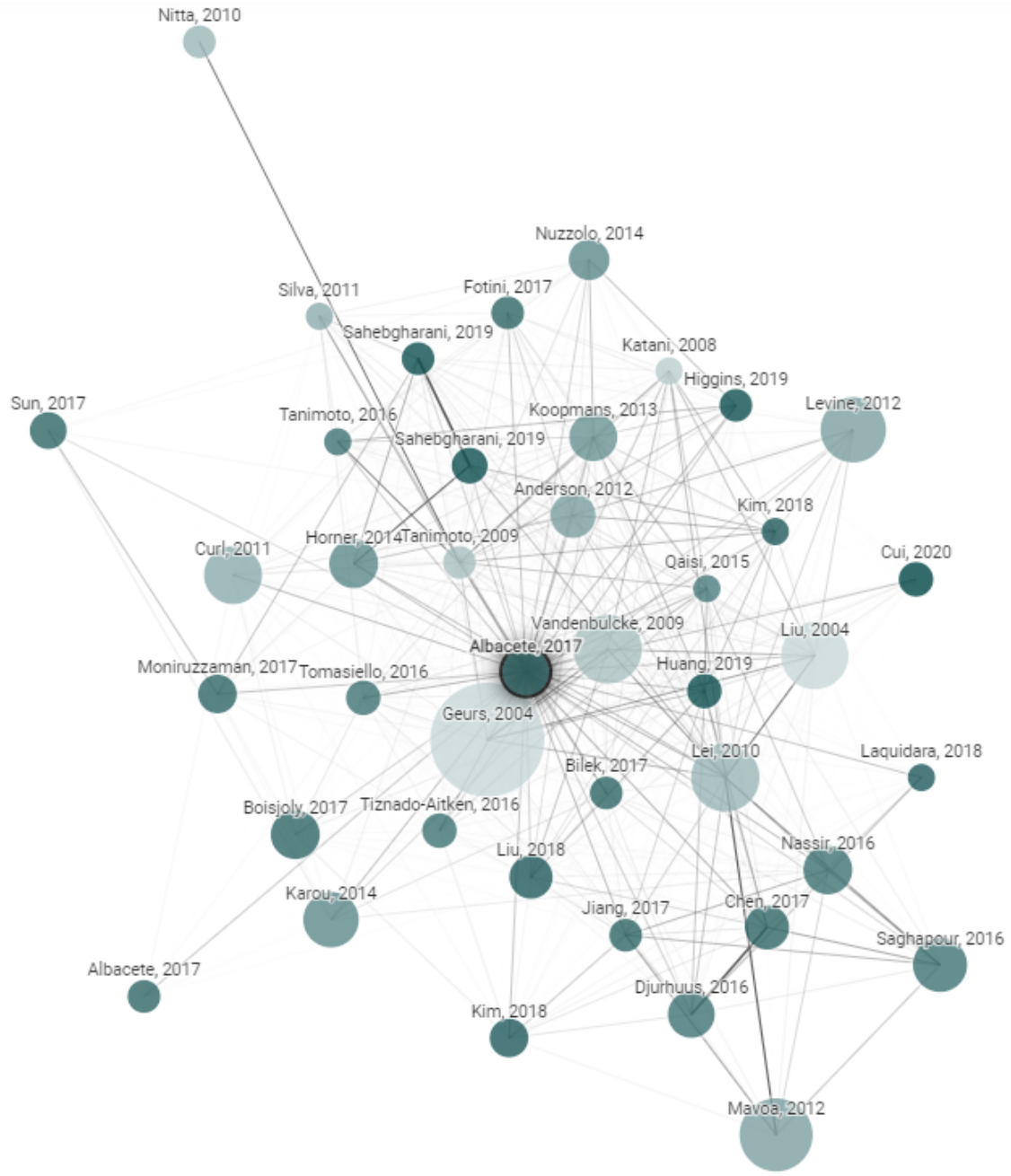
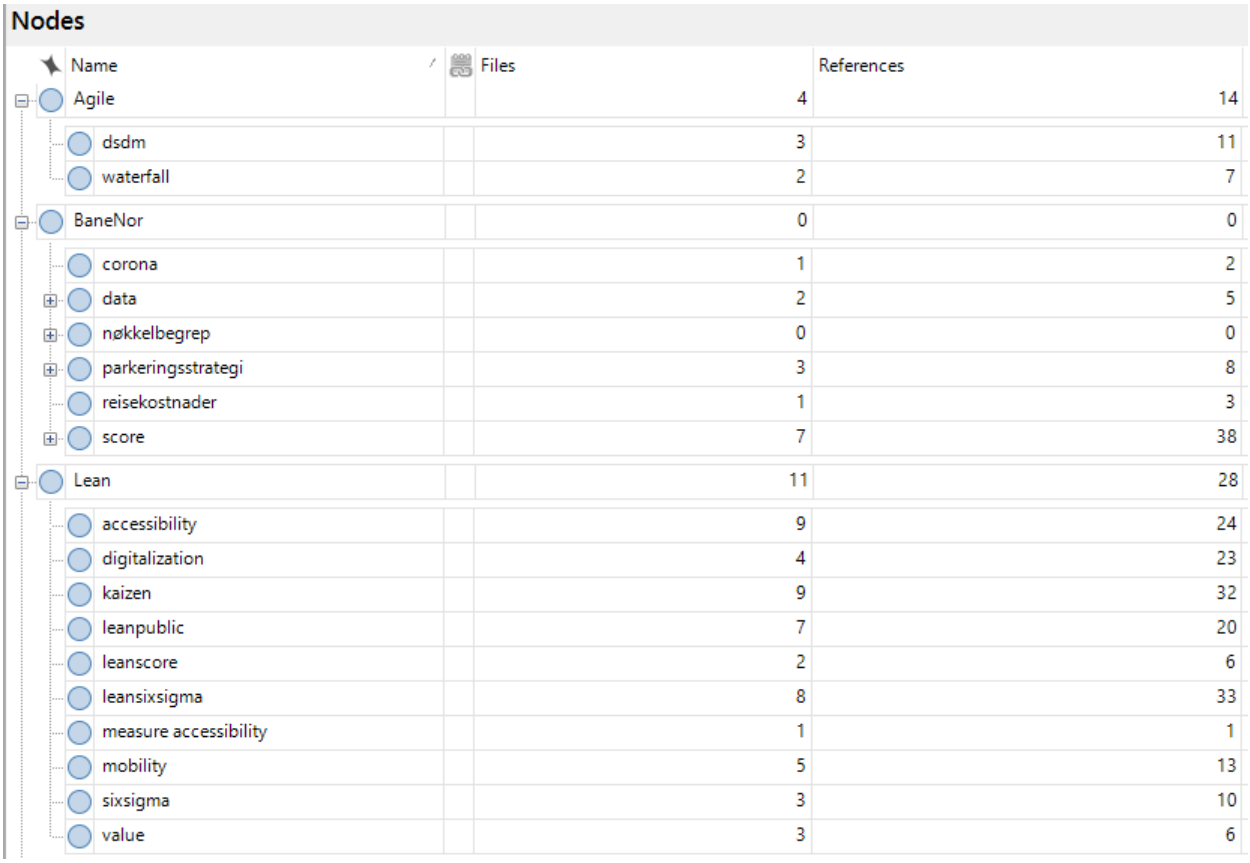


Figure 4.3: *Example from connectedpapers.com*

Then, the literature was imported into NVivo for analysis, in which extracts from papers were assigned to nodes, as displayed in Figure 4.4. By using NVivo to analyze the data, the researchers could gain a deeper understanding of the problem (Malakonlunthu, 2007; AlYahmady & AlAbri, 2013).



Nodes

Name	Files	References
Agile	4	14
dsdm	3	11
waterfall	2	7
BaneNor	0	0
corona	1	2
data	2	5
nøkkelbegrep	0	0
parkeringsstrategi	3	8
reisekostnader	1	3
score	7	38
Lean	11	28
accessibility	9	24
digitalization	4	23
kaizen	9	32
leanpublic	7	20
leanscore	2	6
leansixsigma	8	33
measure accessibility	1	1
mobility	5	13
sixsigma	3	10
value	3	6

Figure 4.4: *Nodes used in Nvivo to analyze information from the structured literature search.*

It must be emphasized that the authors have opted to categorize the literature search as a structured literature search, due to the method being used in a structured manner, as illustrated in Figure 4.2. The structured literature search evolved into a theoretical framework for this thesis, as presented in Section 3.5. Furthermore, at this stage, it was crucial to determine a research method.

4.4 Research method

A qualitative method was favored in this thesis. For instance, the structured literature search provided qualitative data, which served as a basis for this thesis. Qualitative data can be defined as a means of bringing order and structure to a mass of collected data. However, such a process is not easy, and software such as NVivo could considerably improve the quality of a given study (AlYahmady & AlAbri, 2013). For example, during this thesis, NVivo was utilized to create nodes, analyze data, and draw connections between various literature. As presented in Figure 4.4, nodes were created topic-wise to categorize the literature found using Google Scholar.

In addition, qualitative data focuses on the quality or distinctive features of a phenomenon. Hence, this method of data collection examines why something appears rather than counting the number of appearances (Johannessen, Christoffersen, & Tufte, 2019; Lancaster, 2005). However, a phenomenon often has both quantitative and qualitative aspects, making the actual data collection a determining factor of whether it is quantitative or qualitative (Gripsrud, Olsson, & Silkoset, 2010). Although these methods can be complementary (Gripsrud et al., 2010), the research question may determine which method is more suitable to collect the necessary data (Grønmo, 2016). Here, mostly qualitative data was obtained through a structured literature search and interview, but also quantitative data was obtained through two workshops. Quantitative data were collected as a supplement for qualitative data to test whether the new accessibility analysis was objective and verifiable. In this case, the quantitative data was the measurement of intervals and the score of criteria in the accessibility analysis. The data was further used as a comparison to their previously subjective accessibility analysis.

4.4.1 Interview

The respondents were two individuals from BNE, the first a planning consultant and the second a concept developer. Despite their different roles in BNE, both respondents worked with the accessibility analysis. This provided a unique opportunity to conduct a group interview, where the respondents complemented each other's answers. If a researcher requires a high degree of freedom from the respondent(s), qualitative interviews are preferable due to their flexible nature (Johannessen et al., 2019). A semi-structured interview was adopted, as the theme and questions were ordered in an interview guide. This type of structure enables the interviewer to ask a set of questions and compare the answers to the literature (Johannessen et al., 2019). These interviews are often conducted between an interviewer and the respondent(s) to gain in-depth knowledge that a strict quantitative survey could not provide. Both individual and group interviews are often organized as conversation(s) between the interviewer and the respondent(s), during which the interviewer documents the conversation(s) via notes or recordings to collect empirical data (Johannessen et al., 2019). Before conducting the interview, an application was sent to the Norwegian Center for Research Data (NSD), as this was a requirement for data collection with audio recording.

Table 4.1: *Interview guide*

Icebreaker question	What is your specific role in Bane Nor Eiendom?	Notes
General questions about LEAN	Do you have any relationship with the term LEAN? In today's business world, LEAN is in greater focus than ever before. How do you, as a company, approach LEAN? Are there any specific LEAN measures that you know of that are in place? Justify your answer, please.	Notes
General questions about accessibility	Briefly describe the process in which the accessibility analysis is performed. What are the main hurdles regarding the accessibility analysis? How are current analyses verified? Are there any measures taken in the past/present with respect to improving the analysis? And how do you potentially control new improvements? If you could improve the analysis, what would you consider? You conduct several other analyses that are more objective and quantity based; - why is this favorable? Are cause-and-effect relationships in your analysis often known? Do you know why you are measuring specific criterias?	Notes
Specific questions	What is the goal of an accessibility analysis? How do you prioritize which station/node to analyze? How do you assess the current criteria? • Do they variate? • Are they based on personal opinions? Does Bane Nor Eiendom have a specific project model? Are you familiar with the agile methods? Are these used in Bane Nor Eiendom? Do you believe the analysis is important to achieve the "net-zero-emission goal"? Justify your answer, please?	Notes

Table 4.1 illustrates the interview guide used to gather information about BNE. This interview guide is divided into four categories: icebreaker question, general questions about LEAN, general questions about accessibility, and specific questions about BNE. This categorization makes it a structured interview without fixed answers. Such an approach to gathering empirical data was preferred due to its flexible nature. To reproduce the interview in a thesis, it is important to transcribe the interview contents.

Transcription

Microsoft Word was used to maintain accuracy in reproducing the audio recordings of the interview and for privacy. The purpose of transcribing the interview was to safeguard the content and statements, making the data available in textual form and thus forming a good basis for the analytical work (Gubrium & Holstein, 2001). The aim was to reproduce the interview in its entirety while remaining true to the original language and fluency. It must be emphasized that the interview was conducted in Norwegian and therefore first transcribed in Norwegian, before it was translated into English. However, there are some interpretive challenges when transcribing audio recordings, such as the following (Gubrium & Holstein, 2001):

- Adjustment to sentence structure
- Correction of statements
- Use of quotation marks
- Interpretation challenges of the reproduction for others

To minimize misinterpretation, the interview was transcribed literally. However, repetitive words such as "eh," "ja, ja, ja," "hm," pauses, and laughter were omitted, as they did not have any significant meaning for the content. It must be emphasized that in the case of audio recordings, voice and body language are likely lost (Brinkmann & Kvale, 2014). To reduce potential sources of error, the transcription was performed within the same week as the interview. Additionally, the ethical perspective was considered, via confidentiality and a loyal transcript of the statements (Brinkmann & Kvale, 2014). In the transcripts, the names were changed to "respondent" with the corresponding number (e.g., respondent 1) to not record personally identifiable information. Therefore, both of the respondents sought to review the transcripts. The quality of the transcripts was assured by listening to the audio files and comparing them with the text file. Finally, the audio files were saved, processed, and deleted according to NSD's guidelines.

4.4.2 Workshop

The data was collected by conducting two workshops, the first during the early phase of the thesis (February), and the other during late phase (April) to verify and test the objectivity of the new criteria. The workshop should be designed to fulfill a research purpose in terms of producing reliable and valid data regarding the issue in question (Ørngreen & Levinsen, 2017). Therefore, the purpose of the workshop was to test the pre-developed criteria in the accessibility analysis and gather data for further work. The workshop with BNE was performed on the 18th of February 2021. Due to the currently ongoing Covid-19 pandemic, the workshop was limited and performed online through Microsoft teams. First, a brief presentation was given to highlight the activities in the workshop:

- Presentation of objective criteria for walking, bicycling, public transport, and cars
- Perform an objective accessibility analysis for Station 1
- Perform another objective accessibility analysis for Station 2
- Feedback session: What worked, and what did not work?
- Discussion based on the analysis process and results.

The workshop was limited to two hours after the interview. However, due to the time limitation, the respondents managed to complete only the accessibility analysis for the first station. The feedback session and discussion were performed simultaneously, during which weaknesses in the criteria were identified, thus creating a basis for iterative work on the criteria.

It must be emphasized that the iterative work functioned as an example of how BNE could practically approach the continuous improvement of its accessibility analysis. The second workshop, conducted on the 23rd of April 2021, included respondent 2 from the previous workshop and a new respondent, respondent 3, to contribute to the verification of the objective criteria. This provided an opportunity to test the actual objectivity of the criteria. Since respondent 2 had previously utilized the new method, familiarity was already present. However, the new respondent, respondent 3, provided a new insight that contributed to the validity and reliability of the proposed criteria.

4.5 Credibility, transferability, dependability & confirmability

Credibility, transferability, dependability, and confirmability are often considered in medical research, which maintain a high standard due to its rules and regulations. This thesis applied the same approach for its engineering research, since both of medical and engineering research share similar goals in ensuring trustworthiness in qualitative research. Ensuring trustworthiness in qualitative research involves establishing credibility, transferability, dependability, and confirmability (Pandey & Patnaik, 2014).

Frambach, van der Vleuten, & Durning (2013) defines credibility as the extent for which findings are both trustworthy and credible. The authors explains that ensuring credibility involves using multiple data sources, collect data over time, and to ask for feedback from respondents on the data or interpretation of data (Frambach et al., 2013). Multiple data sources were used, such as Google Scholar and Oria, in this thesis. In addition, BNE provided this thesis with their own internal documentation. That said, adding one more source could have benefited the thesis by ensuring data triangulation. However, Connected Papers were used to validate the data, as mentioned in Chapter 4.3, which can be interpreted as data triangulation. Two workshops were conducted to collect quantitative data over time, where more workshops would have provided this thesis with a greater data foundation. That said, the qualitative data was collected through an interview. The selection of respondents could have been greater, but it was limited to the respondents who worked with the accessibility analysis, being the two respondents. Therefore, due to the scope of BNE and the research question, the data collected on the two workshops and interview were sufficient. Lastly, the workshops functioned as a review of the present work, where BNE provided feedback to enhance the quality of the data or interpretation.

Transferability examines to what extent the findings can be applied in different settings, while dependability explores if the findings are consistent regarding the context of which they are gathered (Frambach et al., 2013). According to (Frambach et al., 2013) transferability might be ensured by making findings meaningful and discuss the findings. In this case, findings were discussed with BNE to ensure that the newly criteria were applicable to various stations in Norway. It was uncovered that some criteria were not suitable for both large cities and small towns, due to level of accessibility (e.g., walking/bicycling radius, and population-density). However, it might be applicable for every station if the intervals are adjusted due to the presented issues. These findings were compared with accessibility and mobility theory in Chapter 3, to ensure the quality and transferability

of this thesis.

Dependability was ensured by continuously re-examine the findings with the literature during this thesis. For instance, the findings from the interview and workshop were compared with the theoretical framework to ensure consistency. That said, the data collection could have potentially affected the dependability, as the data was only collected through two workshops. In other words, by examining the literature in-depth, potential deviations could have been uncovered. However, the information from the interview and workshop were consistently compared with the theoretical foundation to ensure highest possible dependability.

Confirmability are based on the participants in the study, which in this case, are BNE's respondents (Frambach et al., 2013). The authors write that ensuring confirmability involves to disconfirm the findings, discuss the research process with experts, keep a diary to reflect the research process and documents the steps and decisions taken in the research (Frambach et al., 2013). This thesis did not directly disconfirm findings but adjusted the theoretical standing point in accordance with SDI. The whole research process was documented in several documents, which included some decisions, activities, backlog, guidance, and feedback from BNE. However, this documentation started a couple of weeks in the project, meaning that the decisions made during the start-up was not documented. That said, there were no major decisions made during the first couple of weeks.

4.6 Methodology framework

To summarize the methodology path selected in Chapter 4, the literature is presented in a framework. The framework consists of the path from the research question, the research design approach, the research method for data collection, how qualitative and quantitative data were collected, and the credibility, transferability, dependability and confirmability of the data. It should be noted that the qualitative data functioned as an input in the research design, as this thesis used SDI as a research design. The methodology framework is presented in Figure 4.5.

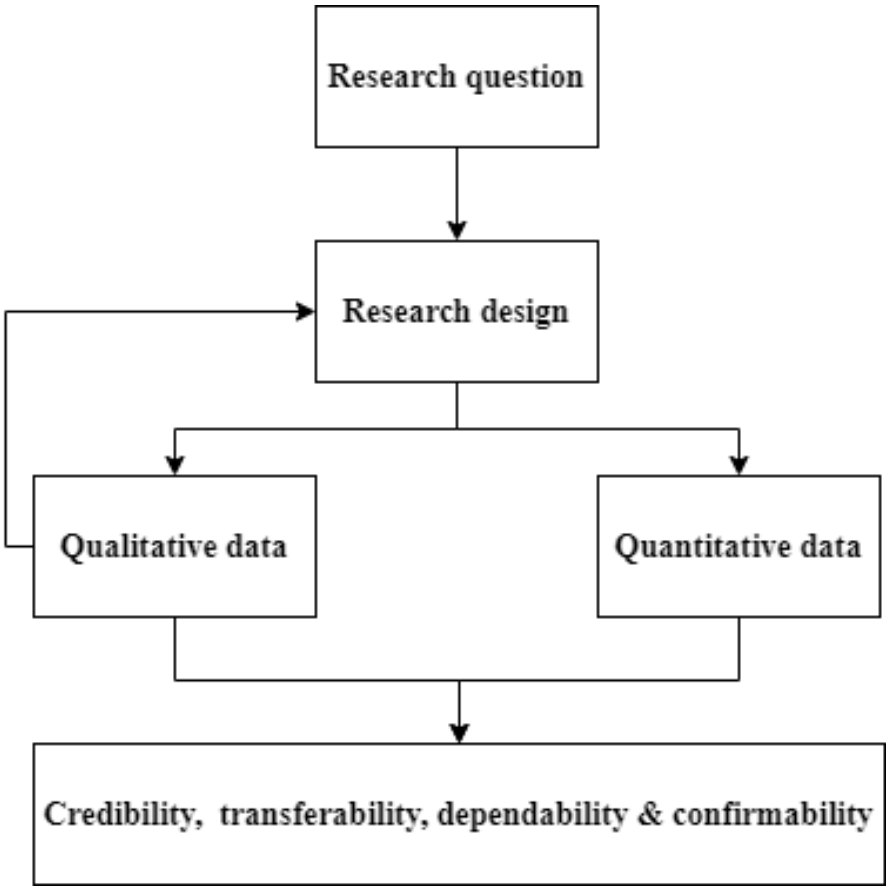


Figure 4.5: *Illustrates a summarized figure of the path selected for this thesis, related to the methodology.*

Chapter 5

Results and Discussion

This chapter seeks to answer the research questions of the thesis: *Examine how BNE's accessibility analysis can be optimized and verifiable with LEAN methodologies* and *determine the usage and knowledge of LEAN in BNE*. First, in Section 5.1, the main findings from the literature review, in-depth group interview, and workshops are presented. Subsequently, in Section 5.2, these main findings are discussed and analyzed in light of the theoretical perspective of this thesis.

5.1 Main findings

In this section, the empirical findings from the research are presented through the theoretical perspective in this thesis: LEAN, agile, accessibility analysis, project model, and execution. The findings could have been presented in the same order as in the interview guide, but in this thesis, they are presented topic-wise. Therefore, each of the following sections presents elements from the interview related to that specific topic.

5.1.1 LEAN

The main findings uncovered that the respondents from BNE have limited knowledge about and relationships with the LEAN term. That said, respondent 1 indicated that the main corporation Bane NOR has individuals who work with LEAN: *"What I know in Bane NOR is that we have our own LEAN people. But I have never been involved in it, and they have often been more in the operation and maintenance part of the railway."* Therefore, the respondents were aware of the term but did not necessarily understand it. Nevertheless, both respondents acknowledge that BNE has attempted to utilize LEAN methodology in places where there are obvious and clear needs for improvement - for example, by attempting to streamline a work process, and to improve areas where there are "clear goals" and "action points." indicating, *"But we probably relate to LEAN, but we do not call it LEAN."* Additionally, there was a mismatch between the job titles and job descriptions of the respondents, and they were often working on different projects within the organization. Regarding to the current accessibility analysis, several challenges (capacity, time, resources, distinguishing the difference between objective and subjective criteria) and areas for improvement (time, better data, stakeholder involvement, and the possibility to verify the analysis) were identified.

5.1.2 Accessibility analysis

Concerning the accessibility analysis, several main findings were unveiled. For instance, this analysis has evolved over time, and at first, only a few factors were considered. According to respondent 2, the former analysis considered only major structural constructions in a region, in addition to parking, ticket zones, and distance to stations. However, with time, the accessibility evolved from a few factors to the consideration of local conditions, such as the possibility of walking, bicycling, taking public transportation, or riding a car, to improve the quality of the analysis. Respondent 2 states that *"When I started this project here couple of years ago, I realized that I had to look at the local conditions"* and *"together with my colleague we got a job to develop criteria based on sources."* As such, the current analysis considered four to five assessment criteria, scored on a scale from one to six, per mode of transport. However, the current criteria are a combination of objective and subjective assessment, which can be challenging, according to the respondents. When the respondents were asked to describe the challenges with the current accessibility analysis, multiple challenges were presented. Respondent 1 stated that *"it has not always been easy to use"*, supplemented by the statement provided by respondent 2, indicating that *"whomever sits and conduct the analysis gives different results."* This indicates that different individuals obtain different outcomes when the same procedure is followed. In addition, the strictness of an individual affects the score of the criteria, while communication and repetitive work were some of the identified issues.

Nevertheless, the largest issues, according to the respondents, were the lack of verification of the analysis once it was completed. Respondent 2 said that *"It has not previously been verified, when it is done it is completed and forgotten,"* while respondent 1 added, *"this analysis has perhaps been a little more verified by a coworker, who will take a new evaluation of the analysis. Respondent 2 also has to sit down, look at it again and look at it from a new perspective. This is not verification."* They concluded by stating it is useful to learn from former findings and results. Additionally, some main findings regarding the criteria in BNE's current accessibility were made. As presented in Table 2.1 in Chapter 2, various criteria for walking, bicycling, public transport, and car usage are assessed to score various stations. However, due to the perception-based approach to these transport modes, objective alternatives were prepared, tested, and suggested during this thesis. For example, in Table 5.1, new criteria for walking are recommended address BNE's current issues. Whereas BNE's current analysis measures X number of criteria, the presented solution focuses on the walking distance, reachability, road safety, and perceived travel route. However, the main difference between Table 2.1 and Table 5.1 is that the latter presents formulas and intervals to provide a more objective measurement of the criteria.

For example, the current accessibility analysis describes the walking distance criteria as *a threshold of 15 minutes of walking distance around the station is mapped. An assessment of the population within walking distance and density around the station is considered,* according to Table 2.1. However, to make a more objective evaluation of the 15-minute threshold value, a formula is suggested based on the population within a 15-minute radius divided by the total population in a municipal or town. Later, the X-value is incorporated into an interval, as illustrated in Table 5.1, to provide an accurate score. The source of data in this criteria is extracted from Statistics Norway (SSB, 2021). Hence, different criteria are evaluated, calculated, and incorporated in intervals based on the source data to score the different transport modes. However, there are overlaps

Table 5.1: *New objective criteria for walking*

Transport Mode - Walking						
Criteria	**Description**	**Formula**	**Variable - Interval - Score**			**Source**
1. Walking distance	(1) A threshold of 15 minutes of walking distance around the station is mapped. An assessment of the population within walking distance and density around the station is considered.	$\frac{Population\ within\ 15\ min\ radius}{Total\ population} \times 100 = X$	X →	0 – 1 %	5	Population extracted from SSB (2021)
			X →	1 – 3 %	4	
			X →	3 – 6 %	3	
			X →	6 – 10 %	2	
			X →	> 10%	1	
			Dependencies: Surface coverage (-1) PT frequency (-1)			
2. Reachability	(2) How the network of roads and paths sewn together to create a good road network for pedestrians is examined. A reachability score from 0 to 1 is used to quantify this.	*Reachability score (RS) see source*	RS →	0 – 0.2	5	Openroute (2021)
			RS →	0.21 – 0.4	4	
			RS →	0.41 – 0.6	3	
			RS →	0.61 – 0.8	2	
			RS →	0.81 – 1	1	
			Dependencies: Squared surface (-1) Congested surface (+1)			
3. Road safety	(3) Intersections and infrastructure that ensure pedestrian traffic safety are assessed, as well as an assessment of previous traffic accidents where pedestrians have been involved.	$\frac{AADT\ of\ the\ three\ most\ trafficated\ roads\ to\ the\ station}{Accidents\ in\ the\ area} \times 100 =$ ROS	ROS →	> 4.0%	5	Vegkart(2021)
			ROS →	2 – 3 %	4	
			ROS →	1 – 2 %	3	
			ROS →	.5 – 1%	2	
			ROS →	0 – .5%	1	
			Dependencies: Same as bicycle			
4. Perceived travel route	(4) Quality of the surroundings, active facades and audience-oriented activities are assessed specifically for each case. Signage of the station and the station's visibility in the landscape are considered. In addition, social security is assessed, with an emphasis on lighting and clear areas.	*Neighbourhood safety (NBT) see source*	NBT →	0 – 20	5	Finn(2021)
			NBT →	21 – 40	4	
			NBT →	41 – 60	3	
			NBT →	61 – 80	2	
			NBT →	81 – 100	1	
			Dependencies: More than 20 roads leading into the station viewed from the road map (-1)			

in some of the criteria across different transport modes. For instance, regarding both road safety/traffic and accidents and reachability/road quality, the formula is equal for walking and bicycle, as presented in Tables 5.1 and 5.2. This is an interesting finding, since both transport modes use the same roads, making these criteria important for safe travel. Additionally, the radius of 15 minutes applies to both walking and bicycle, even though 15 minutes of cycling covers a longer distance. Thus, while the time use is 15 minutes, a larger part of the population might be covered by cycling, since the average speed of a bicycle is higher than that of a regular pedestrian.

Table 5.2: *New objective criteria for bicycling*

Transport Mode – Bicycle					
Criteria	**Description**	**Formula**	**Variable - Interval - Score**		**Source**
1. Distance	**(1)** A threshold value of 3 kilometers is used for bicycles. It can be assumed that more people cycle longer, but it is at this distance that public transport or cars gain a competitive advantage.	$\frac{Population\ within\ 15\ \min\ radius}{Total\ population} \times 100 = X$	X →	0 - 1%	5
			X →	1 - 3%	4
			X →	3 - 6%	3
			X →	6 - 10%	2
			X →	> 10%	1
			Dependencies: Surface coverage (-1) PT frequency (-1)		
2. Traffic and accidents	**(2)** Traffic volume (AADT), speed limit and previous accidents with cyclists are assessed. In addition, intersections and measures that separate cyclists and cars are considered.	$\frac{AADT\ of\ the\ three\ most\ trafficated\ roads\ to\ the\ station}{Accidents\ in\ the\ area} \times 100 =$ ROS	ROS →	> 4.0%	5
			ROS →	2 – 3 %	4
			ROS →	1 – 2 %	3
			ROS →	.5 – 1%	2
			ROS →	0 – .5%	1
			Dependencies: Squared surface (-1) Congested surface (+1)		
3. Quality of bicycle roads	**(3)** Bicycle paths and other infrastructure are mapped. The quality is also assessed, including coherence, marking and safety. In places where it cannot be assumed that there are bicycle lanes, sidewalks will be able to replace these.	$Reachability\ score\ (RS)\ see\ source$	RS →	0 – 0.2	5
			RS →	0.21 – 0.4	4
			RS →	0.41 – 0.6	3
			RS →	0.61 – 0.8	2
			RS →	0.81 – 1	1
			Dependencies: Squared surface (-1) Congested surface (+1)		

Source
Population extracted from SSB (2021)
Vegkart (2021)
Openroute(2021)

The main finding regarding public transportation was that BNE focused on not only the frequency, travel time, and exchange points but also the actual surroundings and condition of the individual locations, as presented in Table 2.1. However, in the new criteria in Table 5.3, there is a focus on only the objective criteria, such as the frequency of each route, the number of routes leading to the stations, and the actual travel time in relation to car usage. The new criteria neglect the local surroundings and conditions, since BNE does not own or manage local bus stops in, for example, Egersund or Stjørdal.

Table 5.3: *New objective criteria for public transport*

Transport Mode – Public Transport					
Criteria	**Description**	**Formula**	**Variable - Interval - Score**		**Source**
1. Frequency	(1) The frequency of the means of transport that serve the station about the surrounding areas is described and assessed specifically for each individual location. In addition, the scaling of the timetable is assessed.	*See timetable for each route* *Threshold: 2 times per hour*	X →	< 0.1/hrs	5
			X →	< 0.5/ hrs	4
			X →	< 1/hrs	3
			X →	> 1 /hrs	2
			X →	> 2 /hrs	1
			Dependencies:		
2. Surface Coverage	(2) The number of routes to the station are assessed.	$\frac{Number\ of\ routes\ to\ station}{Total\ routes} \times 100 = SC$	SC →	< 20 %	5
			SC →	20 – 30 %	4
			SC →	30 – 40 %	3
			SC →	40 – 50 %	2
			SC →	> 50 %	1
			Dependencies: Bus terminal less than 300m from station (-1) Several PT options (-1)		
3. Exchange points	(3) The exchange point is assessed on the simplicity, how far it is between the means of transport, correspondence and how well the routes are coordinated.	*Check if the routes not going to the station, overlap (OP) with the ones going to the station*	OP →	< 10%	5
			OP →	10 - 30%	4
			OP →	30 – 50 %	3
			OP →	50 – 70%	2
			OP →	> 70%	1
			Dependencies:		
4. Travel time	(4) Using (2) as a baseline, all the routes to the station are timed and compared to the travel time with a car.	*Check each route. Example:* $\frac{Public\ transport\ time\ 1}{Car\ time\ 1} \times 100 = X_1$ Average: $\frac{X1+X2+X3...Xn}{Number\ of\ X's} \times 100 = X$	X →	> 80 %	5
			X →	60 – 80 %	4
			X →	40 – 60 %	3
			X →	20 – 40 %	2
			X →	< 20 %	1
			Dependencies:		

The findings regarding car usage as a transport mode uncovered a smaller amount of difference. Both the current criteria and new criteria focus primarily on the same elements, such as the travel time, costs of parking and toll booths and distance from the car parking to the platform. However, the main difference between these analyses is that the new criteria present intervals to categorize the data.

Table 5.4: *New objective criteria for cars*

Transport Mode – Car					
Criteria	**Description**	**Formula**	**Variable - Interval - Score**		**Source**
1. Traffic situation	(1) Concrete assessment of congestion in rush hours around the station, by using 3 or 4 main roads leading to the station. See congestion on google maps.	Choose 3 – 4 main roads and check the congestion during rush hours. Find the minimum and maximum time. $\frac{Congestion\ time\ (max)}{Normal\ time\ (min)} \times 100 = X_1$ $\frac{(X1-100\%)...(Xn-100\%)}{Number\ of\ X's} = X$	X →	> 75%	5
			X →	55 – 75 %	4
			X →	35 – 55 %	3
			X →	15 – 35 %	2
			X →	< 15%	1
			Dependencies: Surface coverage > 60% (-1) Surface coverage < 30% (+1) Squared surface (-1) Congested surface (+1)		
2. Parking	(2) Parking capacity is mapped and occupancy (the proportion of parking spaces occupied) is assessed according to a set scale.	$\frac{AADT\ of\ 3-4\ roads}{Number\ of\ parkingspots} = PF$	PF →	> 15	5
			PF →	10 – 14	4
			PF →	7 – 9	3
			PF →	4 – 6	2
			PF →	1 - 3	1
			Dependencies:		
3. Cost	(3) How expensive it is to choose a car is examined, including toll passes and the price of parking. Fuel costs are not considered.	*Check toll passes (t) and parking costs* (pc)	X →	pc & 2+ t	5
			X →	pc & 2t	4
			X →	pc & 1t	3
			X →	pc or t	2
			X →	0pc & 0t	1
			Dependencies: Same as bicycle		
4. Distance to platform	(4) Numbers of parking withing a set number of radius.	*250m is a threshold value* Example: check number of parking spots within and outside of the threshold. Determine the percentage.	X →	< 20 %	5
			X →	20 – 40 %	4
			X →	40 – 60 %	3
			X →	60 – 80 %	2
			X →	> 80 %	1
			Dependencies:		

5.1.3 Mobility

The largest finding regarding mobility was BNE's focus on the green transport hierarchy pyramid (Figure 3.2. Respondent 2 stated, "*the purpose of the accessibility analysis is to determine what is attractive or not in relation to the mobility pyramid, and come up with recommended measures,*" relating the transport modes to the categorization of walking, bicycling, public transport, and car usage by Bergman & Bergman (2019). However, respondent 2 implied the current trend points toward people using cars instead of walking and bicycling, even though many of these individuals have the ability to walk or cycle. Yet, respondent 2 likewise emphasized that personal reasons, such as children in kindergarten and long distance to the stations, might be a determining factor for why some individuals prefer car usage over other transport modes. In addition, the respondents described the accessibility analysis as a useful tool for identifying measures regarding the mobility pyramid.

5.1.4 Agile

The interview presented an opportunity to identify how BNE conducted the accessibility analysis. The respondents were often unaware of the methods discussed, such as LEAN and agile. However, after learning what agile involved, the respondents could relate their work process to the method. Respondent 1 claimed, *"we jump a little back and forth,"* whereas respondent 2 elaborated that *"When we have finished a stretch, we return to square one where we iterate. The actual follow-up work can be said to be iterative."* The respondents concluded that they might use elements of agile but do not use the term or have a relationship with the methodology.

5.1.5 Project- model and execution

The interview provided the opportunity to gain an overall impression of the BNE project model and how they executed projects, the latter with respect to the prioritization of stations in which the accessibility analysis was performed. The entire organization of BNE and the division performing the accessibility analysis categorized their model as a waterfall project model. Respondent 1 stated that *"We have our own project model, while BNE has its own project model...In the project model of BNE, there is start-up, planning etc. similar to ours."* The reason for these two different project models was due to planning and regulations. BNE as an entire organization needed to consider regulations, while the division performing the accessibility analysis did not. Respondent 1 stated that *"We have created our own project model that does not fit with any laws."* The interview revealed that BNE had a plan for which stations to analyze and in what order. In addition, it illustrated the division's flexibility with rapidly changing focus. Respondent 1 claimed, *"What is determined is determined, while what is demand comes continuously. So, a quick chat with the bosses. We relate to the lists that were made in 2019."* Meanwhile respondent 2 added that *"But we do not have a list that we follow."* To summarize, the findings revealed that BNE followed a waterfall project model. The execution was based on a prioritization list made several years earlier; however, the demand triumphed the list, thus making the division flexible.

5.1.6 Workshops

In addition to an in-depth group interview, a workshop was conducted in February, to test the new objective criteria. To make the test as objective as possible, two random stations were selected: Egersund (Rogaland) and Stjørdal (Trøndelag). The two respondents had the opportunity to assess the accessibility for walking, bicycling, public transportation and car riding to these stations. The outcome of this workshop was that both the respondents received almost identical results, based on the objective criteria. In addition, the respondents acquired new knowledge and got an idea of how they could practically drive continuous improvement of the analysis, namely through a workshop, and their scores were similar to their previous subjective scoring. Later, in April, a new workshop was conducted to test and verify the new criteria presented in Tables 5.1, 5.2, 5.3, and 5.4.

However, respondent 1 was replaced by respondent 3 due to scheduling issues, which provided an opportunity to test the new criteria on an individual without preliminary knowledge about or familiarity with the objective accessibility analysis. This provided unique insight into the progression of the criteria, since an unbiased representative was introduced. Fetsund (Viken) was analyzed during the second workshop, and both respondents respond positively to the scoring of the different transport modes. Unlike the first workshop (Egersund and Stjørdal), there were no previous analyses to which compare the results. However, both respondents implied that the scoring of the transport modes appeared fair thanks to their experience with similar stations, implying that the new criteria provided sufficient data to make decisions around stations. Nevertheless, one concrete challenge with the new criteria was uncovered: the lack of subjectivity. While LEAN methodologies consider subjectivity a waste, BNE is concerned with not only the efficiency to travel to their stations but also their surroundings. Hence, the respondents stated that the new criteria provided an objective and verifiable foundation for decision-making, even though they lacked some subjectivity to determine the areas and surroundings.

5.2 Discussion

In this chapter, a discussion on the main findings is provided regarding the presented theory in Chapter 3 to answer the presented research questions.

5.2.1 LEAN

One of the largest findings regarding LEAN was the lack of knowledge of both the term and its methodologies. However, the respondents agreed that they are both aware of the term and that LEAN is utilized in other parts of the organization. According to Manos (2007), this knowledge stage of LEAN can be described as a LEAN learner, a stage in which the basic concepts of LEAN, such as value and waste, must be understood to further evolve into a LEAN achiever or LEAN thinker stage. This development can be crucial to satisfy the growing demand for efficiency and quality in the public sector (Denhardt & Denhardt, 2000). On the other hand, according to respondent 1, BNE has attempted to utilize LEAN methodology in areas where there is an obvious need for improvement - which, according to Manos (2007), can be related to LEAN achiever, a category in which the goal is to achieve LEAN rather than understand it. Additionally, the respondents stated that the main organization, Bane NOR, has its own individuals who work with LEAN at a maintenance and operational level. This is consistent with the statement by Radnor & Walley (2008) that LEAN principles are being increasingly adapted and adopted in the public sector, despite the implementation differing in various organizations - and, in this case, it differs within the organization. Nevertheless, the respondents stated that they most likely utilize elements from LEAN realizing it. Additionally, both respondents admitted a mismatch between their job titles and job descriptions, which can create uncertainty. This matter might be a critical failure factor for BNE, if they decides to implement and educate on LEAN methodologies (e.g., Kaizen and LSS) for every employee and not only those at a maintenance or operational level.

For instance, as indicated in Section 3.2.2, Albliwi et al. (2014) presented the three most critical failure factors in implementing LSS: the lack of top management involvement, lack of employee education and training, and lack of critical assessment of project selection and prioritization. Hence, the difference between job titles and descriptions at BNE might indicate both a lack of top management involvement (e.g., close follow-up of employees) and a lack of education and training for employees (e.g., uncertainty of what and when to deliver), which might cause issues if the company attempts to implement LEAN methodologies across the organization. However, if BNE manages to educate, train, and follow-up its employees, implementation of, for example, LSS can be both efficient and effective in the public sector (Antony, Rodgers, & Cudney, 2017). This could potentially optimize the current accessibility analysis, which at this stage has several challenges (e.g., capacity and use of resources). By utilizing several LEAN methodologies (e.g., time usage, data accuracy, standardized procedure), the analysis would be not only optimized but also potentially verifiable (e.g., data foundation, verification of the scoring system, and stakeholder involvement).

5.2.2 Accessibility analysis

According to Fuglsang et al. (2011), the focus on accessibility has increased in line with the increasing attention paid to CO2 reduction. As such accessibility is commonly defined as the ability to reach a destination via movement or transport (Manaugh & El-Geneidy, 2012). However, until recently, the measurement of accessibility has been challenging (Lättman et al., 2016), as reflected in the answers provided by the respondents during the interview. Even though the respondents presented several improvements that have been made over the past years, there remain challenges and areas for improvement. Albacete et al. (2015) divided the evaluation of accessibility measurements into two categories, objective and subjective, which complies with the respondents' current analysis. However, the current accessibility analysis combines both objective and subjective data foundations, and not a single defined category. This might seem beneficial due to different perspectives on walking, bicycling, public transport, and caruse, but it introduces several challenges for BNE. The current analysis has four to five assessment criteria for each method of movement or transport, and these assessment criteria are a combination of objective and subjective data foundations. According to the respondents, this is challenging since the current scoring system is too perception-based.

Due to subjectivity, different results are often presented even though the same procedure is followed. This, combined with the fact that the current accessibility analysis lacks verification, indicates that decisions made on subjective criteria might create uncertainty. Thus, decisions are made on perception and not on the data foundation. As such, more objective criteria would potentially make the analysis verifiable, and the decision-making is done according to actual data rather than human perception of every station in Norway. Objective assessment of the transport modes can potentially better assess demand and competitionGeurs & van Wee (2004). However, more characteristics increase the level of accuracy, thereby requiring more data, Albacete et al. (2015), and creating challenges, as well. The more data, that more employees of BNE requires a good work methodology to cope with the amount of information. For instance, instead of simply conducting an accessibility analysis and moving on, a work methodology such as DMAIC cannot be implemented without verification or control, by defining, measuring, analyzing, improving and controlling (Mast & Lokkerbol, 2012) the criteria.

For instance, even though the new criteria in Tables 5.1, 5.2, 5.3, and 5.4 provide a transition from subjectivity to objectivity, BNE might benefit from adjusting the formulas, intervals, and scoring as they progress in their accessibility work. First, from a DMAIC perspective, it is necessary to adjust or improve/control criteria to score different stations accurately. In addition, in may be crucial for BNE to measure new intervals to cope with the different landscapes in Norway. Large cities, such as Oslo, have more dependencies (e.g. multiple roads, options for public transport, high amount of population in walking/cycling distance) than, for example, Stjørdal or Kambo.

According to Kaushik & Khanduja (2009), it is crucial to define and understand the given problem, which in this case is to understand what criteria objectively assess the different method of movement or transport, which can be verified and examined post-analysis. After defining the criteria, the main goal is to gather sufficient information/data to analyze (Smętkowska & Mrugalska, 2018) and provide an appropriate score for every criterion. According to Smętkowska & Mrugalska (2018), some test runs should be conducted to verify the given results; in this case, this would have required getting various employees of BNE to conduct the same test and then comparing the results. For instance, during the workshop, the two respondents had the opportunity to test run the new criteria at a station, which resulted in similar scores at almost every assessment point. However, this is not necessarily representative, which is why the improvement step of DMAIC is important. By further analyzing the collected data, reducing problems/waste, and adjusting variables, which in this case are the criteria, it might benefit the company by creating an immediate and specific solution (Kaushik & Khanduja, 2009).

On the other hand, in the final step of a DMAIC process, it is critical to implement continuous control to ensure that the solution serves its purpose and is sufficient (Kaushik & Khanduja, 2009; Smętkowska & Mrugalska, 2018). Additionally, such control might potentially identify and prevent issues during the early stages (Smętkowska & Mrugalska, 2018). Hence, BNE can identify, measure, analyze, improve, and control its new criteria to take more accurate assessments at every stations, based on an objective data foundation. By optimizing the accessibility analysis, BNE can potentially identify more cause and effect relationships by analyzing both more and better data and advance the Cynefin framework. As presented in Section 3.4, the Cynefin framework is used to understand cause and effect relationships and take actions accordingly Hasan & Kazlauskas (2014). BNE's current stage is similar to the complicated/knowable domain in the Cynefin framework, since the cause and effect relationships exist but are not fully known (Mark & Snowden, 2006; Elford, 2012; Snowden & Boone, 2007). For instance, both respondents agreed that they began to see patterns but did not necessarily understand which data were best for fully calculating the accessibility at different stations. There were deviations between their analysis of Egersund and Stjørdal and the analysis used during the workshop. Thus, even if the analysis was conducted by the same people, respondents 1 and 2, the available data was different, potentially creating a difference due to objective and not subjective options. Hence, by utilizing this data, cause and effect relationships became more understandable and transparent (e.g., 15-minute radius for walkers, frequency of public transport), making it potentially easier to comprehensively assess every method of movement or transport. In addition, parallels between the four domains of the Cynefin framework can be compared with the three categories of LEAN by Manos (2007) - LEAN learner, LEAN achiever, and LEAN thinker - as presented in Figure 5.1.

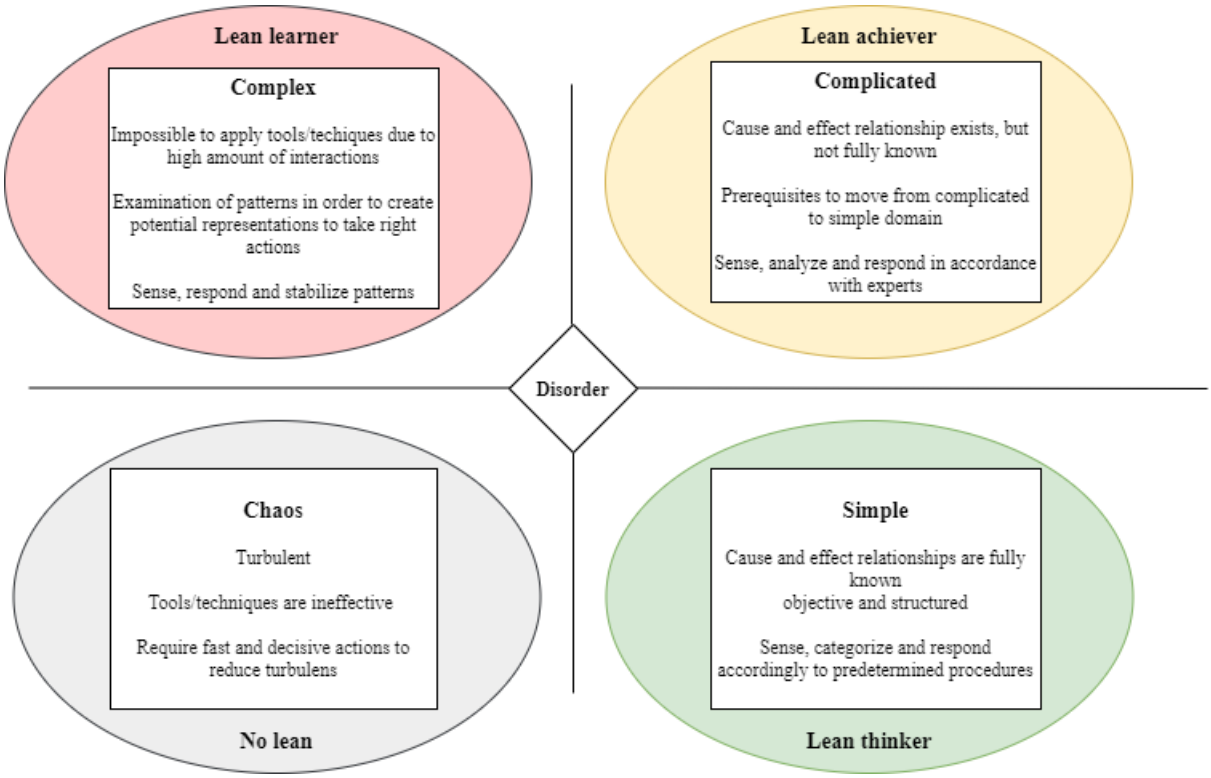


Figure 5.1: *Cynefin framework compared with the stages of LEAN.*

For instance, a LEAN learner might be compared with the complex domain due to the number of interactions and lack of understanding of complex cause and effect relationships of LEAN. Furthermore, the LEAN achiever, a stage during which an individual conducts physical implementations of LEAN rather than understands it fully, can be compared with the complicated domain of the Cynefin framework. The cause and effect relationships are more visible than during the previous stage (LEAN learner/complex), but there remains room to fully understand LEAN and think from a LEAN perspective (Manos, 2007). As such, the simple domain similar to the LEAN thinker stage, during which it is natural to sense, categorize, and respond, and the cause and effect relationships are known.

- LEAN learner / Complex domain: Fundamental understanding of LEAN, with a lack of tools and techniques; the respondents were aware that Bane NOR has LEAN individuals on other levels but did not know what they do.
- LEAN achiever / Complicated domain: A physical stage during which LEAN is utilized but not fully understood. There is a link between cause and effect relationships. The respondents stated that attempts have been made to use LEAN to address specific issues, without fully understand what and why they were using it.
- LEAN thinker / Simple domain: A mindset in which an individual thinks from a LEAN perspective, since all the cause and effect relationships are known and addressed in an objective and structured matter. The goal is to objectify the accessibility analysis, so that BNE can take more accurate and thorough actions at different stations in Norway.

Cause and effect relationships might also serve their purpose of following recommended measures based on the mobility pyramid (Figure 3.2). For example, understanding cause and effect relationships, such as long distances or children in kindergarten might provide BNE with insights into why transport modes such as walking and bicycling are less favored in some places with a high population in the threshold value of 15 minutes. However, it must be emphasized that not every decision made by BNE regarding accessibility requires objectivity. For example, during the second workshop, held in April, the respondents were highly positive about the objectivity of the new criteria. However, one of their concerns other than data-driven decision-making was to focus on the actual surroundings of stations. Attractive facades, people, and lighting were some criteria they sought to investigate further. On the other hand, due to the nature and predetermined scope of this thesis, objectivity and LEAN methodologies were examined and evaluated. Nevertheless, their desire to add subjective elements to the new objective accessibility analysis provides a foundation for further work regarding this thesis.

5.2.3 Agile

The theory related to agile was first presented with Jim Highsmith's definition of agile, before it was elaborated on and connected to other academic research, followed by the challenges with the adoption of agile in the public sector being presented. This discussion aims to use Jim Highsmith's definition of agile as an overall understanding, but as the other literature review is more specific, it is used as a basis point for the discussion. Jim Highsmith defines agile as the ability to deliver quickly, change quickly, and change often (L. Cohen et al., 2011). The respondents from BNE were not familiar with the term agile. However, after elaborating on what the methodology involved, one of the respondents related their analysis work to agile. L. Cohen et al. (2011) state that the application of agile involves iterative development, focus on interaction, and communication. Additionally, the literature review revealed two main challenges with the adoption of agile in the public sector: the lack of final user involvement and the lack of flexibility (Ribeiro & Domingues, 2018; Wisitpongphan & Khampachua, 2016).

Viewing the theory in light of the interview, the latter reveals that BNE has an iterative process based on stretches, and they might use local expertise and operations managers locally. Therefore, BNE has an iterative method of conducting analysis and, to some degree, focuses on interaction and communication. BNE's flexibility to change paths during the initial plan concurs with (Diel et al., 2015) a statement about agile in practice being flexible to changes and, to some degree, correlating to one of the challenges (i.e., being lack of flexibility), presented by (Ribeiro & Domingues, 2018; Wisitpongphan & Khampachua, 2016). One of the respondents claimed that they might use agile without concertizing the methodology. According to (Ribeiro & Domingues, 2018), this is not uncommon, as the methodology in the public sector is not as clear as in the private sector. According to (Nuottila et al., 2016), there are seven challenges related to agile implementation in the public sector; however, not all were identified during the interview. First, agile methodology forms the basis of self-manageable teams, in which employee understanding of their role is important (Nuottila et al., 2016).

In the interview, the respondents' roles at BNE were defined as singular items, while their jobs were describes as a set of activities; in other words, the job title did not match the job description, thus potentially causing their understanding of their role to be vague. Second, communication and stakeholder involvement are important preliminary to a project (Nuottila et al., 2016). The impression gathered during the interview was that the involvement of stakeholders could or did often cause a conflict between the respondents' conceptual vision and the stakeholders' need, as the respondents claimed that emotions were often involved. Thus, the general population might have an opinion about not walking and cycling and rather taking their car for convenience, while BNE's vision was to make walking and cycling more attractive. Hence, while making walking and cycling more attractive, it might have no effect. Third, the complexity of systems used in the public sector might create a conflict with agile methods (Nuottila et al., 2016). The workshop and earlier presentation of BNE's systems revealed the complexity of the systems used in performing the accessibility analysis. A set number of internet tools were used to establish the parameters for the criteria. Last, (Nuottila et al., 2016) write that employees misinterpreted the lack of documentation as being non-existing documentation in a project; though, for this thesis, this was not the case. However, the employees had difficulty pinpointing what documentation to use among all the documentation they had. Thus, the available data was somehow overwhelming for the employees, making it difficult to identify the proper data foundation to use in the accessibility analysis.

5.2.4 DSDM

In this section, the nine principles of DSDM (Howard, 1997; Sani et al., 2013; Voigt et al., 2004) are discussed based on the empirical findings in the interview. It must be mentioned that some of the nine principles are discussed earlier.

- Active user involvement is critical.

  As mentioned earlier, the interview revealed that BNE used local expertise and operations managers to gather input data for the analysis. On the other hand, users who were actually affected by the accessibility analysis were not involved. The BNE respondents reasoned this as it was emotionally biased, such that the users' opinions did not align with the respondents' conceptual vision.

- DSDM team members must be motivated to make decisions

  This research did not find any results contradictory to this principle. However, it must be emphasized that for team members to make decisions, they must have the decision-making authority. However, it is more common to have this authority in the private sector, as it is more bureaucratic than the public sector. That said, the respondents were flexible and motivated to make changes in the analysis. Therefore, even though they did not make decisions that impacted the entire organization, they had the authority to make changes related to their field of work. In addition, the respondents claimed that there were no rules or regulations directly related to their field of work, hence giving them the freedom to make decisions.

- The main concern is frequent deliveries rather than activities

  The respondents claimed that they had an overall plan, formulated a few years earlier. However, when it was demanded, they allocated resources to address the matter immediately. As such, they focused on frequent deliveries but also activities.

- The deliveries must be suited for the business purpose to be accepted as a delivery

  This principle corresponds to BNE's method of working on their accessibility analysis. BNE delivered the completed analysis, which was the business purpose.

- Iterative and incremental development is important to build systems

  The respondents began with one type of accessibility analysis, before iterating after the stretch was completed. During this process, some of the criteria were adjusted. This indicates that there exists evidence of iterative development at BNE in developing a system for the analysis.

- All changes are reversible, meaning that no requirements are frozen

  The accessibility analysis was performed mostly subjectively, so the principle applies as it is reversible. However, the goal was to develop a set of objective criteria, so that the changes related to the results would not be reversible. That said, the analysis and the criteria are reversible; thus, the present work correlated with this principle.

- The baseline of requirement is at a high level

  The baseline of requirement is at a low level in this research. It is more detail-oriented rather than general. However, in this research, the goal is to meet the principle and create a baseline of requirement at a high level.

- During the life-cycle of the project, testing is performed during the development rather than after

  Currently, testing the criteria for the accessibility analysis was not performed.

- Collaboration and cooperation between stakeholders are essential

  As mentioned in the first principle, there is some collaboration with local experts and operations managers. Therefore, this principle somehow follows the same guidelines as the first principle.

The DSDM framework can be applied for both traditional and agile approaches, as it aims to be a best-practice framework (Voigt et al., 2004). It must be emphasized that similarities exists between DSDM and the two approaches. While BNE is currently using the traditional waterfall model, it has some elements of agile features. Hence, DSDM was introduced to bridge BNE's methodology to the theoretical foundation in this thesis.

5.2.5 Project model and execution

Respondents 1 and 2 described their overall project model as a waterfall project model. However, their model differs from BNE's overall model, since respondents 1 and 2 are part of a staff, and their tasks and objectives often change due to demand. Additionally, according to the respondents, BNE as an organization follows laws and regulations, while its analytical work does not apply to this. However, even though their project planning can be compared with a waterfall model, given that they follow a project throughout phases-, the execution is closer to the agile project model. According to Palmquist et al. (2013), the similarities between a waterfall and an agile project model are the scope, cost, schedule, performance, and delivery of a quality product - which, in this case, is an accurate accessibility analysis. However, as stated by Palmquist et al. (2013), the waterfall model often struggles to deliver in dynamic environments due to fixed plans and requirements, which is consistent with the respondents' perception of their project model. For instance, even though they follow a predetermined list of projects as of 2019, the respondents are often placed on different projects, and the prioritization list is frequently adjusted due to BNE's changing demands. Hence, due to the forward-facing and flexible approach to changes (Palmquist et al., 2013), the respondents might need to consider an agile project model to meet their demands in a dynamic environment, due to flexibility and adaptivity (Balaji & Murugaiyan, 2012).

Chapter 6

Conclusions

In this chapter, conclusions are drawn. The research questions that were presented in Chapter 1, are answered based on the empirical findings and theory. Additionally, the limitations of this thesis and recommendations for further work are presented.

In this thesis, the accessibility analysis was divided into two components: analysis and the project execution model. This separation contributes to optimizing all aspects of the analysis, so that both the analysis and the means of conducting the analysis can be optimized. The analysis can use elements of LEAN methodologies to become more verifiable. This thesis introduces a more objective approach rather than a subjective one to eliminate waste and create value. Kaizen and LSS were used to uncover the need for continuous improvement of the analysis. As such, the analysis in this thesis is not fully optimized, and small changes can be made to strive for perfection; such changes can be made to the entire analysis (e.g., criteria, formula, interval, and source). One of the core issues with the analysis was that if one individual conducted the analysis, the results would most likely not be the same as if a different individual were to conduct the analysis. However, by objectifying the criteria and creating an interval for scoring, the analysis proved to yield the same results, independent of the individual conducting the analysis. This thesis used the Cynefin framework to measure the impact of the suggested analysis, where it proved to enhance one step in that framework.

Additionally, BNE's project execution model is currently based on a waterfall model. However, the empirical findings revealed that there was flexibility in selecting which analysis to conduct, followed by an iterative approach after conducting the analysis. Therefore, this thesis recommends using elements from both agile and waterfall and creating a best-practice execution model, such as DSDM.

6.1 Summary

Throughout this thesis, several interesting discoveries were made, such as lack of relation to LEAN and agile methodologies in BNE and the lack of objective criteria for conducting an accurate and verifiable accessibility analysis. According to the presented theory in Chapter 3, this is a common issue in the public sector worldwide. To answer the first research question, *how can BNE's accessibility analysis be optimized and verifiable using*

LEAN methodologies?, the current analysis was examined, and subjective criteria were identified and eliminated. Additionally, by conducting an in-depth group interview and a workshop with two respondents from BNE, the newly proposed criteria were discussed and tested. One of the most interesting findings during the interview was that the respondents had attempted to utilize LEAN without realizing it, while their initial accessibility analysis transitioned from a general analysis of different stations to a more local-based analysis. However, the current analysis was too perception-based, so by presenting new objective criteria, the deviation decreased. For example, during the workshop, two random stations were analyzed by the respondents, and their scores were almost identical based on the new data foundation and scoring system. Thus, to conclude the first research question, it is important to emphasize that even though the current analysis was optimized by using LEAN methodologies (e.g., kaizen, LSS, and DMAIC), there remains room for improvement to make it more accurate and reliable.

The second research question, *to determine the usage and knowledge of LEAN in the public sector*, illustrated that even though the usage and knowledge of LEAN have increased, primarily in healthcare, there remains a lack of understanding in not only the Norwegian public sector but also the public sector worldwide. Kaizen, a continuous improvement process, has, for instance, only a small number of papers that focus on the benefits of implementation in the public sector. However, as presented in Section 3.2.1, there is evidence of these benefits in Spain, Mexico, and the US. Combined with the incremental changes that BNE conducted in relation to the accessibility analysis, it might be possible to document their benefits regarding LEAN methodologies utilized in the public sector. Additionally, there is a lack of literature discussing the best way to combine LEAN and six sigma (LSS), even though this method is used in various industries, such as the public sector. On the other hand, according to the findings obtained in the interview, it was uncovered that various organizations in the public sector - in this case, BNE- have utilized different elements of LEAN methodologies without realizing it or naming these elements in such a manner. Hence, to conclude the second research question, it must be emphasized that the public sector in Norway and worldwide might use LEAN methodologies without actually documenting or acknowledging it. That said, there remains a lack of evidence for best practices, and the suggested application of kaizen, LSS (DMAIC), and agile to BNE is still in an early stage. As such, this thesis can be used as a contribution of the LEAN utilization in the public sector. Thus, no best practice is proposed during this thesis- rather, only a foundation of objective criteria to improve BNE's current accessibility analysis.

6.2 Limitations and further work

Several suggestions are made for further improvement of the accessibility analysis and the implementation of LEAN in the public sector. First, to be more accurate and competitive, BNE should consider DMAIC or a similar working methodology to measure, analyze, improve, and control its criteria with respect to local conditions and the infrastructural development in Norway to achieve its net-zero emission goal. Additionally, due to the agile elements in BNE's project model and execution, the implementation of DSMD might

be beneficial, since this approach is comparable with both the agile and waterfall project models, as it aims to be a best-practice framework. Hence, by determining how to improve and control the objective criteria and how to select and execute projects, BNE could potentially uncover new and clear cause and effect relationships and therefore manifest their standing in the simple domain of the Cynefin framework. Regarding the actual implementation of the analysis, it might be beneficial for BNE to LEAN their IT solution, in which all the data (e.g., maps) are collected in a single location place to minimize the searching time and maximize the time used to actually analyze the data, hence reduce waste and create value. It must be noted that data foundation was based on two workshops and an interview, in which two to three respondents participated. The selection of respondents could have been greater, but the thesis did not find it necessary, as it was these respondents who worked with the accessibility analysis. Therefore, this thesis covered hundred percent of the selection regarding the respondents within the field of accessibility in BNE.

Finally, regarding further work on LEAN in the public sector, more empirical studies are required to determine the usage and knowledge of the phenomena. Due to the limitations and scope of this thesis, only one company was examined, and the empirical data (in-depth interview and two workshops) were conducted with only two respondents, so the amount of gathered data was small. However, even if it is small, the data have been compared with the current literature and findings on LEAN in the public sector. On the other hand, it is too early to draw an absolute conclusion on these topics, and further research is required due to the presented limitations. Nonetheless, this thesis has provided insight into the Norwegian public sector and gives an indication of how LEAN methodologies are utilized and known.

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Appendix A

— Master thesis project proposal

A.1 Master thesis project proposal

This appendix present the master thesis project proposal which was approved by the head of the faculty at University of Agder.

UNIVERSITY OF AGDER

Master Thesis Project Proposal

Master's Program in Industrial Economics and Technology Management

Please enter the information below and deliver the proposal to the Head of Study Program.

Student(s) name	*Akshay Nitin Nayee & Mikhail Grouzdev*
Engineering bachelor	*Electrical- & Mechatronic engineering*
Working title	*Optimize the accessibility analysis with LEAN-methodology.*
Partner company, and contact information	*Bane Nor Eiendom* *Trine-Marie Molander Fjeldstad (moltri@banenor.no)*
Problem statement	*Examine how to optimize the accessibility analysis with specific measures using the LEAN-methodology.*
Background and Relevance	*Bane Nor Eiendom are Norway's largest real estate developers, especially around railways throughout the country. However, one of their main issues is the accessibility analysis, where they use too much subjectivity and too little objectivity as a base of their choices.* *Bane Nor Eiendom wants to take a closer look at the accessibility analysis where there are 4 criterias (cars, pedestrians, bicycle, public transport) to the stations. The current situation is that all the criteria are assessed on the basis of judgment, therefore they are not verifiable and the "score" on the criteria is very dependent on the person who assesses them. Therefore, they wanted us to take a deeper dive into their methodology. For us, it would have been interesting to link the kaizen methodology to the assessment process itself,*

Figure A.1: *Page 1 of the master thesis project proposal*

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	as well as create a "scorecard-system", with measures to eliminate "waste", which in this case is perception. *By optimizing the accessibility analysis, Bane Nor Eiendom may potentially generate a more accurate and verifiable baseline for current- and future analysis.*
Course foundation	*IND 418, ME 425, BE-417-1*
Potential method(s)	*Abductive approach* *Qualitative- and quantitative data* *Interviews* *Workshops - in order to test potential solutions (given that the other parties accept to participate in the workshops).*

Potential theoretical framework	- *Lean theory;*
	  - *"This is lean" - Modig & Åhlström*
	  - *"Deployment of Kaizen in the framework of the implementation of Lean Production in passenger transportation company - Tatarnikova*
	  - *"Kaizen philosophy a manner of continuous improvement of processes and products" - Karkoszka & Honorowicz*
	  - *"Lean, Six Sigma and Lean Six Signa: An analysis based on operations strategy" - Drohomertski et al (2013)*
	  - *"Putting the balanced scorecard to work" - kaplan & Norton (1993)*
	  - *Conceptual foundations of the balanced scorecard - Kaplan (2009)*
	- *Management control systems*
	  - · *M. Coram and S. Bohner, "The impact of agile methods on software project management," 12th IEEE*
	  - *of Birmingham).*

Figure A.2: *Page 2 of the master thesis project proposal*

	- *Choudray B. & Rakesh S. K. (2016). An approach using agile method for software* - *development. 2016 International Conference on Innovation and Challenges in Cyber Security (ICICCS-INBUSH). IEEE. DOI: 10.1109/ICICCS.2016.7542304* - *Datar, Srikant M., and Madhav Rajan. Horngren's Cost Accounting: A Managerial Emphasis 16th ed. Pearson Education, 2018.* - *Research designs (deductive, inductive, abductive)* - *Johannessen, A., Tufte, P.A. & Christoffersen, L. 2019. Introduksjon til samfunnsvitenskapelig metode (5 ed.) Oslo: Abstrakt forlag.* - *Gripsrud, G., Olsson, U.F. & Silkoset, R. (2010). Metode og dataanalyse (2.ed.). Kristiansand: Høyskoleforlaget* - *Crowther, D. & Lancaster, G.(2005). Research methods: a concise introduction to research in management and business consultancy. Oxford: Elsevier.*
Limitations and challenges	*One type of analysis - This study will be focusing on one kind of analysis - accessibility analysis, that Bane Nor Eiendom conducts before making decisions around new projects. Empirical data collection due to Covid-19 rules and regulations in Oslo, including the workshops.*
Preferred written language	*English*
Preferred supervisor	*Knut Erik Bonnier*
Confirmed supervisor	*Yes*

Figure A.3: *Page 3 of the master thesis project proposal*

Appendix B

— Interview

This appendix will undertake every aspect of the interview performed on the 18th of February 2021 with Bane NOR Eiendom.

B.1 Interview guide

Table B.1: *Interview guide*

Icebreaker question	What is your specific role in Bane Nor Eiendom?	Notes
General questions about lean	Do you have any relation with the term lean? In today's business world, lean is in greater focus than ever before. How do you, as a company, approach lean? Are there any specific lean measures that you know of, that is in place? Justify your answer please.	Notes
General questions about accessibility	Briefly describe the process, in which the accessibility analysis is performed. What are the main hurdles regarding the accessibility analysis? How are current analyses verified? Are there any measures taken in the past/present with respect to improving the analysis? And how do you potentially control the new improvements? If you could improve the analysis, what would you consider? You conduct several other analyses which are more objective and quantity-based - why is it favorable? Are cause-and-effect relationships in your analysis often known? Do you know why you are measuring specific criterias?	Notes
Specific questions	What is the goal of an accessibility analysis? How are you prioritizing which station/node to analyze? How do you assess the current criteria? • Do they variate? • Are they based on personal opinions? Do Bane Nor Eiendom have a specific project model? Are you familiar with the Agile methods? Are these used in Bane Nor Eiendom? Do you believe the analysis is important to achieve the "net-zero-emission goal"? Justify your answer please?	Notes

B.2 Transcription standard

I1: Interviewer 1
I2: Interviewer 2
R1: Respondent 1
R2: Respondent 2

Standard	**Elements**
...	Pause
( )	Something that is said with uncertainty
//	Something that is said with hesitation/thinking
?	Questioning
Italic	Quote
Bold	Interview question
**	Something said with confident
h	Laughter

B.3 Transcription

Interviewer 1: What roles do you have in Bane NOR Eiendom?

Respondent 1: I am employed as a planning consultant, much of this job is to take care of planning as well as other things. Including zone planning, municipal planning, and coordinate this on the behalf of the Real Estate division. I have also been given a role in parking and mobility, which includes car parking, bicycle parking, and mobility solutions for our stations. Also, I do not think my title has much to say, because I am a planning consultant, but it does not have a very specific connection with the job, so it does not explain the job. In that sense, respondent 2 probably has a better title.

Respondent 2: My title is concept developer. I have the same education as respondent 1, but I am actually a substitute for someone who is on maternity leave. And when I took over her duties, it was actually parking and mobility that was a priority. As respondent 1 talks about, we are working on the concrete follow-up of the strategy work for parking strategy and mobility and are trying to concretize it on the stretches. I have also over time become a all-arounder. Meaning that I work a little with in different projects, I help with sustainability strategy that they prepare in the Real Estate Division, I also have some technical support on the station handbook which is an overview of requirements and descriptions of routes and stations and what is to be offered at stations. And various contribute here and there. I have been fixing an illustration throughout this week, so it is a bit like that. I work with a lot of strange things. But it is parking and mobility that is the main project development.

Respondent 1: There is no clear task description of what we do. It is a lot. Since we work in a staff, we get like *"Yes you can help with that, you can look at it a bit"* also it comes in projects always, without us having any idea of what 2021 brings of tasks.

Interviewer 1: What is your knowledge of lean, or the term lean?

Respondent 1: Small. What I know in Bane NOR is that we have our own lean people. But I have never been involved in it, and they have often been more in the operation and maintenance part of the Railway. So, I have heard of lean, but I have no connection with the term lean. I have not worked with it, or you may present the term along the way, but I have no knowledge of it other than that there have been lean people in Bane NOR, who will ensure good processes related to operation and maintenance.

Respondent 2: I can almost agree with it, I have heard very little about it and do not know about it at all, but I know that it is being worked on. Then maybe we could do a little more research on what it's about.

Interviewer 1: In today's business world, lean is in greater focus than ever and how does Bane NOR Eiendom relate to the Lean approach?

Respondent 1: Yes, but that is what distinguishes Bane NOR Eiendom from having its own lean people. Because Bane NOR Eiendom does not have its own lean people, because we do not work much with the operation and maintenance of the railway network.

Respondent 2: We have in several areas tried to streamline the work process a bit, but we have not had any conscious relationship to lean as a concept in relation to this.

Respondent 1: Bane NOR Eiendom works a little to improve the processes, but the way lean has been used is often in places where there are clear goals and "action points". Where it is clear what needs to be improved. A lot of our projects are not so technical, they are much more socially oriented, where we have a dialogue with municipalities and actors related to this - and therefore we have routine on the main points we are going through. A lot of can happen in this, between the points we are going through and it is not always so easy to create a system. But we probably relate to lean to some degree, but we do not call it lean.

Interviewer 1: Describe the process of accessibility analysis

Respondent 2: I can start a little with the story, because it is connected to the process. The short or long explanation is that the former concretization of the parking strategy only looked at major structural things in a region that affect parking, demanding things like ticket zone structures, driving distances, etc. When I started this project here couple of years ago, I realized that I had to look at the local conditions, on what makes it possible or difficult to cycle to the station or walk to the station or what barriers to travel by public transport to station X for example. I started in Bane NOR Eiendom as a summer student in 2019, and then together with my colleague we got a job to develop criteria based on sources. Based on these sources, we have set four or five assessment criteria, which we use rooted in knowledge where we know what makes it relevant to use a means of transport, i.e., walking, cycling, driving or public transport to the station, and how

they score. The accessibility analysis is briefly explained. The stations also get points for how they score on the criteria, then all the scores are combined into one overall score. So that is the numerical part of it. Then a short text is written about why the station has scored poorly or well. It is the accessibility analysis.

Interviewer 1: What are the challenges associated with the current accessibility analysis?

Respondent 1: The challenges are if we manage to convey what is good enough, we get what we want out of it. Then maybe respondent 2 can supplement with it, but it has not always been so easy to know how to use it.

Respondent 2: Yes, it is also very true that whoever sits and conduct the analysis gives different results. We start with Østfoldbanen and made some assessments. Who conducted this anlyasis influenced which score was given. It is problematic when you only see one score in isolation, such as Fredrikstad, Råde etc. It is probably the biggest challenge. I have experienced the accessibility analysis, as a tool is a nice way to the solution. So the main problem is which score is given. At the same time, it is a historical accident that 1 is great and 6 is very bad, intuitively it should have been the other way around. The feedback I get when it comes to accessibility analysis is often how strictly one should consider it. Which level to set the score on is also a challenge. Communication and colors are a challenge, repetitive work process, etc.

Interviewer 1: How is the analysis verified?

Respondent 2: It has not previously been verified, when it is done it is completed and forgotten. It is good that others are also looking at it, with new eyes or for sparring.

Respondent 1: This is a bit how coincidences prevail with us, is that this analysis has perhaps been a little more verified with Emma, who will take a new evaluation of the analysis. respondent 2 also has to sit down and look at it again and look at new perspectives. This is not a verification.

Respondent 2: Maybe there is something we can take from this here, I firmly believe now that it has been very useful to go through the findings from the results. So that I do the analysis too, we spend a couple of hours going through them. It is a useful experience we have had with us.

Interviewer 1: There have been some measures in the past to improve accessibility analysis, can you tell us more about it?

Respondent 1: Before, there have been some who have worked with it, also respondent 2 has worked with it and now respondent 2, Emma and me. There are very few who dive deep into the accessibility analysis. But often they rather look at the measures in the analysis that we have proposed. Respondent 2: When it comes to revising the criteria,

we have had an interactive process all the way. Going in to assess, does it work or does it not also adjust. We have been doing this ever since 2019.

Interviewer 1: If you could improve the analysis, what would you consider?

Respondent 2: Spend a little more time on it, have a little better basic data, make inspections in advance, get an impression of the area and maybe also involve others from that area, it would have been ideal. But then there is the question of capacity, time and resources that do not always go up. This is the implementation of the analysis. In the preparation of the criteria, there was an idea that there should be a difference between the qualitative and the quantitative, but it has gone a bit away. There, I think we have to go back, so that there are a little less subjective assessments of us and a little more objective verifiable assessment.

Respondent 1: There is enough time. Ideally, the accessibility analysis should be a separate project, and should preferably have been carried out by a consultant who could dive deep into it and use it as a report. It is quite resource-intensive if you are to do a deep dive at many stations, such as Greater Oslo. So you have to simplify it a bit, as opposed to having a planning case. Sometimes I think that one expects more than we have been able to give, because it is a capacity / time problem.

Interviewer 1: Have you mentioned before that you carry out other types of analyzes that are more objective, does it work better or is it beneficial with such analyzes?

Respondent 2: Yes and no, I'm not quite sure. They are based on objective assessments. But as respondent 1 saw, we work in a field where there are a lot of subjective assessments. In other words, social science and physical planning are not an exact science, and there are many interests that lead the way towards each other. When we say other analyzes, we probably mean to use other types of basic data and make up an opinion about it. That said, it is not very much more objective, but there is also no more opportunity for discretion.

Respondent 1: We also have an analysis of how many people can reach the station, we also have data / sources that show acceptance of cycling / walking so far to the station. We can also meet politicians who completely disagree. So you can have data that is good in the research environment, so politicians turn it down. When, on the other hand, there are technical issues raised by politicians, they cannot disagree. Because there is a thorough legislation in the EU, then the politicians can not disagree. While here it is not so, since there is a lot of personal judgment that can go into the foundation.

Respondent 2: There is a lot of emotion in this here. Where a technical set of rules can involve a lot of emotions.

Respondent 1: Ref. tolls party

Respondent 2: Which has 33 percent in Bergen, so there is a big difference between the different decision makers. That makes it a bit demanding too.

Interviewer 1: Is the cause-effect relationship in the analysis known?

Respondent 1: Sometimes yes and sometimes no. Where we have good data where we can say something about why, then it is known. While cycling hotels, for example, are difficult, there can be some guesswork.

Respondent 2: Yes there can be a lot of guesswork. We see a thing and look for the cause of it. On Rosenholm, it is located just within Ruter's zone 1. There is another reason why people use that station, since it is a large area. So there we go in and identify. There are a lot of personal preferences, so it is difficult to draw a conclusion.

Interviewer 1: Do you use local consultants, if you do not know the answer?

Respondent 1: Yes, we can use the operations managers, who know the stations.

Respondent 2: They have an incredibly good overview of the stations, but they can be a conceptual crash there. We also have local hearings, where the main purpose is to get local knowledge to hear about something, we have not picked up that is happening in the region. It is not just that either.

Interviewer 1: What is the main purpose of the accessibility analysis?

Respondent 2: Try to summarize briefly; Identify barriers and opportunities. That is, things that make it possible or difficult to get to the station by foot, bicycle, public transport or car. We have no purpose description for the analysis. We must prioritize walking, then cycling, then public transport also car in relation to the mobility pyramid. We can shed light on reasons that say something about attractiveness. The purpose of all this here is to get more people to walk, cycle and take public transport. Now I trace a bit, but many critics say that not everyone can walk or bike to the station. That is probably completely correct, but the survey we do shows that many more of those who drive to the station can walk or cycle. The problem with this is that they displace those who actually need to drive to the station, such as those who have to deliver in kindergarten or those who live too far away. The purpose of the accessibility analysis is to find what is attractive and not in relation to the mobility pyramid and to come up with recommended measures. In that sense, it is a useful tool for identifying them.

Interviewer 1: How do you prioritize which stations, nodes to analyze?

Respondent 1: What is determined is determined, while what is "demand" comes continuously. So, a quick chat with the bosses. We relate to the lists that were made in 2019.

Respondent 2: Then it is always work capacity, where we are on the trail, etc. that determines the priorities. But we do not have such a sandwich list that we follow slavishly.

Interviewer 1: Do you have a specific project model?

Respondent 1: We have our own project model, while Bane NOR Eiendom has its own project model. Both are similar, but our model can only be found with us. While in planning matters it is associated with planning and building laws. We have created our own project model that does not fit with any laws. In the project model of BNE, there is start-up, planning, etc., similar to ours.

Interviewer 1: Are you familiar with Agile methods?

Respondent 1: No.

Respondent 2: Never heard of it, but you can present it briefly, so maybe we have heard of it.

Interviewer 2: It is about working iteratively to get a continuous improvement in the process, it does not necessarily have to be product oriented, it can also be process oriented. It is about working in parallel with activities and not afterwards, i.e., iteratively in loops.

Respondent 1: Yes, we jump a little back and forth.

Respondent 2: We have a strategy that is our bible, so we must concretize it. When we have finished a stretch, we return to "square one" where we iterate. The actual follow-up work can be said to be iterative. We have several times gained experience from a place and then return to revisit. It is not carved in stone. Maybe it has become more carved in stone since we are working on the concretization. Maybe we do, but I have no particular relationship with Agile.

Respondent 1: I think we do a lot, but we have nothing to do with the methodology.

Appendix C

— Interview in Norwegian

C.1 Transcription in norwegian

Interviewer 1: Hvilke roller har dere i Bane NOR Eiendom?

Respondent 1: Jeg er ansatt som planrådgiver og da mye av den jobben er jo å blant annet ivareta plansaker. Altså reguleringsplaner, kommuneplaner og lignende på vegne av divisjonen Eiendom, og koordinere dette. Jeg har også fått en rolle innen parkering og mobilitet, som omhandler da bilparkering, sykkelparkering, mobilitetsløsninger for stasjonene våre. Også tror jeg ikke tittelen min har så mye å si, for jeg er planrådgiver, men det har ikke en helt konkret sammenheng med jobben, altså det forklarer ikke jobben. Sånn sett har nok respondent 2 en bedre tittel.

Respondent 2: Tittelen min er konseptutvikler. Jeg har samme utdanning som respondent 1, men jeg er egentlig vikar for ei som er i fødselspermisjon. Og da jeg tok over hennes arbeidsoppgaver, så var det egentlig parkering og mobilitet som var prioritet. Som respondent 1 snakker om, jobber vi jo med konkret oppfølgningen av den strategiarbeidet til parkeringsstrategi og mobilitet og prøver å konkretisere det på strekningene. Også har jeg over tiden blitt litt potet. At jeg jobber litt med inn i forskjellige prosjekter, jeg hjelper til med bærekraftstrategi som de utarbeider i Eiendomsdivisjonen også sitter jeg med litt teknisk støtte på en stasjonshåndbok som er en oversikt over krav og beskrivelser av strekninger og stasjoner og hva som skal tilbys på stasjoner. Og litt sånn, og ymse bidra inn her og der. I hele uka nå så har jeg sittet å fiksa på en illustrasjon for å nevne noe, så det er litt sånn, jeg jobber med mye rart da. Men det er jo parkering og mobilitet som er hovedprosjektutviklingen.

Respondent 1: Det ikke noe tydelig oppgavebeskrivelse på det vi driver med. Det er veldig mye, siden vi jobber i en stab så får vi sånn *"Ja kan dere hjelpe til med det, kan dere se litt på det"* også kommer det på en måte prosjekter, uten at du kanskje har peiling på hva 2021 bringer av oppgaver.

Interviewer 1: Hva er deres kjennskap til lean, eller begrepet lean?

Respondent 1: Liten. Det jeg vet i Bane NOR er at vi har egne lean folk. Men jeg har

aldri vært involvert i det og de har ofte sittet mer i drifts og vedlikeholds delen av Jernbanen. Så lean har jeg hørt om, men jeg har ikke noe forhold til begrepet lean. Jeg har ikke jobbet med det, eller det kan hende dere presenterer begrepet underveis, men jeg har ikke kjennskap til det utover at det har vært lean mennesker i Bane NOR, som skal sikre gode prosesser knyttet til drift og vedlikehold.

Respondent 2: Jeg kan nesten føye meg på det, jeg har hørt svært lite om det og kjenner ikke til det i det hele tatt, men at det jobbes med vet jeg. Så kunne vi kanskje gjort litt mer reasearch om hva det dreier seg om.

Interviewer 1: I dagen næringsliv er lean i større fokus enn noensinne og hvordan forhold Bane NOR Eiendom seg til Lean tilnærmingen?

Respondent 1: Ja, men, det er det som skiller med at Bane NOR Eiendom ikke har egne lean folk. Fordi Bane NOR Eiendom har ikke egne lean folk, fordi vi jobber ikke så mye med drift og vedlikehold av jernbanenettet.

Respondent 2: Vi har jo på flere områder prøvd å effektivisere arbeidsprosessen litt, men vi har ikke hatt noe bevisst forhold til lean som begrep i forhold til dette.

Respondent 1: Bane NOR Eiendom jobber litt med å forbedre prosessene, men på den måten lean har blitt brukt, er ofte i på steder der det er tydelige mål og «action Points». Hvor det er tydelig over hva som skal forbedres. Veldig mye av prosjektene våre er ikke så tekniske, de er mye mer samfunnsorientert, hvordan skal vi ha dialog med kommuner og aktører knyttet til dette og derfor har vi rutine på hovedpunktene vi skal igjennom. I det kan det skje veldig mye, mellom punktene vi skal gjennom og det er ikke alltid så lett å lage ett system på. Men vi forholder oss nok til lean i noen grader, men vi kaller det ikke lean.

Interviewer 1: Beskriv prosessen til fremkommelighetsanalysen

Respondent 2: Jeg kan jo starte litt med historien, fordi det henger jo sammen med prosessen. Kort forklart eller lang forklart, så var jo konkretiseringen av parkeringsstrategien var jo før, kun å se på store strukturelle ting i en region som påvirker parkeringsetterspørselen som for eksempel billett sone strukturer, kjøreavstander osv. Da man satte i gang med dette prosjektet her for et par år siden, så skjønte man at man måtte se på de lokale forholdene, også hva er det muliggjør eller vanskeliggjør å sykle til stasjonen eller gå til stasjonen eller hvilke barrierer for å reise med kollektivtransport inn til stasjon X for eksempel. Jeg startet i Bane NOR Eiendom som sommerstudent i 2019, og da sammen med min kollega fikk vi jobb om å utvikle kriterier basert på kilder. Utefra disse kildene har vi satt fire eller fem vurderingskriterier, som vi bruker mer eller mindre forankret i kunnskap der vi vet hva som gjør det aktuelt å bruke et transportmiddel, altså gange, sykkel, kjøre eller kollektiv til stasjonen, og hvordan de scorer. Det er kort forklart fremkommelighetsanalysen. Også får stasjonene poeng på hvordan de scorer på kriteriene, så blir alle scorene samlet til en samlet score. Så det er den tallmessige delen

av det. Så skrives en kort tekst om hvorfor stasjonen har scoret dårlig eller godt. Det er fremkommelighetsanalysen.

Interviewer 1: Hva er utfordringene knyttet til den nåværende fremkommelighetsanalysen?

Respondent 1: Utfordringene er om vi klarer vi å formidle det som er bra nok, får vi det vi vil ut av det. Så kan kanskje respondent 2 supplere med det, men det er ikke alltid vært så lett å vite hvordan man skal bruke det.

Respondent 2: Ja, også er det veldig at hvem som sitter og holder i det gir ulike resultater. Vi starta med Østfoldbanen og gjorde noen vurderinger. Hvem som satt og vurderte påvirket hvilken score som ble gitt. Det er problematisk når man kun ser en score isolert, som for eksempel Fredrikstad, Råde osv. Det er nok den største utfordringen. Jeg har opplevd fremkommelighetsanalysen, som et verktøy som en fint på veien til løsningen. Altså hovedproblemet er hvilken score som er gitt. Samtidig er det et historisk uhell at 1 er kjempebra og 6 er kjempedårlig, intuitivt sett burde det vært omvendt. Tilbakemeldingene jeg får når det gjelder fremkommelighetsanalysen, er ofte hvor strengt man skal vurdere det. Hvilket nivå man skal sette scoren på er også en utfordring. Kommunikasjon og farger er en utfordring, gjentagende arbeidsprosess osv.

Interviewer 1: Hvordan blir analysen verifisert?

Respondent 2: Det har tidligere ikke blitt verifisert, nå er det i mål, ferdig vedtatt og ut av verden. Det er fint at andre også ser på det, med nye øyne eller for sparring.

Respondent 1: Dette er litt hvordan tilfeldighetene rår hos oss, er jo at denne analysen har kanskje blitt litt mer verifisert med Emma, som skal ta en ny evaluering av analysen. Også må respondent 2 sette seg ned og se på det på nytt og se på nye perspektiver. Det er ikke en verifisering.

Respondent 2: Det er kanskje noe vi kan ta med fra dette her, jeg mener bastant nå at det har vært veldig nyttig å gå igjennom funnene fra resultatene. Så at jeg gjør analysen også bruker vi et par timer på å gå igjennom dem. Det er en nyttig erfaring vi har fått med oss.

Interviewer 1: Det har vært noen tiltak tidligere om å forbedre fremkommelighetsanalysen, kan dere fortelle mer om det?

Respondent 1: Før har det vært noen som har jobbet med det, også har respondent 2 arbeidet med det og nå respondent 2, Emma og dere. Det er veldig få som dypdykker i fremkommelighetsanalysen. Men ofte ser de heller på tiltakene i analysen som vi har foreslått. Respondent 2: Når det gjelder å revidere kriteriene har vi hatt en interaktiv prosess på hele veien. Å gå inn å vurdere, funker det eller funker det ikke også justere. Det har vi gjort helt siden 2019.

Interviewer 1: Hvis dere kunne forbedret analysen, hva ville dere tatt i betraktning?

Respondent 2: Bruke litt mer tid på det, ha litt bedre grunnlagsdata, gjøre befaringer i forkant, skaffe seg et inntrykk av området og kanskje også involvere andre fra det området, det hadde vært det ideelle. Men så er det et spørsmål om kapasitet, tid og ressurser som ikke alltid går opp i opp. Dette er altså gjennomføringen av analysen. På utarbeidelsen av kriteriene var det jo en tanke om at det skulle skille mellom det kvalitative og kvantitative, men det har gått litt bort. Der tenker jeg at vi må tilbake, slik at det blir litt mindre subjektive vurderinger av oss og litt mer objektive etterprøvbare vurderinger.

Respondent 1: Det er nok tid. Ideelt sett skulle fremkommelighetsanalysen vært et eget prosjekt, og skulle gjerne vært gjennomført av en konsulent som kunne dypdykket i det og brukt som en rapport. Det er jo ganske ressurskrevende om man skal gjøre et dypdykk på mange stasjoner, som for eksempel Stor-Oslo. Så man må forenkle det litt, kontra når man har en plansak. Noen ganger tror jeg at man forventer mer enn det vi har kunne gitt, fordi det er et kapasitets/tids problemer.

Interviewer 1: Dere har nevnt tidligere at dere gjennomfører andre type analyser som er mer objektive, fungerer det bedre eller er det fordelaktig med slike analyser?

Respondent 2: Ja og nei, jeg er ikke helt sikker. De er basert på objektive vurderinger. Men som respondent 1 så at jobber vi i et felt hvor det er mye subjektive vurderinger. Altså samfunnsvitenskap og fysisk planlegging er jo ikke noe eksakt vitenskap, og det er jo mange interesser som veien opp mot hverandre. Når vi sier andre analyser, mener vi sikkert å bruke andre type grunnlagsdata og gjøre opp en mening om det. Når det er sagt, er det ikke så veldig mye mer objektivt, men det er heller ikke noe mer mulighet for skjønn.

Respondent 1: Vi har jo også analyse på hvor mange som kan nå stasjonen, også har vi data/kilder som viser aksept på å sykle/gå så langt til stasjonen. Også kan vi møte politikere som er helt uenig. Så man kan ha data som er bra i forskningsmiljøet, så slå politikerne det ned. Når det derimot er tekniske ting som tas opp av politikerne, så kan de ikke si seg uenig. For det er et gjennomarbeidet lovverk i EU, da kan ikke politikerne si seg uenig. Mens her er det ikke slik, siden det er mye personlig skjønn som kan gå inn i grunnlaget.

Respondent 2: Det er veldig mye følelser i dette her. Der et teknisk regelverk, kan innebære mange følelser.

Respondent 1: Ref. bompengepartiet

Respondent 2: Som har 33 prosent i Bergen, så det er stor forskjell mellom de ulike beslutningstakerne. Det gjør det litt krevende det også.

Interviewer 1: Er årsak virkning relasjonen i analysen kjent?

Respondent 1: Noen ganger ja og noen ganger nei. Der vi har god data der vi kan si noe om hvorfor, så er det kjent. Mens sykkelhotell for eksempel er vanskelig, det kan det bli litt gjetting.

Respondent 2: Ja det kan bli mye gjetting. Vi ser en ting og ser etter årsaken til det. På Rosenholm, ligger det akkurat innenfor Ruters sone 1. Det er nok en årsak at folk bruker den stasjonen, siden det er et stort innslagsområde. Så der går vi inn og identifiserer. Det er jo mye personlig preferanser, så det er vanskelig å utlede en konklusjon.

Interviewer 1: Bruker dere lokale konsulenter, hvis dere ikke vet svaret på det?

Respondent 1: Ja vi kan bruke driftssjefene, som kjenner stasjonene.

Respondent 2: De har utrolig god oversikt over stasjonene, men de kan bli en konseptuell krasj der. Vi har jo også lokale høringer, hvor hovedhensikten er å få lokal kunnskap for å høre om det noe vi ikke har plukket opp som skjer i regionen. Det er ikke bare det heller.

Interviewer 1: Hva er hovedformålet med fremkommelighetsanalysen?

Respondent 2: Prøve å oppsummere kort; Identifisere barrierer og muligheter. Altså ting som muliggjør eller vanskeliggjør å komme seg til stasjonen med gange, sykkel, kollektiv eller bil. Vi har ikke noe formålsbeskrivelse på analysen. Vi skal prioritere gående, så sykkel, så kollektiv også bil i forhold til mobilitetspyramiden. Vi kan belyse årsaker som sier noe om attraktivitet. Hensikten med alt dette her er å få flere til å gå, sykle og ta kollektiv. Nå sporer jeg litt ut, men mange kritikere sier at ikke alle kan gå eller sykle til stasjonen. Det er nok helt riktig, men kartleggingen som vi gjør viser jo at mange flere av de som kjører til stasjonen kan gå eller sykle. Problemet med det her er at de fortrenger de som faktisk trenger å kjøre til stasjonen, for eksempel de som må levere i barnehage eller de som bor for langt unna. Hensikten med fremkommelighetsanalysen er å finne det som er attraktivt og ikke i forhold til mobilitetspyramiden og å komme med anbefalende tiltak. Sånn sett er det et nyttig verktøy for å identifisere disse.

Interviewer 1: Hvordan prioriterer dere hvilke stasjoner, knutepunkt som skal analyseres?

Respondent 1: Det som er bestemt er bestemt, mens det som er "demand" kommer fortløpende. Altså en rask prat med sjefene. Vi forholder oss til listene som ble laget i 2019.

Respondent 2: Så er det alltid arbeidskapasitet, hvor vi ligger i løypa osv. som bestemmer prioriteringene. Men vi har ikke noe sånn smørbrødliste som vi følger slavisk.

Interviewer 1: Har dere en spesifikk prosjektmodell?

Respondent 1: Vi har en egen prosjektmodell, mens Bane NOR Eiendom har en egen prosjektmodell. Begge er lignende, men vår modell finne bare hos oss. Mens i plansaker er det forbundet med plan og bygningslover. Vi har laget en egen prosjektmodell som ikke passer med noen lover. I prosjektmodellen til BNE er det jo oppstart, planlegging osv., i likhet med vår.

Interviewer 1: Er dere kjent med Agile/Smidige metoder?

Respondent 1: Nei

Respondent 2: Aldri hørt om, men dere kan jo presentere det kort, så kanskje vi har hørt om det.

Interviewer 2: Det handler om å jobbe iterativt for å få en kontinuerlig forbedring i prosessen, det trenger ikke nødvendigvis å være produkt orientert, det kan også være prosessorientert. Det handler om å jobbe parallelt med aktiviteter og ikke etterfølgende, altså iterativt i looper.

Respondent 1: Ja vi hopper litt frem og tilbake.

Respondent 2: Vi har en strategi som er vår bibel, så skal vi jo konkretisere den. Når vi er ferdig med en strekning, går vi tilbake til "square one" hvor vi itererer. Selve oppfølgingsarbeidet kan man si er iterativt. Vi har flere ganger gjort oss erfaringer fra et sted for så å gå tilbake å revidere. Det er ikke risset i stein. Kanskje det har blitt mer risset i stein, siden vi jobber med konkretiseringen. Kanskje vi gjør det, men jeg har ikke noe særlig forhold til Agile.

Respondent 1: Jeg tror vi gjør mye, men vi har ikke noe forhold til metodikken.